AN EMPIRICAL EXAMINATION OF THE DETERMINANTS OF ECONOMIC GROWTH IN GHANA

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Abstract

The study investigate the long run and the short run determinants of economic growth in Ghana for the period 1970-2011 using autoregressive distributed lag model to contribute to the body of knowledge in the area of macroeconomic determinants of economic growth. The variables are unit root in levels but attained stationarity in first differencing. The results produce evidence of statistically stable long run relationship and short run adjustment among the variables in the estimated model. More importantly, the results suggest that Ghanaian economy has benefited from trade liberalisation policy, expansionary fiscal policy, increases in prices of goods and services but not from investment and financial development, proxied by gross capital formation and money supply respectively.

JEL classification: E44, E62, F11, F14, F43, F44, O47
Keywords: Economic Growth, Long Run, Cointegration, Price, Investment, Trade Openness

1.1 Introduction

The issue of economic growth has attracted attention and has been discussed widely in the literature by many academicians with inconsistent empirical findings in relation to the main macroeconomic determinants of economic growth and Ghana is no exception (Arvanitidis et al., 2009; Artelaris et al., 2006; Vamvakidis, 2002; Easterly, 2001; Krueger & Lindahl, 2001; Pritchett, 2001).Economic growth is defined as sustained increase in the per capita income of a country or a shift in the production possibility curve (Case et al., 2012; O'Sullivan &Sheffrin, 2007; Mankiw, 2004). Economists explain economic growth as an increase in output resulting from factors such as increase in resources supplies, improvement in human resources, and improvement in technology.

It is important to empirically examine the determinants of economic growth of an economy since the findings have significant policy implications in the area of policy formulation and implementation to achieve sustainable growth. Achieving sustaining growth is of paramount importance to policy makers for various reasons such as poverty reduction, job creation, and improvement in the quality of standard of living (Palmer, 2012).

Achieving sustainable economic growth has been the major concern of the government and policy makers in Ghana since sustainable growth has not been achieved over the years. For example, according to the Institute of Statistical, Social and Economic Research (ISSER, 2012), in 2011, the economic growth was 7.2% point higher than that of 2012 and 2.2% point lower than that of 2012 targets. Economic growth targets have not been might over the years. In 2012, the target growth rate

was 8.5% whereas the actual rate was 7.2%. In 2011, the target rate was 14.4% and the actual was 14.4%. The targeted value in 2010 was 6.5% whereas the actual value was 7.7%. The picture was not different in 2009. The target value was 5.9% whereas the actual value was 3.99%.

The aim of the paper is to contribute to the body of knowledge in the area of economic growth by investigating the determinants of economic growth in Ghana, using autoregressive distributed lag model (ARDL) approach to cointegration over 1970-2011 period.

The paper is based on a research question such as what is the effect of price, government expenditure, investment, trade openness, and financial development on economic growth. The assumption underlying the study is that there is a stable long run and short run link among economic growth, price, government expenditure, investment, trade openness, and financial development. It is also assumed that these variables are not stationary in levels but attain stationary on first differencing.

The paper is based on secondary data and might suffer from errors in variable. Structural breaks issues are not examined which might also affect the findings. Causality issues are not discussed, hence cause-effect analysis and prediction are not considered. The rest of the paper looks at the literature review, methodology, the results, and the conclusions.

1.2 Literature Review

There are many but not unifying theories in explaining the determinants of economic growth. The basic theories are the classical and the neoclassical theories. There are many variables determining growth of an economy according to these theories. These variables include human capital, research and Development, trade openness, and investment. The utilization of these variables in an economy creates different growth stages. The explanations of the concepts of growth are found in the works of Smith (1976), Ricardo (1951), Marshall (1890), Solow (1956, 1963), Marx (1885, 1956), Romar (1986), Domar (1946), Harrod (1939), Greenwood and Joranovic (1990), Pagano (1993), Weber (1905),Kaldor (1957), Arrow (1962).

The writers have explained economic growth in developed and developing economies with different explanation. One growth theorist is Torrent (1820). He considered economic growth as linear and endogenous. He considered growth as a function of capital accumulation and profit. If profit levels increase and more capital is accumulated, then the economy will grow. This means that if profit is less, and capital accumulation is less, the economy will not grow as expected.

Marx (1885) developed the theory of capital accumulation and expanded reproduction. His theory is also considered as endogenous. Marx (1885) believed that growth depends on capital accumulation and profit in linear form. He indicates that more capital accumulation leads to growth in the presence of labour. Marx (1885) considered profits as determining accumulation in the economy. According to Marx (1885), falling profit leads to wages reduction by the capitalists, and that profit falls in the long run.

Neumann (1945) another theorist also considered economic growth rate as endogenously determined. Neumann (1945) assumed 'n' goods to be produced by 'M' constant returns to scale in the production process. The central problem was to decide the unprofitable means of production and the profitable means. Real wage is given in the model and is paid at the beginning of the production process. Surplus incomes are reinvested in production. All factors of production except labour are considered as available at any amount without price. Other economists dealing with growth models are Solow and Swan (1956). Solow-Swan (1956) proposed growth model in which there is substitution of capital for labour resulting in capital productivity (ρ). There is wage flexibility, which allows capital to be substituted for labour in a combination that allows the use of the existing labour force with capital stock in production.

According to Smith (1976) the 'father' of economics, economic growth results from the utilization of capital and labour. The more capital is accumulated for production the higher growth an economy realised. The more labour an economy possesses the more growth that economy experiences. Smith considers economic growth as endogenous. Which means growth results from within the system or the model and not outside the model or the system. Smith (1976) growth model is criticised for not clearly indicating the limits to growth. Smith (1976) explains that growth will stop when an economy's potential for growth is fully achieved or attained but did not explain fully the meaning of an economy's potential.

Solow-Swan model assume constant returns to scale, in addition to the assumption that capital and labour are substitutable. The Solow-Swan models are criticised that, there is no such smooth macroeconomic substitutability.

Pagano (1993) developed a growth model to explain the reasons for growth experienced by developing and developed economies. According to Pagano (1993), output is related to capital in a linear form in so far as population remains constant and the economy produces only one good which may be invested or consumed.In that case, economic growth is influence by savings and productivity of capital. In addition, in the Harrod-Domar (1946) growth model, savings and capital productivity are key variables under the assumption of unbalanced growth. Harod-Domar (1946) explains growth model is criticised for its unrealistic assumption of equi-proportional use of labour and capital with economic growth and development as shadow price.

The theoretical review indicates that there is no single theory on the determinants of growth. The current paper is thus founded on integration of growth theories reviewed and not on one single specific theory in line with the no-'unifying' theory advanced by Arvanitidis et al. (2009).Empirical examination of economic growth determinants are found in various studies including Ahmed and Suliman (2011); Johannes, Njong and Cletus (2011); Cavenaile, Gengenbach and Palm (2011); Chakraborty and Ghosh (2011); Dabosand Gantman (2010); Bangake and Egbetunde (2010); Jiranyakul and Brahmasrene (2007); Lensink and Morrissey (2006); Hendry and Krolzig (2004); Ulku (2004);Barro andSala-i-Martin (2003);Vamvakidis (2002); Krueger and Lindahl (2001): Podrecca and Carmeci (2001); Dollar and Kraay (2000) and Hanushek and Kimko (2000).

There has been empirical study on the relationship between government activities and economic growth. According to researchers (Srinivasan, 2013; Adeniyi & Bashir, 2011; Ighodaro & Oriakhi, 2010; Alexiou, 2009; Ranjan & Sharma, 2008) there is positive link between government expenditure and economic growth which might results from positive externalities through the harmonization of the conflicts between private and social interests and the provision of socially optimal direction for growth as well as offsetting market failures. Srinivasan (2013) reported of statistically significant positive relationship between economic growth and public expenditure in India. Adeniyi and Bashir (2011) and Oriakhi (2010) reported of positive effect of government spending on economic growth in Nigeria.

The findings on the effect of government expenditure and economic growth have been inconclusive. For example, other researchers (Afonso & Jalles, 2011; Bergh & Karlsson, 2010; Maku, 2009; Mohammad et al., 2009; Pham, 2009; Afonso & Furceri, 2008, Brady, 2007; Bajo-Rudio, 2000; Barro, 1991) have reported of significant negative relationship between government expenditure and economic growth. According to these researchers, increasing government expenditure may deteriorate economic growth through crowding-out effect. The private sector is crowded out as a result of distortions of the tax, government inefficiencies, incentives systems, and interventions to free markets system. Some researchers (Taban, 2010; Verma & Arora, 2010) have also reported of insignificant link between government expenditures and economic growth.

The effect of price on economic growth has been examined with inconclusive findings. Researchers (Kasidi & Mwakanemela, 2013; Espinoza et al.,2010; Hasanov, 2010; Marbuah, 2010; Quartey, 2010; Bick, Kremer and Nautz, 2009; Mohammad et al., 2009; Mubarik, 2005; Ghosh & Phillips, 1998; Fischer, 1993) have reported of negative effect of price on economic growth. Other researchers (Ahmed & Suliman, 2011; Mallik & Chowdhury, 2001) have also reported of positive effect of price on economic growth whereas some have also reported of neutral effect of price on economic growth (Frimpong & Oteng-Abayie, 2010).

The effect of investment on economic growth has been examined with mixed findings in the literature. Researcher (Uneze, 2013; Bakare, 2011; Dritsakis et al., 2006; Reichert & Liang, 2006) have reported of positive influence of investment on economic growth.

Financial development (proxied by money supply) has been reported to have influence on economic growth. However, the literature has produced mixed findings. For example earlier researchers (Nouri & Samimi, 2011; Tabi & Ondoa, 2011; Mohammad et al., 2009; Owoye et al., 2007; Mansor, 2005) have reported of positive relationship between financial development and economic growth whereas other researchers (Ahmed & Suliman, 2011) have reported of negative effect of financial sector development on economic growth.

Trade liberalisation is reported to have influence on economic growth. Earlier researchers (Antwi-Boateng, 2015; Soliu & Ibrahim, 2014; Khan et al., 2012; Manni & Afzal, 2012; Mishra, 2011; Mehrara & Firouzjaee, 2011; Elbeydi et al., 2010; Dash, 2009; Dollar & Kraay, 2000) have reported of positive link between economic growth and trade openness in support of the theoretical postulation of positive link between trade and growth.

The review of the empirical works indicates inconclusive effect of macroeconomic variables on economic growth, which calls for further studies.

2 Methodology

The paper is based on quantitative research design and a descriptive cross sectional times series analysis. The empirical investigation of the effect of price, investment, financial development, government activities and trade openness on economic growth is performed by first examining the unit root properties of the time series variables using the Augmented Dickey-Fuller (1981) (ADF) and the Kwiatkowski et al. (1992, KPSS) as the confirmatory test for the ADF test. Secondly, the long run and the short-run links among the variables are examined using the ARDL model (Pesaran, & Shin, 1999; Pesaran, Shin, & Smith, 2001). Since the ADF, KPSS, and the ARDL models are popular in the literature they are not treated in detail in the current paper. For detail review of the these models refer to Ofori et al. (2015), Antwi-Boateng (2015) and Acaravci and Ozturk (2012). The ADF test is as specified in equation (1).

$$\Delta Z_t = \alpha_t + \beta_t t_t + \rho Z_{t-1} + \sum_{i=1}^{q} \partial \Delta Z_{t-1} + \varepsilon_t \quad \text{.....(1)}$$

Where Z= time series variable in the model, t = time trend, ε_t = error term or stochastic error term. Given that Z_t is the series variable under investigation, Kwiatkowski et al. (1992) specify the KPSS equation as shown in equation (2) to decompose the series into the sum of a deterministic trend (t), a random walk (r_t) and a stationary error (u_t).

$$Z_t = \xi t + r_t + u_t \quad \text{.....(2)}$$

The ARDL Model is specified as in equation (3).

The ARDL model is used in defining the long run link among the variables. The model is specified as in equation (3) and equation (4) for the error correction model. The ARDL model has many advantages (Pesaran et al., 2001). It performs well in small sample studies and allows different optimal lags for the variables in the model.

$$\Delta z_t = C_{0y} + C_{1y}t + \mu_1 z_{t-1} + \mu_2 x_{1,t-1} + \mu_3 x_{3,t-1} + \ldots + \mu_k x_{k,t-1} + \sum_{i=1}^{m-1} \gamma_i \Delta z_{1,t-1} + \sum_{i=0}^{n-1} \alpha_{ik} \Delta x_{k,t-i} + \varepsilon_{ty} \ldots\ldots (3)$$

$$z_t = \sum_{i=1}^{p} \alpha_i \Delta z_{t-1} + \sum_{i=1}^{s} \beta_i \Delta z_{t-1} + \sum_{k=1}^{q} \beta_k \Delta x_{t-k} + \lambda ECM_{t-1} + e_t \ldots\ldots (4)$$

In equation (3) and (4) Δ= the first difference operator, 'ε' and 'e' are white noise residuals, 'p', 's', 'q', 'm', and 'n'= lag length for the unrestricted error-correction model (ecm), t= time trend; x_k= explanatory variables; z= dependent variable; λ= the speed of adjustment parameter and is expected to be less than one; ECM= the error correction term; $\mu_{k=}$ represent the long run coefficients; $_\gamma$, α, β_k= short run coefficients of the variables.For detail information of the ARDL model, refer to Pesaran and Shin (1995) and Pesaran, Shin and Smith (1996).

The operational model that was estimated is defined in equation (5) with Z as the dependent variable representing economic growth. The explanatory or predictor variables are defined in W to represent price (P), investment (INV), trade openness (OPEN), money supply (M2), and government expenditure (GE).

$$Z_t = \beta_0 + \beta_1 W_1 + \ldots + \beta_p W_p + \varepsilon_t \ldots\ldots (5)$$

3Discussions and Analysis

3.1 The ADF/KPSS Test Results

The results on the ADF test for unit root test are reported in Table 1. The results of the ADF test for unit root in levels show that the series are non-stationary in intercept. The null hypothesis of unit root was accepted for all the series variables.

Table 1. ADF stationarity test results with a constant and trend

Variables	t-statistics	ADF P-Value	Results	Lag length
y	4.85154	1.000	Not stationary	1
y-1st dif.	-2.08822	0.5519	Not stationary	1
GE	-2.46708	0.3419	Not stationary	1
GE-1st dif.	-5.84979	0.0001062***	Stationary	1
M2	-1.62565	0.7652	Not stationary	1
M2-1st dif.	-5.98178	7.189e-005***	Stationary	1
INV	-2.92979	0.1642	Not stationary	1
INV-1st dif.	-6.33633	1.653e-007***	Stationary	1
OPEN	-2.03577	0.5649	Not stationary	1
OPEN-1st dif.	-5.43876	0.0003485***	Stationary	1
P	6.335	1.000	Not stationary	1
P-1st dif.	-3.00133	0.1445	Not stationary	1

Source: Author's computation, 2013/2014: Note: *** and ** denote significance at 1% and 5% levels of significance

Taking the logarithm of the first difference of the series and testing these with intercept and trend makes series stationary. That is, the null hypothesis of unit root was rejected. The results are reported in Table 2. These results indicate that the series exhibit unit root processes in levels.

The KPSS test is based on the null assumption (Ho) that the series variables under investigation are stationary (series are not unit root) against the alternative hypothesis (H1) that the series are not stationary (series are unit root). The KPSS is a reversed test for unit root. It is used in the current study as a confirmation test for the stationarity test of the ADF test. The results are reported in Table 3 and Table 4.

The series were examined in levels and in first difference (Table 3) as well as in their logarithm form (Table 4). The results in Table 4.3c indicate mixed results. Some series are unit root in levels but become stationary in first difference, indicating that they are integrated of order one, I(1). Series variables that are stationary at levels are integrated of other zero, I(0). The levels of significance are 1%; 5% and 10%. Some series are stationary at 10% but not at 1% and 5%. The results based on logarithm form indicate the series are stationary in first difference.

Table 2. ADF stationarity test results with a constant and a time trend

Variables (First Difference)	t-statistics	ADF P-Value	Results	Lag length
Δlny	-5.552	0.000***	Stationary	1
ΔlnGE	-5.071	0.000***	Stationary	1
ΔlnM2	-6.273	2.988e-005***	Stationary	1
ΔlnINV	-6.508	1.438e-005***	Stationary	1
ΔlnOPEN	-4.674	0.000***	Stationary	1
ΔlnP	-4.723	0.003***	Stationary	1

Source: Author's computation, 2013/2014: Note: *** denotes significance at 1% level

Table 3 KPSS stationarity test results with a constant and a time trend

Variables	t-statistics	KPSS P-Value	Results	Lag length
Y	0.239	n.a	Not stationary	3
y-1st dif.	0.231	n.a	Not stationary	3
GE	0.107	n.a	Stationary	3
GE-1st dif.	0.072	n.a	Stationary	3
M2	0.192	0.023	Stationary	3
M2-1st dif.	0.069	n.a	Stationary	3
INV	0.139	0.067	Stationary	3
INV-1st dif.	0.148	0.052	Stationary	3
OPEN	0.134	0.076	Stationary	3
OPEN-1st dif.	0.121	n.a	Stationary	3
P	0.273	n.a	Not stationary	3
P-1st dif.	0.257	n.a	Not stationary	3

(Author's computation, 2013/2014): Critical values at 10%, 5% and 1% significant levels are 0.122 0.149 0.212 respectively

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

Variable	KPSS P-value	Results	Lag Length
Δlny	0.105	Stationary	3
ΔlnGe	0.071	Stationary	3
ΔlnM2	0.076	Stationary	3
ΔlnINV	0.127	Stationary	3
ΔlnOPEN	0.104	Stationary	3
ΔlnP	0.090	Stationary	3

(Author's computation, 2013/2014): Note: Critical values at 10%, 5% and 1% significant levels are 0.122 0.149 0.212 respectively

3.2 ARDL/Bound Cointegration Test Results

The results reported in Table 5 indicate significant cointegration between economic growth (y) and the series variables in only models 1, 4 and 6 since the calculated F-statistics are greater than the critical values of the upper bounds at the 90%, 95% and 99% levels of significance. The null assumption of no cointegration is rejected in the models 1, 4, and 6. Model 1 is estimated for the long run and short run parameters.

Table 5 Test for cointegration relationship

Critical bounds of the F -statistic: intercept and trend			
	90% level	95% level	99% level
	$I(0)$ $I(1)$	$I(0)$ $I(1)$	$I(0)$ $I(1)$
	2.915 3.695	3.538 4.428	5.155 6.265
Models	**Computed F -Stats**	**Decision**	
1. F_Y(y|OPEN, GE, P, INV, M2)	6.6298[.010]***	Cointegrated	
2. F_{OPN}(OPEN|y, GE, P, INV, M2)	2.5310[0.112]	Not cointegrated	
3. F_{GE}(GE|y, OPEN, P, INV, M2)	3.1563[0.076]	Not cointegrated	
4. F_P(P|y, OPEN, GE, INV, M2)	85.5978[0.000]***	Cointegrated	
5. F_{INV}(INV|y, OPEN, GE, P, M2)	1.1603[0.281]	Not cointegrated	
6. F_{M2}(M2|y, OPEN, GE, INV, P)	32.1957[.000]***	Cointegrated	

Source: Author's computation, 2013/2014: Note: critical values are obtained from Pesaran et al., (2001) and Narayan, (2004): Note *** denotes significance at 1% level

3.3The Long-Run Elasticities coefficients

The results on the long run parameter estimates are reported in Table 6. The results indicate that GE, P, and M2are statistical significant determinantsof economic growth in the long run. Trade openness, government expenditure, and money supply have expected a priori theoretical signs whereas price and investment do not have the expected a priori theoretical signs. Trade openness and investment are not a significant determinant of economic growth. The results show that 1% increase in

government expenditure; price, and money supply leads to about 19.8% increase in economic growth; about 50.8% increase in economic growth and about 65.9% decrease in economic growth.

Table 6 Estimated long-run coefficients. Dependent variable is lny

Variables	Coefficient	Standard error	T-Ratio	Prob. Values
Constant	-1.828	0.215	-8.513	0.000***
Trend	0.149	0.009	16.038	0.000***
$\Delta lnOPEN_{-1}$	0.104	0.065	1.613	0.117
$\Delta lnGE_{-1}$	0.198	0.114	1.744	0.091*
ΔlnP_{-1}	0.508	0.032	15.901	0.000***
$\Delta lnINV_{-1}$	-0.099	0.096	-1.045	0.304
$\Delta lnM2_{-1}$	-0.659	0.088	-7.521	0.000***

Author's computation, 2013/2014: ARDL (2) selected based on Akaike Information Criterion. Note:**denotes significance at 5% level

3.4 The Short-Run Impact

The results of short-run dynamic equilibrium relationship coefficients estimated are reported in Table 7. The nature of the signs of the short run parameters is not different from that of the long run parameters. The value of the long run parameters are as expected. They are larger than the short run parameters. The results on the nature of the short run coefficients indicate that except trade openness and gross fixed capital formation the rest of the series variables (GE, P, and M2) are significant determinants of income in the short run. The results show that 1% increase in government expenditure; price, and money supply leads to about 15.6% increase in economic growth; about 40.0% increase in economic growth and about 51.9% decrease in economic growth.

The error correction term is statistically significant and does have the theoretical expected sign of negative. The coefficient of -0.78712 indicates that, after 1 percent deviation or shock to the system, the long-run equilibrium relationship of aggregate energy consumption is quickly re-established at the rate of about 78.71% percent per annum.

Table 7 Short-run representation of ARDL model. ARDL (2) selected based on Akaike Information Criterion. Dependent variable: Δlny_{-1}

Variables	Coefficient	Standard error	T-Ratio	Prob. Values
Constant	-1.439	0.264	-5.449	0.000***
Trend	0.117	0.015	7.554	0.000***
$\Delta lnOPEN_{-1}$	0.082	0.052	1.591	0.122
$\Delta lnGE_{-1}$	0.156	0.088	1.777	0.085*
ΔlnP_{-1}	0.400	0.043	9.252	0.000*
$\Delta lnINV_{-1}$	-0.079	0.073	-1.077	0.290
$\Delta lnM2_{-1}$	-0.519	0.091	-5.674	0.000***
Ecm_{-1}	-0.787	0.083	-9.520	0.000***

ecm = lny +1.828C -0.149T + 0.659lnM2 + 0.099lnINV -0.508lnP -0.198lnGE-0.104lnOPEN……(1)

R-Squared 0.99967 R-Bar-Squared 0.99959

S.E. of Regression 0.065741 F-stat. F(7, 31) 13352.7[0.000]

Mean of Dependent Variable 0.72768 S.D. of Dependent Variable 3.2610

Residual Sum of Squares 0.13398 Equation Log-likelihood 55.2971

Akaike Info. Criterion 47.2971 Schwarz Bayesian Criterion 40.6429

DW-statistic 1.5402 Durbin's h-statistic 1.6765[.094]

Source: Author's computation, 2013/2014. Note: *** and * denotes statistical significance at the 1% and 10% levels

The findings on stable long run link among growth and the determinants under investigation are in support of that of previous studies (Soliu & Ibrahim, 2014; Mwakanemela, 2013; Srinivasan 2013; Uneze, 2013; Manni & Afzal, 2012; Ahmed & Suliman, 2011; Adeniyi & Bashir, 2011; Bakare, 2011; Espinoza et al., 2010; Hasanov, 2010; Ighodaro & Oriakhi, 2010; Alexiou, 2009; Marbuah, 2010; Quartey, 2010; Mohammad et al., 2009; Dritsakis et al., 2006).

Srinivasan (2013) established significant positive effect of government expenditure on growth in India whereas Adeniyi and Bashir (2010) Ighodaro & Oriakhi, (2010) reported of positive influence of government expenditure on economic growth.

The current findings are contrary to that of previous findings (Kasidi & Mwakanemela, 2013; Afonso & Jalles, 2011; Nouri & Samimi, 2011; Tabi & Ondoa, 2011; Espinoza et al., 2010; Bergh &

Karlsson, 2010; Maku, 2009). Uneze (2013) reported of significant positive link between investment and economic growth whereas the current paper has established negative though insignificant link. Frimpong and Oteng-Abayie (2010) reported of neutral effect of price on economic growth whereas Kasidi and Mwakanemela (2013) reported of significant negative effect of price on growth. Afonso and Jalles (2011) and Maku (2009) produced results indicating negative effect of government expenditure on growth.

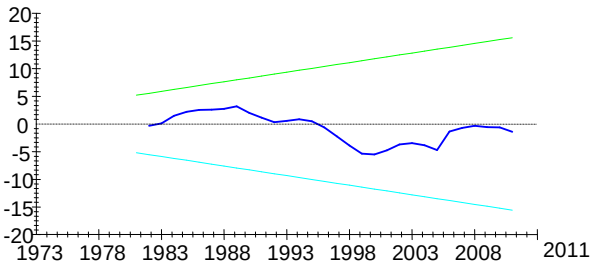
3.5Diagnostic/Stability Test Results

The results of the diagnostic tests to examine the reliability of the results of the error correction model are reported in Table 8. The model passed the entire test. The R^2 (0.999) and the adjusted R^2 (0.999) in Table 7 are an indication of a very well behaved model. Both stability tests (CUSUM and CUSUMSQ) as shown in Figure 1 and 2 revealed that the estimates and the variance were stable as the residuals (CUSUM) and the squared residuals (CUSUMSQ) fall within the various 5% critical boundaries. The null assumptions are rejected in both tests.

Table 8Short-Run Diagnostic Tests of ARDL Model

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 2.2809[0.131]	F(1, 30)= 1.8635[0.182]
B:Functional Form	CHSQ(1)= 1.1733[0.279]	F(1, 30)= 0.93051[0.342]
C:Normality	CHSQ(2)= 0.81730[0.665]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 0.0065514[0.935]	F(1, 37)= .0062164[0.938]
A:Lagrange multiplier test of residual serial correlation B:Ramsey's RESET test using the square of the fitted values C:Based on a test of skewness and kurtosis of residuals D:Based on the regression of squared residuals on squared fitted values		

Source: Author's computation, 2013/2014.



The straight lines represent critical bounds at 5% significance level

Figure 1: Plot of Cumulative sum of recursive residuals

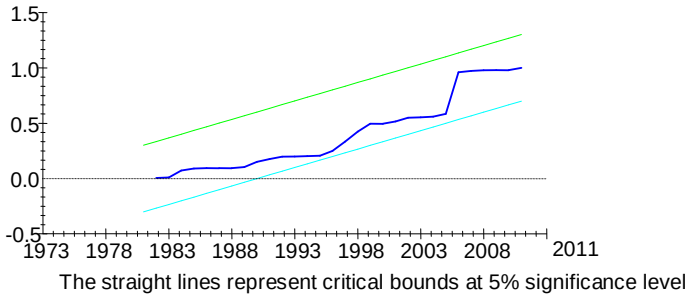


Figure 2: Plot of Cumulative sum of squares of recursive residuals

4. Conclusions and Policy Implications

The paper draws on time series data to examine the determinants of economic growth for the period 1970-2011 using ARDL model. The results show that there is significant stable long run link among economic growth, government expenditure, price, trade openness, money supply, and investment. In both long run and short run, increases in government expenditure and price improve growth whereas increase in money supply worsens growth.

The implications of the findings are that Ghanaian economy has benefited from trade liberalisation policy, expansionary fiscal policy as well as increases in the price of goods and services. However, this is only one side of the coin in that the economy has apparently not benefited from investment and financial sector development, proxied by money supply. Financial sector development and investment policies should therefore be reviewed and activated to stimulate significant economic growth.

Future studies should consider issues of unit root with structural breaks and causality to examine the direction of causality. Panel cointegration model should also be considered in future studies to allow for more flexible analysis and discussion.

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