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ABSTRACT

The empirical literature on aid effectiveness is mired with controversy. In this regard, the paper aims to investigate the effect of aid on economic growth in Ghana. Using Auto-Regressive Distributed Lagged Models as the main estimation strategy, the study concludes that aid has a positive and statistically significant effect on economic growth. The effect of aid on economic growth is more pronounced taking into account the marginal effect of a shift in economic policy from a controlled economic regime to an open market system. The result is robust when the data is triangulated with other estimation methods. Following the key findings, the study recommends that government pursues economic policies that promotes more private sector participation. Also, alternative financing that focuses on the domestic market should be encouraged to avoid the negative impact of dwindling aid inflows.

JEL: G2; F35; O4; O11

Keywords: Economic Growth; Aid; Economic Regime; Cointegration; Ghana

1. Introduction

Aid is one of widely discussed topics in development economics due to its political and economic significance. Studies on aid have evolved over time. However, the existing literature is still mired with controversy as to whether aid has been effective (Askarov & Doucouliagos, 2015;). Various groups of studies have produced distinct empirical conclusions with different policy implications (Lessmann & Markwardt, 2012). Generally, early studies on aid-growth relations conclude that aid and growth are positively related (Hansen & Tarp, 2000; Lof, Mekasha, & Tarp, 2015), whereas recent studies find aid as ineffective in influencing growth at the aggregate level (Mekasha & Tarp, 2013). The controversy raises several questions regarding aid effectiveness. Whereas some studies attribute aid ineffectiveness to the econometric procedure and data treatment used to analyse aid-growth nexus (Juselius, Møller and Tarp, 2014), others posit that the theoretical exposition and choice of explanatory variables affects the empirical conclusions (Chatelain & Ralf, 2014). This paper examines aid-growth nexust using Ghana as case study in a cointegrating time series framework. The choice of Ghana fits into the context of a country that has transitioned from interventiinist economic regime to a liberal economic policies (Adu, Marbuah, & Mensah, 2013). Although the result herein are specific to the case of Ghana, it is widely applicable to other countries especially in Sub-Sahara Africa that moved away from interventionist policies to an open market policies championed by the Bretton Woods Institutions (Abbott, Barnebeck, & Tarp, 2010).

The study adds to existing knowledge in two ways. There is scant literature on country specific studies on aid-growth relations. This study adds to the existing knowledge by providing further evidence on aid-growth relations in a time series framework. Second, it provides new evidence on aid effectiveness by accounting for shift in economic regime. After Burnside and Dollar's (2000) paper on aid effectiveness in the presence of good economic policy, different proxies have been used to measure "good policy". As discussed by Juselius, Møller and Tarp (2014), the choice of proxies and data treatment affects the empirical result. This study adopts a constructive approach to identify policy shift by examining structural breaks in data series and relates it to historical change in economic regimes pursued by Ghana. Thus, a good policy is derived from data rather than being subjectively assigned. This paper refers to economic regime as a set of rules that regulates the operation of an economy within a period of time. The study distinguished between a regime with interventionist polices and a regime with liberal policies. This is done through application of structural breaks (Zivot & Andrews, 1992). Although structural break is not uncommon in time series analysis, it has not received the needed attention in aid-growth analysis. This study applies structural breaks in identifying policy shifts to bridge the gap in literature.

The rest of the paper is structured as follow; section 2 discusses the theoretical and empirical literature on aid-growth relations, while section 3 highlights its importance for the Ghana case. Next, the empirical strategy used to examine aid-growth relations is explained in section 4. Section 5 provides the results for our empirical analysis; the final section discusses the findings followed by conclusions and recommendations.

2. Literature Review

There are two theoretical models that dominates aid effectiveness literature. The neoclassical growth model by Robert Solow and the early growth theory by Horrod-Domar (Hansen & Tarp, 2001). The Harrod-Domar model which was developed into two-gap and three-gap models dominated early studies on aid effectiveness. The use of the Harrod-Domar model has two main implications. First, aid is needed to finance the gap between funds available from the private sector and domestic savings. Second, there is constant returns to incremental aid. However, this assertion is debunked by Hansen and Tarp (2000) that quite a proportion of aid is consumed instead of invested resulting in aid ineffectiveness. Empirical studies based on the Harrod-Domar growth model assumes aid as an exogenous variable. Meaning, aid is an exogenous flow of additional capital stock from the donor country to the recipient country. Thus, aid affects growth through savings and investment (Gomanee, Girma, & Morrissey, 2005). Irrespective of the model used, capital accumulation remains the engine of growth. Easterly (1999) provides a critique of how multilateral institutions such as the World Bank use the gap models to guide aid allocation by way of bridging financial gap. However, the aid-growth relation is not linear and renders the approach ineffective. The method commonly used in the Harrod-Domar model to examine aid-growth relations is a cross country analysis. However, the analytical procedure suffers from model specification errors (Easterly, 1999), problems of endogeneity, measurement error and unobservable characteristics (Juselius, Møller, & Tarp, 2014). Studies relating to this group generally arrived at a positive relationship between aid and economic growth (Minoiu & Reddy, 2010) albeit dubious significance levels.

The second strand of aid-growth literature is based on the Solow growth model and recent expansions into the new growth models (Arndt, Jones, & Tarp, 2010). The Solow model differs from the Harrod-Domar model based on factor substitutability. Whereas the Solow growth theory allows for perfect factor substitution and increasing returns to scale, the Harrod-Domar model assumes constant returns to scale. The implication is that, in the new growth models, aid can lead to a long run effect (Morrissey, 2001). There are several extensions to the new growth model by incorporating factors such as technical change, human capital development, etc (Morrissey, 2001).

The framework of analysis using the new growth theories is interdisciplinary. It incorporates macroeconomics with other disciplines such as politics, institutional environment and economic policy. For instance, studies in the 2000s focused on aid effectiveness based on good policy which was championed by Burnside and Dollar (2000). However, the term good policy has been defined differently by different studies. Easterly (2003) in his work "can aid buy growth" used inflation, budget surplus and economic openness of a country which relates to trade tariffs as measures of good policy. Other measures of good policy includes institutional quality (Young & Sheehan, 2014). Hence, the definition of good policy is arbitrary and lacks sufficient empirical construct. As noted by Hansen and Tarp (2001), the choice of explanatory variables in the aid effectiveness regression influences the results. Arndt et al.(2010) observed that the amount of aid a country receive does not translate into a proportionate increase in growth hence the aid-growth relations is modelled as non-linear.

Due to econometric and statistical problems associated with estimating aid-growth nexus, the current strand of literature has focused on country specific studies in time series framework. This is made possible with the emergence of new sets of data over long periods. Time series approaches used include cointegrating Vector Auto-Regressions (VAR) (Lof et al., 2015) which accounts for problems associated with methods such as heterogeneity, specification bias, etc. This study belongs to country specific analysis in a cointegrating framework using Auto-Regressive Distributed Lag Model (ARDL). The ARDL model is able to account for both short run and long run dynamics of aid effectiveness on growth (Feeny, 2005).

3. Economic Growth and Economic Regimes in Ghana

The analysis in table 1 below shows the trends in macroeconomic indicators from 1975 to 2016. The time intervals chosen relates to the years coinciding with state controlled economic regime (1975-1983), the same time interval after the switch in economic regime to open market system (1984-1992), the entire period under consideration (1975-2016), and the periods where breaks occurred (1983 and 2011) and the year just after a switch in economic regime (1984). Ghana has over the years transitioned from a state dominance economy to a liberal economic regime. Ghana launched an economic recovery program (ERP) in 1983 to salvage previous years of protracted economic decline as shown in negative growth in GDP and per capita GDP (see table 1) from 1975 to 1983, a period characterized by state intervention policies. The overriding goal of the ERP was to reduce Ghana's debt and improve its trading position at the world stage. Ghana recorded -4.56% real GDP growth in 1983 and a significant leap to 8.65% in 1984, a year after the introduction of the ERP.

Table 1: Macroeconomic Indicators of Growth (all figures are in percent)

Indicators	1975 - 1983	1984 -1992	1975 -2016	1983	1984	2011
Real GDP growth	-2.472	5.215	5.478	-4.564	8.648	14.046
Per capita GDP growth	-4.741	2.190	2.754	-7.829	4.976	11.278
Aid/ GDP	4.034	7.578	5.327	3.546	6.516	4.450
Trade/GDP	9.733	6.324	14.152	4.261	4.687	13.841
Capital formation/GDP	6.879	11.541	20.643	3.750	6.877	26.440
Government Expenditure/GDP	10.197	9.868	12.481	5.861	7.259	16.643
Gross Savings/GDP	6.540	5.064	8.132	3.317	4.150	14.018
Domestic Credit to private sector/GDP	3.381	3.846	10.219	1.542	2.209	14.385
Current Account Balance	-0.339	-6.478	-9.903	-0.433	-2.727	-12.422

Source: World Development Indicators (2019), and Authors' Construct

The years before the introduction of ERP was characterized by poor financial management and high inflation rate. The ERP was market-oriented policy (Government of Ghana, 2002).

A Hodrick-Prescott smoothing filter of real GDP from 1975 to 2016 shows a general long-term increase in trend of GDP (see figure 1) since 1984. The real GDP growth mimics a stable growth averaging 5.48% from 1984 to 2016 (see table 1). By 2011 GDP growth had reached its peak of 14.05% partly due to petroleum revenues after the country started mass oil

exploration. Adu and Marbuah, (2011) posit that Ghana's growth dynamics (see cyclical component of GDP in figure 1) can be explained by unsustainable economic policies, and external shocks.

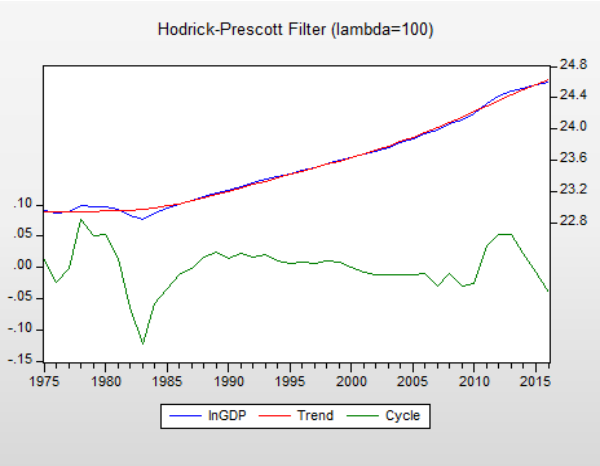

Figure 1: Trends in real GDP (annual), long term trend and cyclical

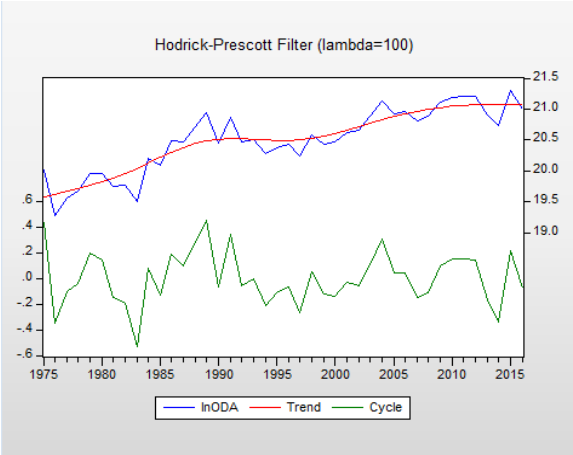

Figure 2: Trends in ODA/GDP (annual), long term trend and cyclical

Source: Author Construct (2019). Data: World Development Indicators (2019)

Ghana's vulnerable external shocks is owed to a volatile commodity and gold prices, and a highly volatile development assistance (see the cyclical component of figure 2). Aid volatility can be inferred from the high deviations in the cyclical components of aid received. The years of declining economic performance corresponds with decrease in donor support. With a shift in economic regime from state controlled system to market friendly economy, aid inflows increased steadily from 1984 to 1989. Increase in donor support dwindled and remained relatively low from 1991 to1997. Structural adjustment in 1990s following tight financial polices deteriorated the country's external accounts. In 1996, non-concessional borrowing increased, heaping further pressure on debt burden. As a result, gross international reserves reduced to equivalent of 2.8 months of imports in 1997. However, the current account was cushioned by aid transfer by about 4.5% of GDP. With unsustainable debts, Ghana joined HIPC in 2002 (International Monetary Fund, 2004). Aid inflows increased steadily until 2005. Development assistance in recent years has been very low. This can be explained by stable economic growth which has propelled the economy into lower middle-income status in 2012. This corresponds to a steep decline in ODA from 2012 to 2014. In general, trends in aid correspond with growth trends (see figure 3 on the relationship between growth trends and aid).

4.0 Model Specification, Data and Methodology

4.1. Model specification

Following review of literature on different specifications of aid-growth relations, the study adopted an empirical specification to capture the impact of aid on economic growth (Hansen & Tarp, 2001; Minoiu & Reddy, 2010). The aid-growth relation is expressed in endogenous

growth theory as $Y = AK_t$ (Boucekkine, Pintus, & Zou, 2018). A is a measure of technology. Y is defined as the real aggregate output of the economy which is a function of total factor productivity and real aggregate capital stock, savings rate and the efficiency of financial intermediation (Adu, Marbuah, & Mensah, 2013). Real aggregate capital stock is a composite of human and physical capital. The empirical model derived from the above theory of growth in a log linear form is stated as;

$$lnY = \delta_0 + \delta_1 lnA_t + \delta_2 W_t + u_t \quad \text{.....(1)}$$

$$lnY = \delta_0 + \delta_1 lnA_t + \delta_2 lnW_t + \delta_3 R_t + \delta_4 \ln(A_t * R_t) + u_t \quad \text{.....(2)}$$

To avoid problems associated with non-logged data such as non-normality, non-linearity in functional form we used logged data. The reasons for using non-logged aid data is often grounded in economic models of gap theories that aid is added to domestic savings to compensate for deficient investment or public investment. This could be solved without compromising on econometric concerns by using (aid + investment). But this would have the restriction that aid is used to compensate for deficient savings which we have no means of verifying (Juselius et al., 2014).

The variable Y represents economic growth, which is measured by real GDP, A is net development assistance (ODA) received. The study uses OECD/DAC definition of ODA which is provided bilaterally from donor governments to recipient or channelled through multilateral agencies. W is a vector of covariates of economic growth including C/Y- gross capital formation as ration of GDP, T/Y- trade volume which is the sum of imports and exports as a ratio of GDP. This study uses trade to measure the degree of openness to international trade. GE/Y is government final consumption expenditure as a ratio of GDP, S/Y- gross savings as a percentage of GDP and $DCPS/Y$- domestic credit to private sector as a ratio of GDP. Gross capital formation as percentage of GDP is a function of both physical and human capitals. In Feeny (2005), government policy and institutions which makes up the economic environment influences economic growth. The study also concludes that a country that attracts inflow of business is one that is opened to international trade and competition and sound economic policies. There are different measures of financial development. However, this study proxies financial development by domestic credit to private sector as ratio of GDP following (Adams & Atsu, 2014) and (Adu et al., 2013). The choice of DCPS/Y as a proxy for financial development is based on strong evidence of its influence on economic growth (Adu et al., 2013). The variable (R) in equation (1b) represents a change in economic regime corresponding to structural break in real GDP. The break is used to represents distinct economic regimes pursued over the time range of the analysis. The period marked by state interventionist policies (1975-1983) assumes the value 0 whereas the period characterized by an open economic system (1984-2016) is denoted by 1. As explained by Burnside and Dollar (2000), aid effectiveness is dependent on good policy. To find the effect of a change in economic regime from a controlled economic system to an open market policies, an interaction term $(Aid * R)$ is constructed following Lskavyan (2014).

In terms of *a priori* expectations, the literature is inconclusive on the sign of aid in relation to economic growth. However, in the presence of good policy, aid is expected to have a positive

and statistically significant effect on economic growth. Theoretically, all the other variables are expected to have a positive influence on economic growth (see figure 3-8 below for expected relationship between economic growth and its covariates).

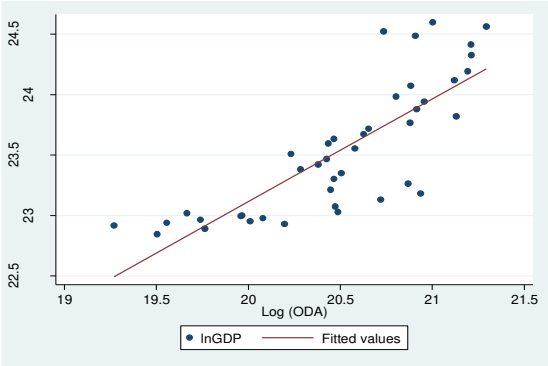

Figure 3: Economic growth vs Official development assistance

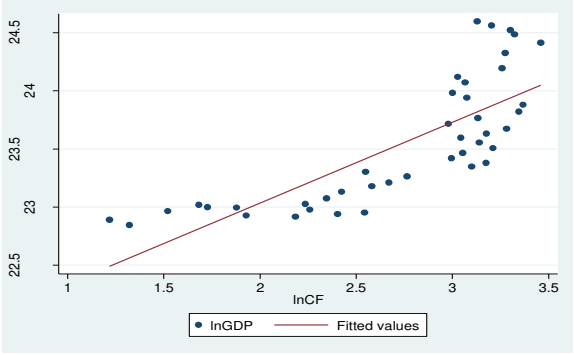

Figure 4: Economic growth vs Gross Capital Formation

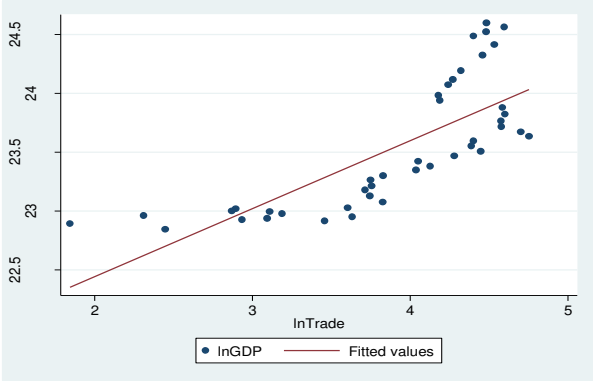

Figure 5: Economic growth vs Trade

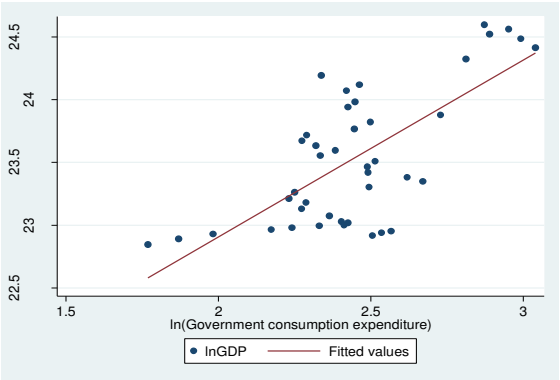

Figure 6: Economic growth vs Government Consumption Expenditure

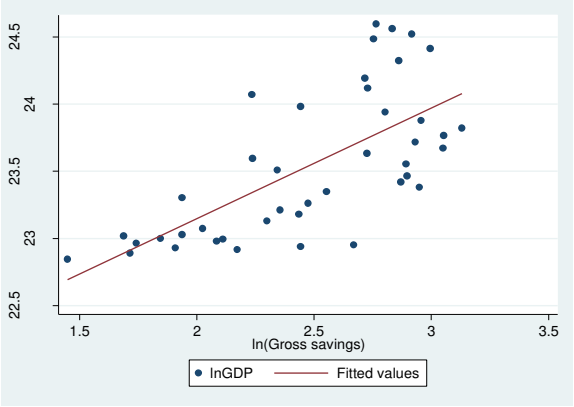

Figure 7: Economic growth vs Gross Savings

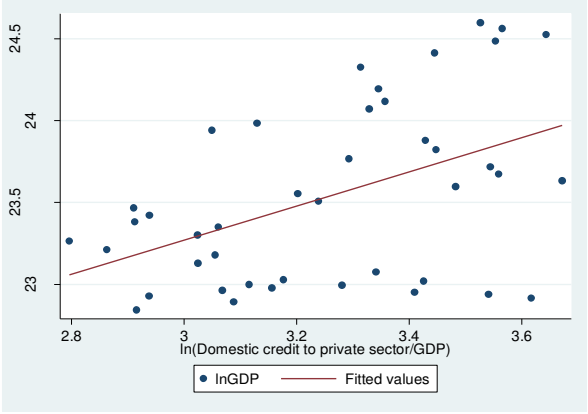

Figure 8: Economic growth vs Domestic credit to Private sector as ratio of GDP

Source: Author Construct (2019). Data: World Development Indicators (2019)

Annual times series data spanning the period 1975–2016 was used. The data was obtained from the World Development Indicators provided by the World Bank. The choice of the time frame of the analysis is based on availability of all the data series. The variables used to estimate aid effectiveness in endogenous growth model are real aggregate GDP, gross capital formation as percentage of GDP, net official development assistance and official aid received as ratio of GDP, gross savings as a percentage of GDP, trade which is measured by the sum of import and export as a ratio of GDP, and domestic credit to private sector as ratio of GDP. Labour force was dropped from the analysis due to the problem of multi-collinearity.

The data was log transformed to put all the data series into the same unit of measurement and to minimize the problem of heteroscedasticity. As explained by Chatelain and Ralf (2014), there is the possibility of encountering the problem of classical regressors in data treatment. In this case, the regressors were tested in both simple and multivariate regression analysis to observe the changes in the coefficients of the parameters. The analysis found absence of the classical regressor problem.

4.2 Unit Root Tests

In time series analysis, it is important to understand the behaviour of the data overtime. Therefore, it is imperative to examine if a time series variable presents unit root characteristics (Shrestha & Bhatta, 2018). A time series data has unit root if it is not level-stationary. Non-stationary time series data has both economic and statistical implications. Thus, non-stationary time series analysis leads to spurious regression if fitted to Ordinary Least Squares Regression (OLS). This implies that, one makes wrong judgement and interpretations from OLS results if a series has unit root. Statistically, unit root series has the potential to affect the magnitude and sign of the coefficient of the estimated regression. Although the ARDL methodology does not require pretesting, it is imperative to avoid the presence of I (2) series (Reed & Smith, 2017). The presence of $I(2)$ invalidates the analytical procedure. The Philips-Perron test for unit root was preferred over other approaches such as the Augmented Dicky-Fuller test. The PP test prevents loss of observations implied in the ADF test. The PP test uses non-parametric methods to adjust for serial correlation and endogeneity of regressors (Phillips & Perron, 1998). Also, PP test allows for heterogeneity of the error term. In order to verify the presence of structural breaks in the variables, Zivot and Andrews test was conducted to complement the PP test (Zivot & Andrews, 1992). ZA test helps to identify structural breaks in data series at an unknown point. Extraordinary events such as wars, violent overthrow of governments, varying aid modalities and conditionality, and abrupt change in economic policies have been frequent in Sub-Sahara Africa which Ghana is not an exception. Unless such events are controlled for, statistical inference is likely to be jeopardized (Juselius et al., 2014). Unlike previous studies (Adams & Atsu, 2014 ; Sethi & Sahoo, 2010), we address this problem by accounting for structural breaks to test whether a change in economic regime have shifted the equilibrium relationship between aid and economic growth in a permanent way.

4.3 Concrete estimation strategy: the ARDL model

The bound testing approach within Auto Regressive Distributed Lag model proposed by Pesaran, Shin, and Smith (2001) is used to test for cointegration between economic growth and its covariates. The bound test ARDL framework is applicable to both level stationary (I (0)) and first differenced stationary (I (1)) or mutually integrated series. Meaning, the method produces reliable estimates irrespective of the level of integration in the absence of I(2) series. The ARDL provides reliable estimates even in the presence of endogenous variables (Feeny, 2005). Pesaran et al. (2001) argue that the ARDL method produces robust estimates. To establish the effect of aid on economic growth, a bound test approach within the framework of ARDL methodology was used. Following equation 1, the ARDL model is stated as follows;

$$\Delta Y_i = \alpha_0 + \sum_{i=1}^{m} \gamma \, \Delta Y_{t-i} + \sum_{i=1}^{m} \theta \, \Delta A_{t-i} + \sum_{i=1}^{m} \varphi \, \Delta W_{t-i} + \sum_{i=1}^{m} \emptyset \, \Delta R_{i-i} + \sum_{i=1}^{m} \beta \, \Delta(A * R)_{t-i} + \rho_1 Y_{t-1} + \rho_2 A_{t-1} + \rho_3 W_{t-1} + \rho_4 R_{t-1} + \rho_5 (A * R)_{t-1} + \varepsilon_t \ldots\ldots \qquad (3)$$

All the variables are previously defined, α_0 is the drift component, Δ is the change operator and ε is the error term assumed to be uncorrelated.

The next stage is to test for the long run relationship between economic growth on one hand, aid and other covariates of growth using the F-statistic. At this step, the F-statistic tests the null hypothesis that the variables are not cointegrated ($H_0 : \rho_1 = \rho_2 = \rho_3 = \rho_4 = \rho_5 = 0$) against the alternative hypothesis that the variables are cointegrated ($H_1 : \rho_1 \neq \rho_2 \neq \rho_3 \neq \rho_4 \neq \rho_5 \neq 0$). The optimal rule of thumb is that the calculated F-statistics is compared with critical values. Pesaran et al. (2001) decomposed the critical values into upper bound and lower bounds. The rule of judgement is that if the calculated F-statistic is greater than the upper critical value, the variables are cointegrated and we are unable to accept the null hypothesis of no existence of long run relationship. The result is inconclusive if the F-statistic falls between the lower and the upper bounds. The optimal lag model is selected based on the Bayesian Information Criteria. This method is chosen over other methods because it has the power to minimize information loss.

5. Empirical results for the Ghana case

5.1 Results of Unit Root Test

Table 2.0 presents the results of the unit root test. The result shows unit root test for PP at level and first differenced and ZA with breaks in intercept, trend and both intercept and trend respectively. The result indicates that the variables used in the regression analysis are all first differenced stationary except log of gross savings to GDP ratio which is level-stationary when trend is included. Thus, when considered at level, all the variables are non-stationary when PP unit root test is applied with restricted trend term. Considering PP unit root test with both intercept and trend, the variables are both mixture of stationary I(0) and non-stationary I(1). For instance, net development assistance and official aid received as ratio of GDP and gross savings as ratio of GDP are all level stationary when a trend term is included. However, the remaining variables such as real aggregate GDP, general government final consumption expenditure, domestic credit to private sector as percentage of GDP, gross capital formation as ratio of GDP and trade as ratio of GDP are non-stationary at the level when trend term is

included. Conversely, all the variables included in the analysis proved stationary after first differencing whether with only intercept or both intercept and trend term. In general, there is no sufficient evidence against the variables as mixture of $I(0)$ and $I(1)$ series.

To examine the presence or lack thereof of structural breaks in the variables, Zivot and Andrews unit root test was used to complement the PP test. The ZA unit root test identifies break at unknown points (Zivot & Andrews, 1992). The ZA test shows a break in trend of real aggregate GDP in 1983. As applied in Adu et al. (2013), we constructed a dummy variable for an economic regime change corresponding with a break in real aggregate GDP. Economic regime variable took the value one (1) after the breakpoint (1984 -2016) and zero for the period before the breakpoint (1975 – 1983). The breakpoint can be explained by a leap in GDP growth from -4.56% in 1983 to 8.64% in 1984 following the launch of economic recovery program (ERP) in 1983 by the IMF. The ERP aimed at reversing protracted period of economic growth. The years before the breakpoint was characterized by lax financial management and complete state control of the economy (International Monetary Fund, 2004).

The result of the PP and ZA unit root test above shows that most of the variables are not stationary at the level. The unit root characteristic of the variables has both economic and statistical implications. By economic implication, shocks to the variables that has unit root leads to permanent effect. This include variables such as real GDP, gross capital formation, trade as a ratio of GDP, etc. Statistically, non-stationarity of the data series implies the likelihood of spurious regression using least square estimates except in the scenario where the independent variables are strictly exogenous. This informed the choice of ARDL as estimation procedure which does not impose strict exogeneity assumptions of regressors and also applicable irrespective of whether the series are I (0) and I(1) so far as there are no I(2) variable

Table 2: Results of the Unit Root (Stationarity) Test

Variables	PP Unit Root Test Result				ZA Unit Root Test Result		
	Level		1st Difference				
	Intercept	Intercept and Trend	Intercept	Intercept and trend	Break in Intercept	Break in Trend	Break in both
Ln(Y)	2.538	-1.988	-3.915***	-4.386***	-2.541(2008)	-3.793(1983)	-2.908(1982)
Ln(A/Y)	-1.484	-4.147**	-10.841***	-10.885***	-3.500(1984)	-2.898(1988)	-3.665(1992)
Ln(T/Y)	-1.121	-2.405	-4.171***	-4.081**	-4.194(2006)	-4.366 (2001) *	-4.430(1983)
Ln(C/Y)	-1.120	-2.656	-7.074***	-6.959***	-4.018(1984)	-3.903(1997)	-4.535(1984)
Ln(GE/Y)	-1.774	-2.754	-5.197***	-5.185***	-3.771(2010)	-4.051(1982)	-3.799(1985)
Ln(S/Y)	-2.373	-4.309***	-10.294***	-10.146***	-5.326 (2007) **	-4.915 (2003) **	-5.312 (1993) **
Ln(DCPS/Y)	-2.096	-2.397	-6.608***	-6.783***	-3.513(1997)	-3.664(1981)	-3.743(1997)

- Note:
  ***** Rejection of the null hypothesis of unit root at the 10% level
  ** Rejection of the null hypothesis of unit root at the 5% level
  *** Rejection of the null hypothesis of unit root at the 1% level

5.2 Results of Long Run Estimates

This section presents the results of the bounds test approach of the ARDL cointegration test and the long run estimates. The test is conducted for two estimation models. The first model has no structural break. In model 2, a dummy is constructed to account for an economic regime switch from controlled economic system to open market system. The bound test approach, tests for the presence of long-run relationship between economic growth and its regressors with results shown in table 3.0 below.

Based on the bounds test result, there is evidence of a long run relationship between economic growth and its covariates. The critical values are different depending on the number of variables in the model. Model 1 has 6 regressors whereas model 2 has 8 regressors. In all model specifications, we were unable to accept the null hypothesis of no cointegration at 99% confidence interval (1% significance level). Hence, there is cointegrating relationship between economic growth and its regressors in all the models. We proceeded to estimate the long run growth effects of aid and other determinants of growth. The long and short run effects of aid on economic growth is presented in table 4.0 and 5.0 respectively. The estimated models 1a, 1b and 1c corresponds to equation (1) whereas results in 2a, 2b and 2c are estimated results for equation (2). The equations are estimated using ARDL cointegration approach with Fully Modified Least Squares and Dynamic Ordinary Least Squares used as robust check.

In model 1a aid has a positive and statistically significant effect on economic growth at 10% significance level. Specifically, the coefficient of aid on economic growth is 0.223. Meaning, a percentage increase in aid inflows causes GDP to increase by 0.223 percent. The effect of aid on economic growth is different when we account for a transition from an interventionist regime to open market regime in model 2a. The effect is positive and significant but dwindles to 0.088%. Thus, to find the effect of aid on economic growth in open market regime, we add the coefficients (-1.186 +1.274) = 0.088. The magnitude of the marginal effect of open market regime on aid is highly elastic at 1.274. The result from this study is consistent with the section of aid-growth literature that concludes on aid effectiveness based on "good policy" (Antwi, 2010 ; Arndt, Jones, and Tarp, 2015; Burnside & Dollar, 2000 ; Juselius et al. 2014; and Wamboye, 2012). In this paper, we assume open market economic regime to be a better policy over interventionist economic regime. Specifically, a shift in a controlled economic system to a market friendly system resulted in high marginal effect on aid and economic growth. Conversely, Adams and Atsu (2014) found a negative and significant effect of aid on economic growth. The differences in the result could be accounted for by methodological procedures and theoretical expositions. Also, the choice of time frame of analsysis differs. Whereas theoretical exposition and data availability allowed for time range from 1975 to 2016, previous studies used data up to 2011. This problem is discussed extensively in Lof et al. (2015). They explained that the choice of explanatory variable and method of data transformation or treatment affects the magnitude of the parameter and statistical signifcance. By triangulating with other methods of estimation procedures, the result is consistent when robust checked using FMOLS and DOLS (models 2b and 3b). In both cases, aid has a positive and significant effect on economic growth with positive marginal effects of open market economic regime.

Table 3: Result of Bounds Test for Cointegration

Estimated Regression Equations		**Critical Values**				
	F-stats	95 %	Bound	99%	Bound	Decision
		I(0)	*I*(1)	*I*(0)	*I*(1)	
$\boldsymbol{F_Y(Y/\ lnAid, lnT, lnC, lnGE, lnS, lnDCPS,)}$	9.4701***	2.45	3.61	3.15	4.43	Evidence of Cointegration
$\boldsymbol{F_Y\ (Y/\ lnAid, R, \ln(Aid * R)\ lnT, lnC, lnGE, lnS/Y, lnDCPS)}$	11.247***	2.22	3.39	2.79	4.10	Evidence of Cointegration

***Rejection of null hypothesis of no cointegration at 1% significance levels

Table 4: Long Run Aid-Growth Nexus

Variables	ARDL		FMOLS		DOLS	
	1a	2a	1b	2b	1c	2c
Constant	2.408	3.060	3.120	2.631	2.710	2.131
	(4.025)***	(6.230)***	(5.185)***	(4.977)***	(6.209)***	(4.324)***
$\boldsymbol{ln(A/Y)}$	0.223	-1.186	-0.103	0.363	0.128	1.854
	(1.829)*	(-3.274) ***	(-0.511)	(0.936)	(0.805)	(2.767)***
$\boldsymbol{ln(A*R)}$		1.274		1.850		3.020
		(3.168)***		(3.477)***		(3.555)***
$\boldsymbol{R}$		-1.777		-0.750		-2.037
		(-2.752)***		(-1.945)*		(-3.140)***
$\boldsymbol{ln(T/Y)}$	-1.845	-0.987	-0.148	0.089	0.004	-0.312
	(-6.738) ***	(-5.616)***	(-0.750)	(0.607)	(0.020)	(-2.280)**
$\boldsymbol{ln(C/Y)}$	-0.249	-0.262	-0.237	-0.633	-0.631	-0.464
	(-2.802) ***	(-2.398)**	(-1.056)	(-3.654)***	(-4.309)***	(-3.017)***
$\boldsymbol{ln(GE/Y)}$	0.454	0.719	0.412	0.399	0.606	0.770
	(2.170) **	(4.865)***	(1.433)	(2.159)**	(2.172)**	(5.134)***
$\boldsymbol{ln(S/Y)}$	0.200	0.009	0.069	0.116	0.106	0.092
	(4.440)***	(0.123)	(0.649)	(1.686)*	(0.972)	(1.719)*
$\boldsymbol{ln(DCPS/Y)}$	2.310	1.545	0.791	0.628	0.896	0.929
	(8.851) ***	(10.046)***	(3.560)***	(4.151)***	(6.137)***	(11.803)***

Note: Values in parenthesis are t-statistics with *, ** and *** represents significance levels at 10%, 5% and 1% respectively. ARDL (1, 0, 1, 0, 1, 0, 1) Selected based on Schwarz Bayesian Criterion). GDP is the dependent variable

Another variable of interest is trade. Trade has a negative and significant effect on economic growth in models 1a, 2a, and 2c. Cases where the sign of trade is positive has no significant effect on economic growth. The negative effect of trade on economic growth can be explained by trade balance deficit recorded over the time range (see table 1). Thus, the volume of import far outweighs the volume of exports**.** Inferring from model 1a, and 2a, 1 percent increase in trade worsens real GDP by approximately 1.85% and 0.99% respectively.

The next variable considered in the endogenous growth model is capital formation. Gross capital formation was found as a significant determinant of economic growth in all the models except in (2a) in table 4.0. This result is surprising and contrary to the Harrod-Domar and the Solow growth models which regards capital accumulation as the most important determinant of growth.

The result of the effect of final general government expenditure on economic growth produced a positive and significant effect on economic growth except in model (2a). In model 2a, although the sign of government final consumption expenditure is positive, it has no significant effect on economic growth. In models (1a and 2a), a percentage increase in government final consumption expenditure is expected to cause economic growth to increase by 0.45% and 0.719% respectively. The robust check by triangulation with alternative estimation methods produced positive and significant causal effect of government spending on economic growth.

The expected sign of gross savings as ratio of real aggregate GDP is positive. An increase in gross savings is expected to make money available for investment thereby leading to economic growth. The result confirms the a-priori expectations and a significant effect in models 1a and 2b. Whereas the positive sign of the parameter is confirmed by the robustness check, the effect of savings on economic growth is insignificant.

Economic theory postulates a positive relationship between economic growth and financial development. Thus, financial deepening leads to growth. The study used domestic credit to private sector as ratio of real aggregate GDP as proxy for financial development. The sign of the parameter is positive and statistically significant in all models, confirming the a-priori theoretical assumptions.

The short run result is provided in table 5 above to check and ensure reliability of the estimates. The result shows consistency in the ARDL framework and its associated diagnostic tests. Thus, the short run effect of aid on economic growth is consistent with the long run estimates. The diagnostic test shows congruence with the data and passes all specification tests applied. The results depict the absence of the problem of serial correlation, heteroscedasticity, functional specification and non-normality of the residuals. The F-statistics shows a good fit of the model, confirming its predictive power. The $\overline{R^2}$ values imply that about 87% and 91% of the variations in economic growth are explained by variations in the estimated regressors.

Table 5: Short Run Results

Variables	1a	2a
Constant	2.870	3.209
	(5.398)***	(5.792)***
Δ*ln*(Y)	-0.875	-0.303
	(-6.029)***	(-2.364)**
Δ*ln*(A/Y)	0.026	-0.152
	(2.128)**	(-3.633)***
Δ*ln*(A*R)	-	0.163
	-	(3.841)***
Δ*ln*(R)	-	-0.145
	-	(-2.258)**
Δ*ln*(T/Y)	-0.101	-0.073
	(-7.380)***	(-5.719)***
Δ*ln*(C/Y)	-0.029	-0.024
	(-2.550)**	(-1.345)
Δ*ln*(GE/Y)	0.081	0.092
	(3.775)***	(4.395)***
Δ*ln*(S/Y)	0.024	0.018
	(3.468)***	(2.707)***
Δ*ln*(DCPS/Y)	0.095	0.077
	(4.785)***	(3.564)***
ECM(-1)	-0.118	-0.128
	(-5.447)***	(-5.549)***
Diagnostic Statistics		
F-Stats	19.288(0.000)	22.917(0.000)
DW-Stat	1.814	1.678
AIC	106.803	113.577
SIC	91.834	94.446
Auto	0.799(0.371)	1.705(0.192)
Functionality form	0.001(0.973)	5.418(0.020)
Normality	0.473(0.790)	1.236(0.539)
Heteroscedasticity	0.927(0.761)	1.832(0.176)
$\bar{R}^2$	0.87	0.91

Note: Values in parenthesis are t-statistics with *, ** and *** represents significance levels at 10%, 5% and 1% respectively. ARDL (1, 0, 1, 0, 1, 0, 1) was selected based on the Schwarz Bayesian Criterion.

Consistent with the long run estimates, a percentage change in aid is expected to cause growth to increase by 0.026% in model 1a and 0.011% (that is, -0.152 + 0.163) in model 2a. The speed of adjustment to long run equilibrium is -0.118 and -0.128 in models 1a and 2a respectively. However, the effect of aid in the short run is weaker as compared to the long run estimates. Theoretically, this is expected as it takes time for investments (projects and programmes) to mature and realise its effects.

The result shows the error correction term is correctly signed (negative) and statistically significant at 1% significance level ensuring attainment of a long run equilibrium following a system shock. The coefficient of the error term measures the speed of adjustment of economic growth to long run equilibrium due to variations in the covariates of growth. Thus, following a deviation from the long run in the previous year, a convergence to the steady state equilibrium is corrected by 11.8% and 12.8% in the current year in models 1a and 2a respectively.

6. Conclusions and Recommendations

This paper sought to examine the effect of aid on economic growth in Ghana. The ARDL cointegration method was used, with FMOLS and DOLS techniques being used for robustness checks. The theoretical model on which the estimation is based is the endogenous growth model. However, labour force was found to be highly correlated with capital and trade. Since the endogenous growth model allows for factor substitution, labour force was dropped from the analysis. The study conclude that aid has a positive and significant effect on economic growth in Ghana consistent with some previous studies (Clemens, Redelet, & Bhavnani, 2012; Juselius et al., 2014; Minoiu & Reddy, 2010)). Again, our analysis shows that aid is more effective in the presence of 'good' economic policy (a proxied by an open market economic regime) following the conclusion by Burnside & Dollar (2000). By implication, withdrawal of significant proportion of aid due to Ghana attaining lower middle-income status will significantly affect the country's growth trajectory, ceteris paribus.

Following the key findings, the study recommends that government put in more effort to open up the economy to enhance aid effectiveness. Thus, policies that promotes private sector participation should be promoted. Also, policies that improves access to domestic credit should be improved. Providing affordable credit to Small and Medium Scale Enterprises will spur the needed innovation and capacity in the various sectors. Increased local production for consumption and export will mitigate the negative effect of trade openness.

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