Effects of Education Budget and Enrolment on Science, Technology, Engineering and Mathematics (STEM) Education in Nigeria

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Abstract

In Nigeria, much efforts have been made to improve the status of Science, Technology, Engineering and Mathematics (STEM) education. These revolve around policy uptake and financial commitment. However, the dearth of studies that investigate influence of education budget and enrolment on the development of STEM education created impetus for this study. Expo-facto design that involved collection of time series data on education budget, students' enrolment and the performance in West African Senior School Certificate Examination (WASSCE) between years 1991-2017 was adopted. Variables in the study were subjected into Auto-Regressive Distribution Lag (ARDL) model. Two structural breaks existed in the development of STEM education in the years under review. These coincided with the adoption and ratification of the Universal Basic Education (UBE) into law in the years 2000 and 2004 respectively. Short run effects of education budget ($\beta=0.148$, $t=2.314$, $p<0.05$) and students' enrolment ($\beta=-1.153$, $t=-5.090$, $p<0.05$) had significant effects on the development of STEM while no statistical significant of long run effects was observed. From findings of the study, it is obvious that status of STEM education in Nigeria need to be improved and sustained, therefore, it is recommended that stakeholders in STEM education should show more commitment in terms of facilities provision and funding.

Keywords: Education budget, Enrolment, STEM, Performance

Introduction

Science, Technology, Engineering and Mathematics (STEM) education has a structured history in Nigeria and it date back to the colonial era. This was predicated on the fact that Nigeria recognized that acquisition of appropriate STEM skills and competence is germane to individual tendency to live and contribute to the growth and development of his society. Most especially in this era; when technology dictates the way we live, knowledge of science and technology is more important that any factor of production (capital, land, labour etc.) and the providers of STEM skills are

seen as indispensable fuel in the engine of development.
In fact, an individual may be pardoned for thinking that STEM education has a limited past in Nigeria. But in the real sense, it has a long history which started from the era of visual education that emphasized production and the use of low cost instructional materials for teaching and learning activities before year 1940. This was succeeded by the era of radio media in the early 1940s and 1950s. The significance of the adoption of radio media was that it provides foundation for the effective thrive of Information and Communication Technology (ICT) in the country. Around 1958, the first Audio-visual center was established in Ibadan and subsequently, the establishment of radio and television broadcasting stations commenced (Oyelade & Abolade, 2017).

Another prominent effort made on the development of STEM education was the introduction of science and technology education into curriculum of post-secondary education following the establishment of Federal College of Arts, Science and Technology education in 1950 and the upgrading of Yaba College into the Yaba College of Technology in the year 1962 to teach courses in science, engineering and technology (Brown, 2015). Other historic effort on STEM education in Nigeria was the introduction science and technology education into primary and secondary school curriculums following the result of National Curriculum conference held in 1969 which put more emphasis on the need to inculcate science and technology education by improving students' knowledge in the areas of mathematics and integrated science (Oyelade & Abolade, 2017).

However, it should be noted that knowledge of mathematics constitutes a pivot on which science, technology and engineering education are based. Also, economic development and stability in the 21st century is scientific and technologically based. This means that economic prosperity of a nation depends largely on the scientific and technological development, which cannot be possibly attained without sound, effective and strong Mathematics education. This may be the rationale for allocating 60% of University admission to science and technology by the National Policy on Education (FRN, 2013). Moreover, due to the importance of mathematics as a subject, it was considered as a core subject alongside with English language for both primary and secondary school students in the National Policy on Education (FRN, 2004). Again, knowledge of Mathematics constitutes a unified theme among science, technology and engineering students, hence, using performance in mathematics as a yardstick to gauge students' performance in STEM may not be out of place.

Discursively, the trend of students' performance in standardized examinations such as West African Senior School Certificate Examination (WASSCE) seem not to reflect the impact of the investment in education in terms of budgetary allocation. In fact, WAEC chief examiner's report for the period of years 2010-2016 indicates that the general performance of the candidates in Mathematics for the May/June 2010, 2011, 2012 and 2015 examinations did not differ significantly from those of the previous years. Zalmon and Wonu (2017) reported that those who obtained (A1 - C6) and pass below (D7 - F9) in Mathematics in WAEC May/June in the years 1991 to 2003 and 2004 to 2016 were not significantly different from each other. This is an indication that there was little improvement in STEM education over years.

Despite the deplorable status of STEM in Nigeria, other nations have recognized and harnessed the usefulness of STEM. The report shows that STEM enhances inculcation of scientific values, and this requires coordination of both knowledge and skills simultaneously including entrepreneurial skills (Matazu and Julius, 2017). Critical thinking, creativity, engineering design process, and problem-solving skills was also observed as the outcomes of STEM education among the recipients (Onanuga Saka, 2019). Shameema and Christian (2017) are of the opinion that for a nation to update her citizen's skill in line with recurrent and current emerging technological development, STEM education needs to occupy the central place in her curriculum development. Consequently, inference could be made that STEM constitutes one of the 21st century skills to foster individual and collective contributions to societal development.

The problems inherent in the development of STEM education in Nigeria is traceable to the dysfunctional budgetary allocation to education which could not cater for customary education programs let alone the development of STEM skills and competences among the recipients. Another bottleneck to the quality of STEM education in Nigeria is the gross students' enrolment into education which was far above the magnitude of investment in education in term of education budget. This situation was worsened particularly when many students who indicate an interest in STEM subjects in secondary schools do so to boost their chances of qualification for tertiary education after which they will drop these subjects. (McDonald, 2016). It should be noted that education budget in Nigeria may not cater for education services because most government initiatives such as UBE are to increase access to education without corresponding facilities or resources provision.

Various studies in the higher and other levels of education outside Nigeria found an inverse relationship between students' enrolments and performance in Mathematics (Gibbs, Lucas and Simonite 1996; and Gibbs, Lucas and Spouse 1997). Extending the same understanding to the development of STEM education in Nigeria, believing that increased enrolment into STEM education or large class sizes may be detrimental to students' performance in STEM would be purely speculative in the absence of empirical evidence that the study propose to generate.

Apart from enrolment, Babalola, Jaiyeoba, Ayeni and Ojelabi (2006) observed an increasing shortfall between what the institutions requested and what the government allocated on paper to the institutions, while some of the allocations did not even get to the institutions. For example, in 1999 – 2008 out of the total allocation to all public universities which is #26, 439,877,960.12 only #15, 705,503,511.93 was disbursed with an outstanding of #10,734,374,448.19 (TETF, 2009). Besides of

Babalola and et.al (2006), studies abound on the effects of education budget and students' enrolment on students' performance at the tertiary education level. However, there is few or no known study that has ever examined the same effect on students' performance at secondary education level most especially in the area of STEM hence, the need for this study.

As a matter of fact, the development of science, technology, engineering and mathematics education in Nigeria has been bedeviled with many inconsistencies. At the formative period of STEM in Nigeria, its curriculum was to fulfil the requirement for passing Cambridge and London General Certificate Examination without its contextualized practical orientation. In a couple of times, the government of Nigeria took a giant stride to separate science from technology education after their integration into school curriculum. In the recent past, a drift in policy merges technical education with science education to become science and technology education (FRN, 2013) with little or no improvement in the quality STEM education as a result of policy changes.

Apart from policy inconsistency in STEM education in Nigeria, many things have gone awry in the development of quality STEM education in the country. It is a known fact that lack of basic infrastructure and facilities such as laboratory, science equipment and apparatus for teaching and learning of STEM constitutes the major bottleneck in the development of STEM education and are rooted in the ridiculous budgetary allocation to the education sector. It should be noted that the status of STEM in Nigeria correspond to her investment in education as Nigeria spends about 0.76 % of her GNP on education, South Africa spends 7.9%; Kenya 6.5%; Malawi 5.4%; Cote d' Ivoria 5 %; Angola 4.9 %; Ghana 4.4 % and Tanzania 3.4 % (World Bank, 2012).

Furthermore, government activities on STEM in the recent and remote past was to sensitize people on the importance of STEM education and increase students' enrolment into it without corresponding and commensurate finding. This condition has led to many issues in the development of quality STEM education which the current study investigated. Therefore, the study investigated short and long run effects of education budget and enrolment on the development of STEM education in Nigeria by taking an in-depth study of national budget on education and the students' enrolment and performance in Mathematics in the WASSCE.

Findings of this study will be of immense importance to the Nigerian government and other education stakeholders as it revealed the impacts of education budget on the development of STEM education in Nigeria. The result of the study also shows the balance between students' enrolment into STEM education and corresponding available resources to sustain and assure quality in its administration. Information on education policies and initiatives in Nigeria that has helped development of STEM education in the past constitute the major outcomes of the study. More so, the result of the study will serves as baseline information for future researchers who are working in the area of investment in education and the resultant quality of education most especially on the emerging theme of Science, Technology Engineering and Mathematics education.

Hypotheses

The following hypotheses were formulated to guide the study;

H_{O1} There is no significant structural breaks in the development of science, Technology, Engineering and Mathematics (STEM) education in Nigeria.

H_{O2} There is no significant short run effect of education budget and students' enrolment on development of STEM in Nigeria.

H_{O3}There is no significant long run effect of education budget and students' enrolment on development of STEM in Nigeria.

Methodology

Expo-facto design was adopted for the study. The study used time series data on budgetary allocation to education in Nigeria from National Bureau of Statistics (NBS) data from 2005 – 2018 and Statistical Fact Sheets and the National Manpower Board (NMB) data file and the students' performance in Mathematics with the corresponding number of candidates enrolled for Mathematics in the West Africa Senior Secondary Certificate Examination (WASSCE) from year 1991 to 2017. The data was limited to the year 2017 because of non-availability of WAEC data for the subsequent years. The data of students who scored grade A1-C6 were sieved and used for the study. The description of variables and data could be found in Table 1.

Table 1
Variables and Data Sources

Variable	Measurement	Symbol	Source
Performance	*Natural Logs*	*lpef*	WAEC
Education Budget	*Natural Logs*	*led*	NDES
Enrolment	*Natural Logs*	*len*	WAEC

The data collected were converted to natural logs for easy of interpretation and the descriptive analysis of both actual and transformed data were presented in Table 2

Table 2
Descriptive Analysis

Statistics	Performance	Education Budget	Enrolment
Actual Data			
Mean	313639.5	138.5959	1242642
Median	314903	80.53	1051246

Maximum	819390	403.96	7886565
Minimum	32727	0.29	294079
Std. Dev.	232122.9	140.4551	1405132
Skewness	0.290	0.760	4.081
Kurtosis	1.839	2.015	20.002
Jarque-Bera	1.897	3.691	400.156
Probability	0.387	0.158	0.000
Natural Logs			
Mean	12.260	4.003	13.757
Median	12.660	4.389	13.865
Maximum	13.616	6.001	15.881
Minimum	10.396	-1.238	12.592
Std. Dev.	1.012	1.841	0.676
Skewness	-0.407	-1.097	0.826
Kurtosis	1.628	3.815	4.697
Jarque-Bera	2.860	6.164	6.312
Probability	0.239	0.046	0.043
Observations	27	27	27

The result in Table 2 shows that students' performance is the only variable that is normally distributed while education budget and enrolment are skewed due to Jarque-Bera statistics of the two variables that are statistically significant. Table 3 examined the relationship among the variables in the model. The result shows that the variables are highly related.

Table 3: Correlation Matrix

Variable	***LPEF***	***LED***	***LEN***
Performance	1		
Education Budget	0.837 (7.660)***	1	
Enrolment	0.793 (6.514)***	0.831 (7.466)***	1

Note: Values in parentheses are t-statistics of correlation coefficients

However, the t-statistic result revealed that they are significantly different from each other. Therefore none can be substituted for each other. For the variables to be fit for analytical procedure designed for the study, the level of stationarity of each of the variables must be examined by conducting Unit Root test as shown in Table 4.

Table 4: Unit Root Tests

Test	[illegible]		[illegible]		Remark
	Intercept	**Intercept & Trend**	**Intercept**	**Intercept & Trend**	
PP					
Performance	-1.763	-3.176	-9.057***	-9.223***	I(1)
Education Budget	-2.205	-3.146	-8.499***	-10.008***	I(1)
Enrolment	0.703	-2.697	-3.713**	-3.413*	I(1)
ADF					
Performance	-1.837	-3.176	-6.744***	-4.881***	I(1)
Education Budget	-4.083***	-3.325*	-9.112***	-6.752***	I(0)
Enrolment	0.222	-4.252**	-4.538***	-4.172**	I(0)

Note: PP & ADF imply Phillip-Perron and Augmented Dickey-Fuller tests respectively

*, **, & *** denote significance at 10%, 5%, & 1% respectively

Two approaches were adopted to examine the level of stationarity of each of the variables. It could be observed that using Phillip-Perron approach (PP) with the general equation $d(y_t) = \beta_0 + \beta_1 t + (\rho - 1)y_{t-1} + \varepsilon_t$, all the variables in the model are stationary at I(1). However, Augmented Dickey-Fuller tests (ADF) expressed as $d(y_t) = \alpha_0 + \alpha_1 t + (\rho - 1)y_{t-1} + \sum_{i=1}^{p} \tau_i \cdot d(y_{t-i}) + \epsilon_t$ revealed that dependent variable (Performance) is stationary at I(1) while independent variables are stationary at I(0). The stationary nature of these variables fulfil the conditions [dependent variable must be I(1) while at least one of the independent variables must be I(1)] for using Auto Regression Distribution Lag (ARDL).

ARDL model represents as $lpef_t = \eta + \alpha T + \sum_{i=1}^{p} \rho_i lpef_{t-i} + \sum_{i=0}^{q1} \psi_{1i} led_{t-i} + \sum_{i=0}^{q2} \psi_{2i} len_{t-i} + \vartheta_t$ (where T=deterministic trend and ϑ =error correction term) gives allowance for the model to be re-parametrized to show long-run and short-run effects of independent variables. This technique also allows speed of adjustment after short-run shocks to the model to be easily estimated through error correction term (ϑ). The error correction term and speed of adjustment are given as $\gamma(ect_{t-1}) = \rho[lpef_{t-1} - \eta^* - \alpha^* T - \psi_1^* led_{t-1} - \psi_2^* len_{t-1}]$ while ect is the Error Correction Term, γ measures the speed of adjustment, ψ_j^* and φ_{ji} are long-run and short-run coefficients respectively.

Results and Discussions

The findings of the study were presented based on formulated hypotheses as follows:

Hypothesis 1

H_{01} *There is no significant structural breaks in the development of science, Technology, Engineering and Mathematics (STEM) education in Nigeria.*

The structural break graph was drew for the students' performance in Mathematics using WAEC data collected from year 1991 to 2017 as it could be seen in Figure 1. By way of definition, structural breaks are shocks or changes that occur in the system (education) at a particular period that produces corresponding changes in the variables of interest (students' performance).

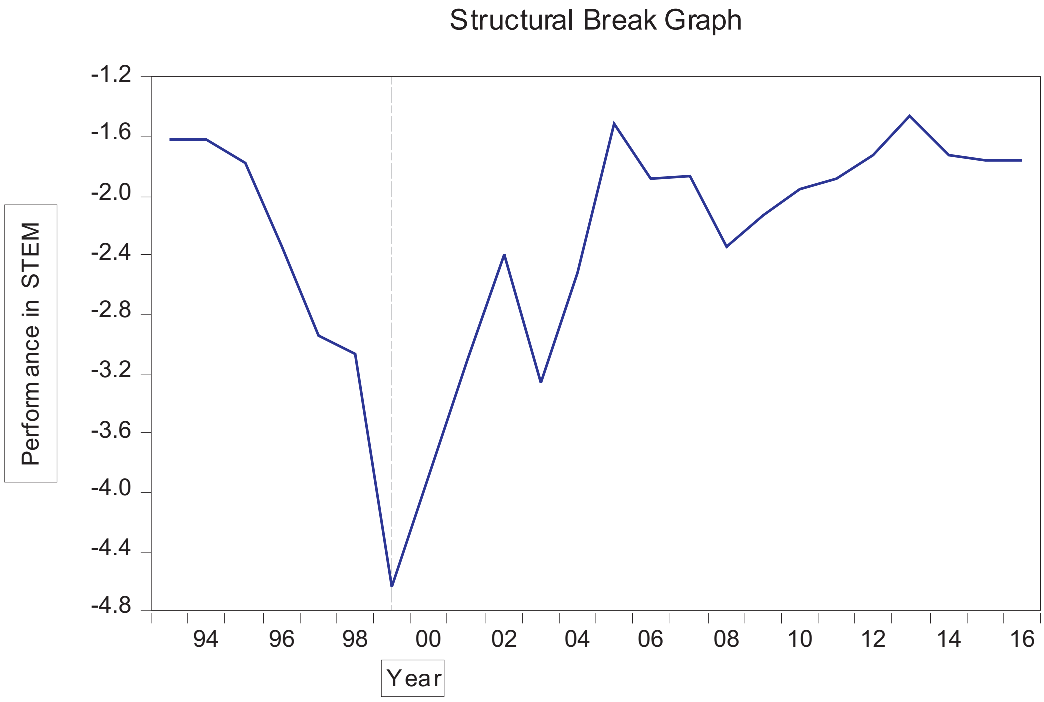

Figure 1: Structural Breaks in Students Performance in Mathematics

The result from the structural graph revealed that break only occurred in year 1999 as it could be seen in the Figure 1. However, further analysis was conducted using (Bai & Perron, 2003, p. 1-22) test as presented in Table 5

Table 5: Bai and Perron (2003) Test

Hypothesis	*Scaled F*	*Critical F*	*Decision*	*Estimated Break Dates*
1 not 0	159.281	8.58	Reject	
2 not 1	15.844	10.13	Accept	2000, 2004
3 not 2	9.335	11.14	Reject	
4 not 3	0.208	11.83	Reject	
5 not 4	0.000	12.25	Reject	
Break Dates	***Potential Cause of Breaks***			
2000	Transition from military to civilian regime and adoption of MDGs.			
2004	Signing Universal Basic Education (UBE) bill into law.			

Bai and Perron (2003) test revealed that there are two structural breaks in students' performance in the STEM in Nigeria as against one shown in Figure 1. The result revealed that these occurred around years 2000 and 2004. The first break coincided with the transition from military regime to the civilian government in Nigeria: a period the welcome Basic/universal compulsory primary education and shifted its status from being a privilege to a right for all children as a result conference held in the year 2000 in Darkar, Senegal. The Darkar conference culminated into the Millennium Development Goals (MDGs) which makes the Universal Basic Education (UBE) imperative for both primary and basic post primary school children. Wolfensohn (2002) stated that the MDGs goals 2, 3 and 8 were closely related to Universal Basic Education (UBE) and so stood to benefit substantially from its full implementation. Studies have shown that introduction of UBE.

The second structural break occurred in year 2004 which marked a significant year when the UBE bill was ratified into law by the former Nigerian President Obasanjo after its passage by the National Assembly on 26th May, 2004. The UBE Act makes provision for basic education comprising Early Child Care Education (ECCE), Primary and Junior Secondary Education. The signing of UBE has implication on vast aspect of education including education administration, financing, students' enrolment and system structure. Therefore, its adoption has great potential to improve status of STEM in Nigeria.

Hypothesis 2

H_{o2} *There is no significant short run effect of education budget and students' enrolment on development of STEM in Nigeria.*

In order to determine short and long run effect of education budget and students' enrolment on STEM, assumption of cointegration was tested and the result was presented in the Table 7

Table 6: Bounds Test of Cointegration

Significance	I(0)	I(1)
10%	2.845	3.623
5%	3.478	4.335
1%	4.948	6.028
F (2 df.)	6.242	

The result in Table 6 shows that null hypothesis that states that there is no significant cointegration or long run effect of the variables in the model should be rejected on the ground that value of F (2 df.)= 6.242 is greater than the upper bound criteria value in all levels of significant (1%, 5% and 10%). Therefore, the model makes allowance for determining short and long run effects as estimated in Table 8 and 9. Apart from the education budget and students enrolment, the two structural breaks were included in the model. These were conceptualized as dummy variables that have the value of zero prior to the break and assumed the value of 1 in the years after the break. The coefficient of error correction term was also estimated in the model and the value *ect* (-1)= -0.810 indicated that 81% of the shock in the model can be corrected within 1 year and the model will recover from all the shocks in 2 years.

Table 7: Estimated Short-run Effects

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
D(LPEF(-1))	0.197	0.118	1.667	0.130
D(LED)	-0.017	0.121	-0.144	0.889
D(LED(-1))	0.353	0.161	2.192	0.056
D(LED(-2))	0.148	0.064	2.314	0.046
D(LEN)	-0.105	0.115	-0.916	0.384
D(LEN(-1))	-1.080	0.295	-3.666	0.005
D(LEN(-2))	-0.633	0.313	-2.026	0.073
D(LEN(-3))	-1.153	0.227	-5.090	0.001
Break 1	0.665	0.138	4.826	0.001
Break 2	0.606	0.157	3.862	0.004
ECT(-1)	-0.810	0.140	-5.770	0.000

The result from Table 7 shows short run effects of the variables in the model including the two structural breaks. It could be observed that short run of education budget, student enrolment and the structural breaks produced significant effects on the development of STEM. The results suggests that education budget had positive significant effect on development of STEM. More so, 1% increase in education budget will cause 0.35 increase in STEM and 1.15 in the subsequent years. The result further revealed that students' enrolment into STEM produces negative and significant short run effect on the development of STEM: a 1% increase in enrolment into STEM produces corresponding -1.08 decrease development of STEM and -1.15 in the two subsequent years. The result also shows that the first and the second structural breaks which connotes conversion of MDGs into UBE and signing of UBE into law produces positive and significant effect on the development of STEM. Therefore, no statistical reason why null hypothesis should not be rejected.

The findings of this study is in alliance with the theoretical and empirical expectation. Ordinarily, it is expected that increase in education financing should produce corresponding increase in learning outcomes most especially in the development of STEM skills among students. The result also corroborates the fact that annual education budget in Nigeria is too minute to the extent that it can only produce little or infinitesimal effect on students' performance with respect to STEM. This corroborates the World Bank 2012 report on the annual budgetary allocation to education for 20 countries in the Africa also with the report that Nigeria is at the last position with percentage allocation to the education sector at 8.4% in 2012 whereas countries like Ghana occupied first position with allocation to the education sector of 31.0%, South Africa and Kenya 5th and 8th positions with percentages of allocation to education sector at 25.8% and 23.0% respectively. Also, while Nigeria spends about 0.76 % of her GNP on education, South Africa spends 7.9%; Kenya 6.5%; Malawi 5.4%; Cote d' Ivoria 5 %; Angola 4.9 %; Ghana 4.4 % and Tanzania 3.4 % (World Bank, 2012, pp. 133-154).

As reported, increase in students' enrolment causes a decrease in the development of STEM education. This could be due to inadequate resource availability as a result of low budgeting for education in Nigeria as inadequate funding has placed constraints on staff recruitment and development, as well as facility improvement and expansion (Onuka, 2004). Increasing enrolment coupled with low financial allocation and the associated problems in the post primary education could lead to poor student–teacher ratio, learning facilities like buildings, lecture rooms, offices, learning environment, equipment for science based courses and knowledge facilities like library accessions, computing facilities, and teaching aids which constitutes major debacle to the development of STEM education.

More so, the result on the two structural breaks experienced in students' performance shows that the adoption of MDGs vis-à-vis UBE into Nigerian education system made positive significant impact on the development STEM Education in Nigeria. As reported by UNESCO (2015), students enrolment increased by 130% for secondary level of education in the period from 2000 to 2013. The same report also submitted that as at 2015, Nigeria was ranked 103 out of 118 nations in UNESCO's EFA Development index which was reckoned into the account of Universal Basic Education.

Hypothesis 3

H_{03}*There is no significant long run effect of education budget and students' enrolment on development of STEM in Nigeria.*

The long run effects of education budget and students enrolment on STEM development are not significant on students' performance as presented in Table 8. Therefore, null hypothesis was not rejected

Table 8: Estimated Long-run Effects

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LED	0.249	0.419	0.595	0.567
LEN	-0.178	0.910	-0.196	0.849
Constant	12.866	10.951	1.175	0.270
Adj. R-Squared	0.980			
F-statistic	34.755			
p.> F	0.000			

The result indicated that investment in education (education budget) has positive long effect on the development of STEM while increased students enrolment into post primary education in Nigeria could revert to low quality of STEM education. The result could be probably due to increase in students' enrolment without corresponding increase education budgeting and human and material resources available in the school system. The result is contrary to the theoretical and empirical expectation which is that increase in education financial budgeting should lead to increase in development of STEM education (Papke, 2005, and Papke, 2008), and that an increasing students' enrolment due to increasing interest in STEM education should also produce corresponding increase in students' performance provided that there is increased resources, in order to maintain quality (Verspoor, 2008). However, the situation is contrary probably due to the level education financial budget that is not commensurate with the level of students' enrolment.

In order to examine the effect of presence of autocorrelation in the estimated model, CUSUM and CUSUMSQ plots were assessed and the result indicates that the estimates are stable as seen in Figure 2 and 3.

CUSUM Plots

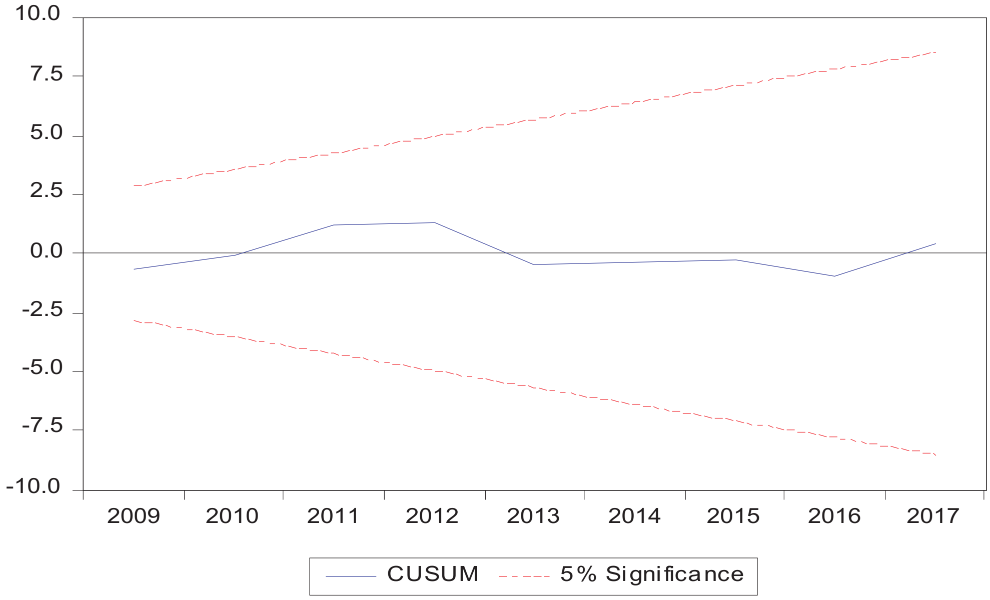

Figure 2: CUSUM Model Stability

The result in Figure 2 and 3 attests to the stability of the model at 0.5% .The plot shows that the coefficients of the model are stable even in the long-run. This is an indication that the variables in model are valid predictors of STEM education.

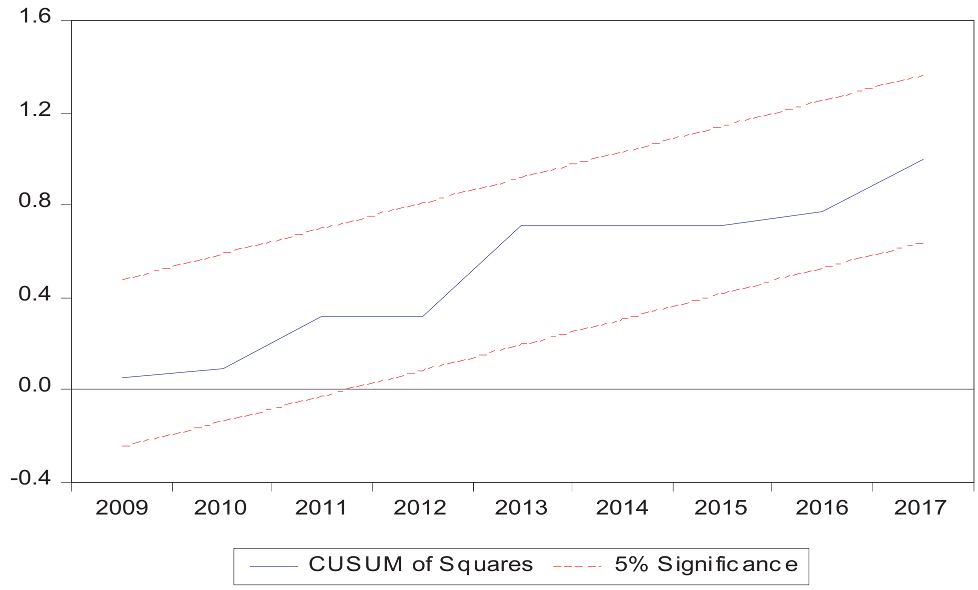

Figure 3: CUSUM of Squares Plot

The CUSUM square plot also confirms the stability of the model at 5% since the blue line is within boundary of the two red lines.

Conclusion

Optimizing benefits inherent in STEM is the quest of many nations especially in the current era when technology dictates the manner by which individuals do things and live. Based on the findings of the study it could be observed that funding and students enrolment are germane to the development STEM education. The findings revealed that the current status of STEM education with respect to financial budget and students' enrolment might lack sustainability in the future. This is premised on the fact that both education budget and enrolment have no significant long run effects on the development of STEM education. This finding in particulars shows that the investment in STEM education by Nigerian education stakeholders was not commensurate with number of recipient of education service which has implication on the quality of STEM education. The result also serves as a pointer to the fact that more resources in term of human and materials are needed for quality STEM education in Nigeria to assume global competitiveness. Therefore, it could be said that Nigerian lacks required STEM culture to compete among STEM advanced nations or she need more commitment to the investment in education for quality STEM education to be assured.

Recommendations

Based on the conclusion made, the following recommendations could be proffered for actionable strategy by education stakeholders to improve the status of STEM education in Nigeria:

1. Nigerian government and other education stakeholders should increase spending on STEM education by increasing the monetary value of budgetary allocation to education as opposed to customary 0.76 % of her GNP.
2. Effort should be made by government and education administrators to moderate students' enrolment into STEM to be commensurate with the carrying capacity of available human and material resources with students' enrolment for better assurance of quality STEM education in Nigeria.
3. Policies that will improve the status of STEM education and its sustainability should be made in order to foster global competiveness in STEM education in Nigeria both now and in the future.
4. Commitment to the development of STEM education at the basic level (through investment in Universal Basic Education in Nigeria) should be the pursuit of government at every levels so as to lay solid foundation for STEM for other levels of education to build on.

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