Modelling Government Expenditure-Poverty Nexus for Ghana

Nyarkoh, James Bright

Faculty of Economics and Business Administration, Catholic University of Ghana-Fiapre, Sunyani, Ghana

21 December 2016

Modelling Government Expenditure-Poverty Nexus for Ghana

James Nyarkoh Bright (PhD Candidate)
Faculty of Economics and Business Administration,
Catholic University of Ghana-Fiapre, Sunyani, Ghana
Corresponding E-Mail: brightnyarkoh@yahoo.com
Phone: +233249307101

Abstract

The paper examines the effect of government expenditure on poverty incidence for Ghana during the period 1960 to 2013. Using the Johansen test (JH), Vector Error Correction (VECM) test, and the Ordinary Least Square (OLS), it is found that poverty incidence positively correlated with government expenditure. The implication of the finding is that poverty is not reducing with increase in government expenditure. Future studies should consider the issues of causality and structural break as well as panel study.

Jel Codes: I32, I38
Keywords: Poverty incidence, government spending, Income

1.0: Introduction

The nexus between government expenditure and poverty has attracted a lot of attention in the literature (Ostensen, 2007; Fan et al., 2008; Birowo, 2011) because poverty has become pervasive and intractable in developing economies. In order to meet the objectives of the Millennium Development Goals (MDGs) of reducing poverty, policy makers embark on various policies to promote economic growth and subsequent reduction of poverty. Among the policy measures are increases in government expenditure in total and in composition. Various definitions have been provided for poverty. For a review of the definitions, see the works of these authors and bodies (Ringen, 1988; Sumodiningrat, 1999; World Bank, 2001; Ravallion, 2001; Asian Development Bank, 2006; Meth, 2006).

The empirical verification of the effect of government spending on poverty reduction have not yielded consistent results in the literature. The findings are found in the works of various researchers (Ostensen, 2007; Fan et al., 2008; Mehmood & Sadiq, 2010; Birowo, 2011; Nazar and Mahmoud, 2013; Okulegu, 2013; Hidalgo-Hidalgo & Iturbe-Ormaetxe, 2014). For example, Hidalgo-Hidalgo & Iturbe-Ormaetxe (2014) study finding suggest that public expenditure in primary education has a strong effect on raising individuals above the poverty line.

In addition, in the Sistan and Baluchestan Province of Iran for the period 1978 to 2008, Nazar and Mahmoud (2013) investigated the government spending-poverty rate nexus and reported that constructive expenditures component of government spending have significant positive effect on poverty reduction. However, current expenditure component of government spending have negative effect on poverty rate for the period under discussion. The findings of the study suggest that components of government spending have different effects on poverty reduction in Iran. The study is of interest for using the autoregressive distributed lag model (ARDL) which have various advantages in analysing the long run and short run effect.

In a similar study of the link between poverty and government spending in Nigeria for the period 1980-2009, Okulegu (2013) investigated the effect of government expenditure (proxied by agriculture spending) on poverty reduction. The findings of the study indicated negative relationship between poverty reduction and government spending for the period under investigation. For example, the results show that 1% increase in Agricultural Credit Guarantee Scheme Fund leads to about 0.06% decrease in poverty rate. The findings are in line with that of Nazar and Mahmoud (2013) that poverty reduction is related differently to different components of government spending. Mehmood and Sadiq (2010) study reported of the link between government spending and poverty reduction for Pakistan reported of significant effect of government spending on short run in the short run as well as long run.

Fan et.al (2008) examined the link between poverty reduction and government spending for Thailand for the period 1977-1999. The findings of the results suggest that various components of government expenditure have different effect on poverty reduction. For example, government expenditure on rural electricity has the largest marginal return for the country. The findings show that 272 poor are lifted out from poverty for every million baht spent on rural electricity, whereas130 poor are lifted out of poverty for every million baht invested in agricultural research. These are followed by expenditure in education and in irrigation.

Other studies that have reported significant effect of government spending on poverty reduction are Benneth (2007) for Nigeria, Ostensen (2007) for Norway, Mosley, Hudson, and Verschoor, (2004), Gomanee, Morrissey, Mosley, and Verschoor (2003), Balisacan (2002) for Indonesia, Fan, Zhang, and Zhang (2000) for China. The review indicates that government expenditure effect on poverty is still an empirical fact.

The aim of this study is to examine the effect of government expenditure on poverty (proxied by child mortality) for Ghana. The findings in the literature are mixed, and that motivated the current study. The issue of poverty in many economies have become intractable and policy makers have been dealing with the issue with various policies such as increases in public expenditure. The study is based on the assumption that government expenditure has not significantly reduced poverty incidence (proxied by mortality) in the short run and long run.

The rest of the paper is organised as follows. The econometric methodology is given in section 2. The data and empirical results are discussed in section 3. Section 4 looks at the conclusions.

2.0: Econometric Methodology

2.1: Estimation Method

Stationarity of government expenditure and poverty variable is tested by using the augmented Dickey-Fuller (ADF) unit root test procedure and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root test procedure. The ADF test is based on the null assumption that there is unit root in the variables in levels. The KPSS is based on the assumption that there is stationary around a deterministic trend (i.e. trend-stationary) against the alternative of a unit root. The ordinary least square test procedure (OLS) is used to test the correlation between government expenditure and poverty incidence (proxied by child mortality). The long run relationship between government expenditure and poverty incidence is tested using the Johansen test procedure (JH). The short run link between government expenditure and poverty incidence is tested using the vector error correction test procedure (VECM).

The ADF is specified as in equation (1).

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \partial_1 \Delta y_{t-1} + ... + \partial_{p-1} \Delta y_{t-p+1} + \varepsilon_t ....(1)$$

where is α a constant, β the coefficient on a time trend and ρ the lag order of the autoregressive process. Imposing the constraints α=0 and β=0 corresponds to modelling a random walk and using the constraint β= 0 corresponds to modelling a random walk with a drift.

The KPSS may be specified as in equation (2), considering deterministic time trend, a random walk and a stationary residual.

$$Y_t = \beta t + (r_t + \alpha) + e_t ....(2)$$

Where $r_t = r_{t-1} + u_t$ is a random walk, the initial value $r_0 = \alpha$ serves as an intercept, t is the time index, u_t are independent identically distributed $(0, \sigma_u^2)$. The null and the alternative hypotheses are formulated as follows:

$H_o : Y_t$ is trend (or level) stationary or $\sigma^2{}_u = 0$

$H_1 : Y_t$ is a unit root process

The Johansen test is specified in VAR (ρ) form as in equation (3).

$$X_t = \mu + \Phi D_t + \prod_p X_{t-p} + ... + \prod_1 X_{t-1} + e_t ....(3)$$

Where t=1,…,T. The Π_p, and Π_1 are matrixes of variables. The lag length in the VAR is p lags on each variable. The Johansen test has two main forms, the trace test, and the eigenvalue test, which are equivalent test, are used to test the long run hypothesis. The null hypothesis for the trace test is that the number of cointegration vectors is r=r*<k, against the alternative hypothesis that *r=k*. Testing proceeds sequentially for *r**=1, 2, 3, …, T. The first non-rejection of the null hypothesis is taken as an estimate of *r*. The null hypothesis for the "maximum eigenvalue" test is the same as that for the "trace" test but the alternative hypothesis is r=r*+1 and, again, testing proceeds sequentially for *r**=1, 2, 3, … T, with the first non-rejection used as an estimator for r.

The VECM is specified as in equation (4).

$$\Delta X_t = \mu + \Phi D_t + \prod X_{t-p} + \Gamma_{p-1} \Delta X_{t-p+1} + ... + \Gamma_1 \Delta X_{t-1} + e_t ....(4)$$

For t=1,…,T. Where $\Gamma_i = \prod_1 + ... + \prod_i - 1, i = 1,..., p-1$.

2.2: Data

The empirical study uses annual mortality data, government expenditure, and income for Ghana over the period 1960-2013. Data used are secondary time series data obtained from World Bank database. The sample size is 54.

Table 1: Data Description, Proxies and Sources

Data Description	Source
Government Expenditure (GE)	World Bank World Development Indicator (WDI)
Poverty (POV), proxied by Mortality	World Bank World Development Indicator (WDI)
Income, proxied by Gross Domestic Product (GDP)	World Bank World Development Indicator (WDI)

Source: World Bank, 2014

2.3 Conceptual Framework and the Model

The relationship between government expenditure and poverty is modelled for Ghana to determine whether government expenditure and poverty are cointegrated over the period under discussion. The link between government expenditure and poverty is modelled in the current study in a trivariate model as shown in equation (5). The dependent variable in the model is poverty (POV) whereas the independent variable is government expenditure (GE) with income as the control variable (GDP). The model is specified in log-linear form.

$$\ln POV_t = \ln GE_t + \ln GDP_t + e_t ....(5)$$

3.0: Empirical Results

3.1: Descriptive Statistics

Table 2 provides a summary statistics of the variables in the model estimated. The mean is use to measure the central tendencies, and the values indicate a good fit. The coefficients of variation is use to measure the volatility of the data set. The results show that government expenditure (0.2209) is less volatile than poverty (0.3328), with gross domestic product (0.5968) been more volatile. Poverty falls as low as 66.5000 and as high as 210.9000, whereas government expenditure falls as low as 5.8613, and as high as 20.9870. Gross domestic product falls as low as 3.2039e+009 and as high as 1.9844e+010. The standard deviation is use to measure the dispersion of a set of data from its mean. The more spread apart the data set, the higher the deviation. The results indicate that government expenditure is less spread (2.5982) than poverty (47.8440) with income more spread than poverty and government expenditure (4.0840e+009). The coefficient of skewness is use to measure the nature of distribution of the series. The results indicate government expenditure (0.7946), and income (1.5853) are positively skewed, whereas poverty is negatively skewed (-0.0604). The coefficient of kurtosis is use to measure the nature of peakness. The value for poverty (1.4515), government expenditure (2.1238), and income (1.7933) are more than zero and does not indicate more flat-topped distribution.

Table 2: Summary Statistics, using the observations 1960 - 2013

Variable	Mean	Median	Minimum	Maximum
POV	143.7900	146.9000	66.5000	210.9000
GE	11.7590	11.4470	5.8613	20.9870
GDP	6.8434e+009	4.8264e+009	3.2039e+009	1.9844e+010
Variable	**Std. Dev.**	**C.V**	**Skewness**	**Ex. Kurtosis**
POV	47.8440	0.3328	-0.0604	-1.4515
GE	2.5982	0.2209	0.7946	2.1238
GDP	4.0840e+009	0.5968	1.5853	1.7933

Source: Author's Computation, December 2016

3.2 Results on Unit Root Test

3.2.1 Time Series Plot

The time series plot results are shown in figure 1 to figure 7. The figures show that the variables (POV, GE, and GDP) are non-stationary in levels (figure 1 to figure 3). However, the variables attained stationarity after they were first differenced, and second differenced (in the case of POV) (figure 4 to figure 7). The unit root properties are scientifically examined using the ADF test, and the KPSS tests. The results of the test are reported in Tables 3 and Table 4.

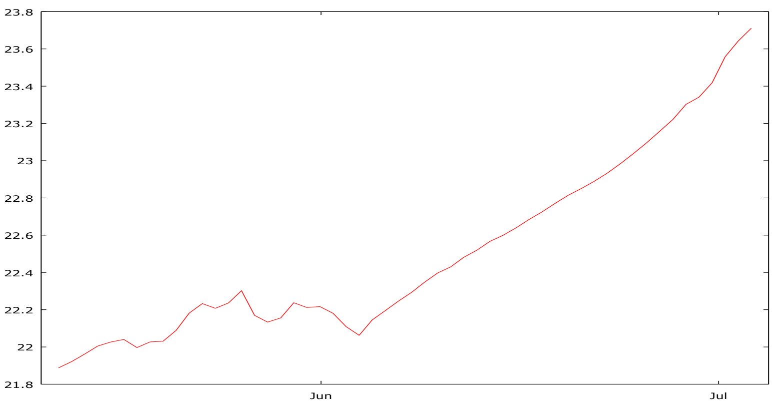

Figure 1. Time Series Plot of lnGDP (levels)

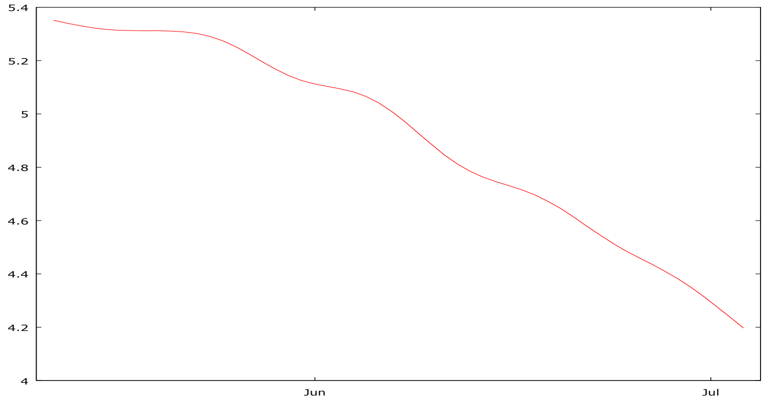

Figure 2. Time Series Plot of lnPOV (levels)

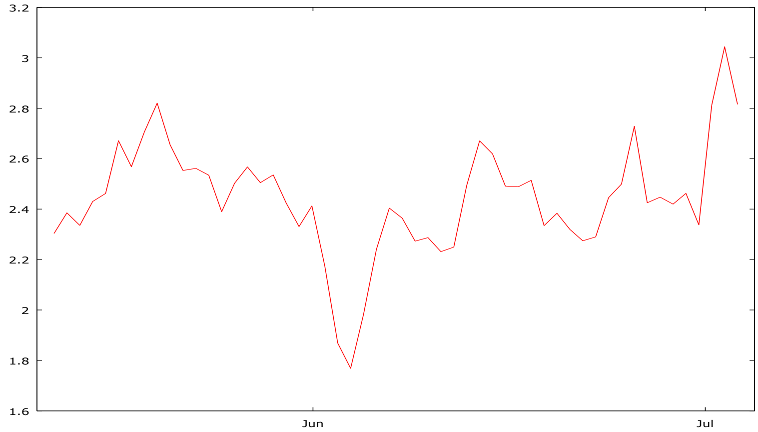

Figure 3. Time Series Plot of lnGE (levels)

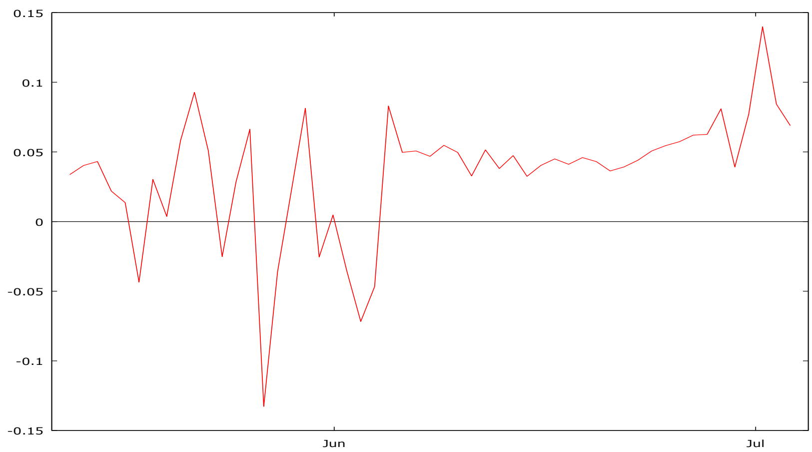

Figure 4. Time Series Plot of lnGDP (1st diff.)

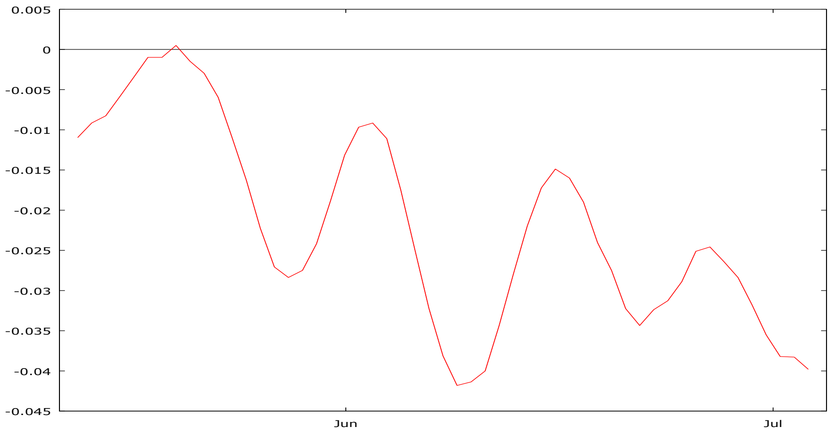

Figure 5. Time Series Plot of lnPOV (1st diff.)

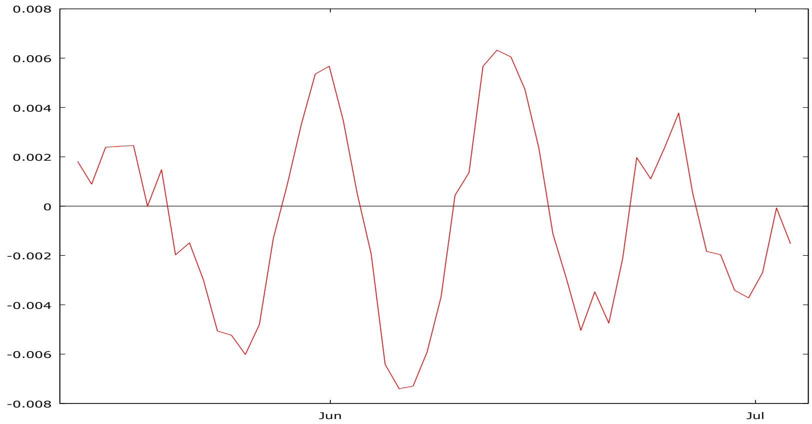

Figure 6. Time Series Plot of lnPOV (2nd diff.)

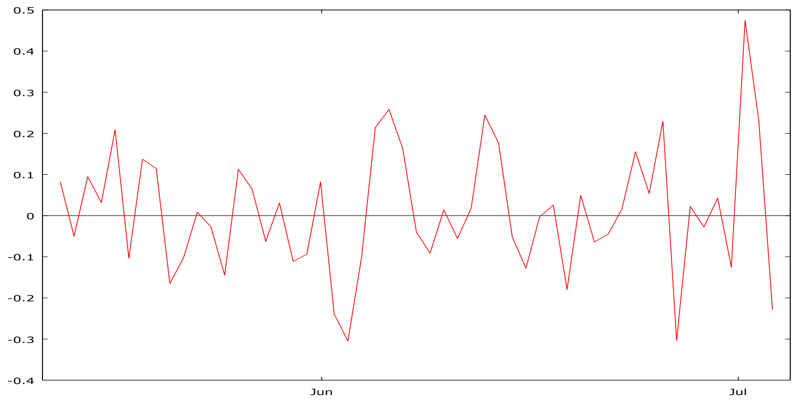

Figure 7. Time Series Plot of lnGE (1st diff.)

3.3: Results of Unit Root Tests

The two stationarity tests used in the study are the Augmented Dickey-Fuller test (ADF), and Kwiatkowski, Phillips, Schmidt and Shin (KPSS).

3.3.1: The ADF Test

The ADF test was first used to test for stationarity. Table 3 reports the results of the tests. The results of the ADF test in levels and in first difference in logarithm form show that the series are non-stationary in levels. However, they attained stationarity on differenced. The null hypothesis of stationarity was accepted for all the variables (in levels), however, the null hypothesis of stationarity was rejected on differenced.

Table 3: ADF stationarity test results with a constant and trend

Variables	t-observed	t-critical	ADF P-Value	Results	Lag length
lnGDP-level	0.0286	0.6275	0.9996	Not stationary	10
lnGDP-1st diff.	-1.0976	-3.7709	0.0180	Stationary	10
lnPOV-level	-0.0052	-0.5837	0.9795	Not stationary	10
lnPOV-1st diff	-0.1174	-2.2017	0.4881	Not stationary	10
lnPOV-2nd diff.	-0.9203	-4.2781	0.0033	Stationary	10
lnGE-level	-0.1834	-1.2427	0.9008	Not stationary	10
lnGE-1st diff	-1.8804	-5.1699	8.31e-005	Stationary	10

Source: Author's Computation, December 2016

3.3.2: The KPSS Test

The KPSS test for investigating the stationarity properties was used in addition to the ADF test as a confirmatory test. The results (in levels and in difference in their logarithm form) are shown in Table 4. All the variables attained stationarity on differenced but not in levels.

Table 4: KPSS stationarity test results with a constant and trend

Variables	t-observed	Results	Lag length
lnGDP-level	0.3352	Not stationary	3
lnGDP-1st diff.	0.1163	Stationary	3
lnPOV-level	0.3159	Not stationary	3
lnPOV-1st diff.	0.0816	Stationary	3
lnGE-level	0.1712	Not stationary	3
lnGE-1st diff.	0.0562	Stationary	3
	10% 5% 1%		
Critical values:	0.121 0.149 0.213		

Source: Author's Computation, December 2016

3.4: Regression Results

The OLS regression performed to examine the correlation among the variables in the model are reported in Table 5. The results shows significant positive relationship between government expenditure and poverty incidence. The results indicate that 1% increase in government expenditure leads to about 25.4% increase in poverty incidence. The results in addition, show that 1% increase in income leads to about 74.4% decrease in poverty incidence. The values of the R^2 and the adjusted R^2 show that the estimated model perform very well. The value indicates that government expenditure and income explains about 95.6% changes in poverty incidence.

Table 5: OLS Regression Results of the link between Poverty incidence and Government Expenditure

OLS, using observations 1905/05/13-1905/07/05 (T = 54)					
Dependent variable: lnPOV					
	Coefficient	Std. Error	t-ratio	p-value	
Const	21.0277	0.5563	37.8022	<0.00001	***
lnGE	0.2542	0.0451	5.6388	<0.00001	***
lnGDP	-0.7436	0.0263	-28.2740	<0.00001	***

Mean dependent var	4.9077	S.D. dependent var	0.3619
Sum squared resid	0.2932	S.E. of regression	0.0758
R-squared	0.9578	Adjusted R-squared	0.9561
F(2, 51)	424.0907	P-value(F)	1.66e-32
Log-likelihood	64.2073	Akaike criterion	-122.4145
Schwarz criterion	-116.4476	Hannan-Quinn	-120.1133
Rho	0.8484	Durbin-Watson	0.3203

Source: Author's Computation December, 2016

Note *** denote 1% significance level

3.4.1: Results of Diagnostic and Stability Tests

Table 6 reports the diagnostic tests results of the OLS regression on the estimated parameter coefficients. The estimated model passed the heteroskedasticity test and the normality test. However, the model did not pass the specification test, and the autocorrelation test. The stability tests results using the CUSUM and CUSUMSQ as depicted in figures 8 and 9 indicate that, the estimates and the variance as well as the residuals are not stable. The square residual is also not stable. The CUSUM and CUSUMSQ plots fall outside the 5% critical boundaries. The null assumptions of parameter stability are rejected in both tests.

Table 6: Diagnostic Test Results of OLS Regression

A. Reset Test for Specification
Null hypothesis: specification is adequate Test statistic: F(2, 49) = 10.4116 p-value = P(F(2, 49) > 10.4116) = 0.0001
B. Breusch-Pagan Test for Heteroskedasticity
Null hypothesis: heteroskedasticity not present Test statistic: LM = 9.1421 p-value = P(Chi-square(5) > 9.14207) = 0.1035
C. Test for Normality of Residual
Null hypothesis: error is normally distributed Test statistic: Chi-square(2) = 1.4779 p-value = 0.4776
D. LM Test for Autocorrelation up to order 7
Null hypothesis: no autocorrelation Test statistic: LMF = 19.2680 p-value = P(F(7,44) > 19.268) = 0.0000

Source: Author's Calculation from data Collected from WDI, December 2016

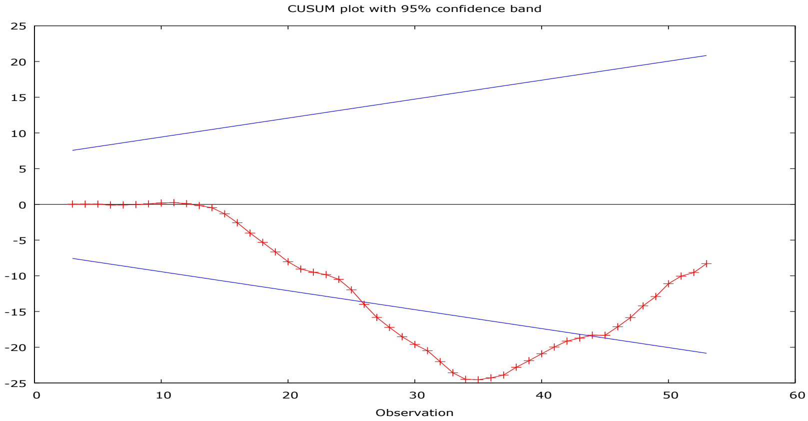

Figure 8. Plot of CUSUM

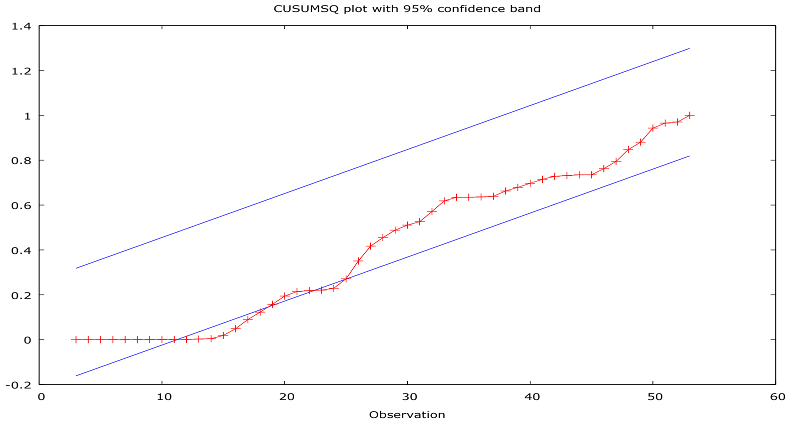

Figure 9. Plot of CUSUMSQ

3.4.2: Johansen Test Results of the Long Run Relationship between Poverty incidence and Government Expenditure

The results on the investigation of the long run relationship among poverty incidence, government expenditure, and income are as reported in Table 7. The results indicate significant long run relationship among the variables using the Johansen method. Both the trace test and the maximum Eigen value test passed the test of stability.

The error correction test (ECM) used to examine the short run relationship among poverty, government expenditure, and income indicate that there is still disequilibrium in the short run since the error correction term (ECM-1=-0.0103; p=0.0133) is significant. The value have the expected a priori theoretical sign of negative. The value indicate that about 1% of errors generated in the previous period is corrected in the current period for the estimated model. The speed of adjustment is very slow.

Table 7: Johansen Cointegration Test Results and the Vector Error Correction Results

Johansen test: Number of equations = 3 Lag order = 7 Estimation period: 1905/05/20 - 1905/07/05 (T = 47)				
Rank	**Eigenvalue**	**Trace test/p-value**	**Lmax test p-value**	
r=0	0.5277	50.7320[0.0000***]	35.2580[0.0001***]	
r=1	0.2408	15.4740[0.0488**]	12.9450[0.0789*]	
r=2	0.0524	2.5291[0.1118]	2.5291[0.1118]	
Variable	**Coefficient**	**Std. Error**	**T-Ratio**	**P-value**
EC-1	-0.0103	0.0039	-2.6490	0.0133**
Mean dependent var	-0.0237	S.D. dependent var	0.0116	
Sum squared resid	0.0000	S.E. of regression	0.0011	
R-squared	0.9941	Adjusted R-squared	0.9898	
rho	0.0147	Durbin-Watson	1.8943	

Source: Author's Computation, December 2016

Note ***, ** denote 1%, and 5% significance level

4.0: Conclusion

The study has examined government expenditure-poverty incidence nexus using the OLS, Johansen test, and the VECM in log-linear form for Ghana for the period 1960-2013. There is long run and short run link between poverty incidence and government expenditure, which is in line with that of Mehmood and Sadiq (2010) study that there is stable long run and short run link between poverty incidence and government expenditure.

The positive link between government expenditure and poverty incidence does not support the findings of the studies (Hidalgo-Hidalgo & Iturbe-Ormaetxe, 2014, Nazar & Tabar, 2013, Mehmood & Sadiq, 2010, Fan et al., 2008) that reported that increases in government expenditure has positive effect on poverty reduction. The findings do not support the theory that government expenditure reduces poverty incidence through various channels. The findings suggest that increases in government expenditure is associated with increases in poverty incidence (proxied by mortality rate). Government expenditure should be targeted at sectors that will lead to a reduction in poverty incidence.

Future study should consider disaggregate government expenditure effect on poverty incidence since the literature indicate various components of government expenditure have different effect on poverty reduction. Future research should also take into account the effect of structural breaks, causality, and panel analysis. Other proxies of poverty should be considered in future study.

The findings are limited by the use of secondary data, which may be associated with certain challenges. The findings are also limited by the limitations of the KPSS, ADF, OLS, and the Johansen tests. Causal interpretations could also not be made in the current study. However, these limitations do not in any way invalidate the findings of the study.

References

Asian Development Bank (2006). Poverty Handbook Analysis and Processes to Support ADB Operations:

Balisacan, A. M., Pernia, E. M., & Asra, A. (2002). Revisiting Growth And Poverty Reduction In Indonesia: What Do Subnational Data Show? ERD Working Paper No. 25, Asian Development Bank.

Benneth, O. (2007). Fiscal policy and poverty reduction: some policy options for Nigeria, African Economic Research Consortium, Aerc research Paper 164.

Birowo, T. (2011). Relationship between Government Expenditure and Poverty Rate in Indonesia: Comparison of Budget Classifications before and After Budget Management Reform in 2004. Available at http://r-cube.ritsumei.ac.jp/bitstream/10367/2586/1/Tejo%20Birowo.pdf. Retrieved on 10/12/2016

Fan, S., Zhang, L., & Zhang, X. (2000). Growth and Poverty in Rural China: The Role of Public Investments. EPTD Discussion Paper No. 66.

Fan, S., Yu, B., & Jitsuchon, S. (2008). Does Allocation of Public Spending Matter in Poverty Reduction? Evidence from Thailand. *Asian Economic Journal*, 22 (4), 411-430.

Gomanee, K., Morrissey, O., Mosley, P., & Verschoor, A. (2003). 'Aid, Pro-Poor Government Spending and Welfare', University of Nottingham: CREDIT Research Paper, no.03/03.

Hidalgo-Hidalgo, M., & Iturbe-Ormaetxe, I. (2014). Long-run Effects on Poverty of Public Expenditure in Education. WP-AD 2014-06.

Mehmood, R., & Sadiq, S. (2010). The Relationship between Government Expenditure and
Poverty: A Cointegration Analysis. *Romanian Journal of Fiscal Policy*, 1(1), 29-37.

Meth, C. (2006). "What was the poverty headcount in 2004 and how does it compare to recent estimates by van der Berg et al?," Unpublished Report. 18 May 2006.

Mosley, P., Hudson, J., & Verschoor, A. (2004). "Aid, Poverty Reduction and the New Conditionality". *The Economic Journal*, 114(496), 217-43.

Nazar, D., & Tabar, M. H. (2013), "Government Expenditures and its Impact on Poverty Reduction (Empirical From Sistan and Baluchestan Province of Iran)". International Journal of Academic Research in Economics and Management Science, 2(1), 251-260.

Okulegu, B. E. (2013). "Government Spending and Poverty Reduction in Nigeria's Economic Growth". *International Journal of Social Sciences and Humanities Reviews*, 4(1), 103-115.

Ostensen, M. (2007). The Effects of Local Government Spending on Poverty in Norway. Department of Economics of University of Oslo.

Ravallion, M. (2001) 'Growth, Inequality and Poverty: Looking Beyond Averages'. *World Development*, 29(11), 1803-1815.

Ringen, S. (1988). Direct and indirect measures of poverty. *Journal of Social Policy*, 17(3), 351- 365.

Sumodiningrat, G. (1999). Community Empowerment and Social Safety Nets. Jakarta: Gramedia Pustaka Utama.

World Bank (2001). *World Development Report 2000/2001: Attacking Poverty*. New York: Oxford University Press.

World Bank (2014). *World Development Indicators 2014*. Washington DC: World Bank.