MACROECONOMIC DETERMINANTS OF ECONOMIC GROWTH IN GHANA: COINTEGRATION APPROACH

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Abstract

The study is on Macroeconomic Determinants of Economic Growth in Ghana using cointegration approach. The main objective of this study is to examine the major macroeconomic determinants of economic growth in Ghana between the periods 1970 and 2011 applying the Johansen method of cointegration. All the variables are integrated at first order, as a result the Johansen's cointegration approach was used. The study find out that physical capital and foreign aid had a positive effect on growth in real gross domestic product per capita. In the long run, physical capital, labour force, foreign direct investment, foreign aid, consumer price index, government expenditure and military rule are the significant determinants of growth in real gross domestic product per capita in Ghana. Also, in the short run, foreign direct investment and government expenditure are significant determinants of growth in real gross domestic product per capita. The result shows that there is unilateral directional causality between labour force and physical capital, physical capital and foreign direct investment, foreign aid and physical capital, physical capital and consumer price index, physical capital and military rule, labour force and foreign direct investment, consumer price index and labour force, foreign direct investment and foreign aid. Also, there is bidirectional causality between consumer price index and foreign direct investment. Base on the findings the following policy recommendations are made: Policies should be put in place to increase physical capital and foreign aid. Educational institutions should link up with

the corporate organizations to train productive larbour force. Military rule had negative impact on growth in real GDP per capita, therefore, the Government must put in place strategies to protect and sustain democratic rule in Ghana.

Keywords: Foreign Direct Investment, Cointegration, Macroeconomic, Unit Root Tests, Economic Growth

1.0 Introduction

After independence in 1957, the immediate challenge that faced the Ghanaian economy was how to accelerate economic growth in order to help reduce extreme poverty, improve health care, overcome illiteracy, strengthen democratic and political stability, improve the quality of the natural environment, diminish the incidence of crime and violence, and become an investment destination of choice for global capital, ceteris paribus. Long-term broad-based economic growth is essential for Ghana to increase incomes and enable herto reach herpotential of becoming a significant trade and investment partner in the world (GPRS II Annual Progress Report, 2007, page, 9 - 24). While rapid growth in China, Malaysia and India for instance, have lifted millions beyond subsistence living, Ghana and many other African countries have, however, experienced the opposite by recording low growth rates and even in some years recorded negative growth rates in the 1970s, to the early 1990s (The Global Social Change Research Project, 2007).

In 1991, Ghana launched the Vision 2020 Programme, with the aim of becoming an upper middle income country by the year 2020 with an average growth rate of 8% for the period (Vision 2020 Report, 1995). Specifically, gross domestic product was expected to grow between 7.1% and 8.3% in the period 1996 to 2000. However, the actual growth rate was only between 4.2% and 5.0%. Presently, Ghana aims at becoming a higher middle income earning nation by the year 2020, that is, only in sevenyears' time to come. This goal can only be a reality if there is a high and sustainable rate of growth above 8% annually (The Coordinated Programme of Economic and Social Development Policies, 2010 – 2016, page, 4 and 5).

From the early 1990s, the growth rates in Ghana have been registering positive values. The average growth rate from 1990 to 2008 was approximately 5% (Computed from the State of the Ghanaian Economy, 1990-2008). However, these impressive growth records between 1990 and 2008 as compared to the earlier growth records of the Ghanaian economy in the 1960s, 1970s and 1980s, are deemed inadequate to move the economy to the targeted higher middle income (a per capita income of US$3000 from the low level of US$380 per capita in 2005) status by the year 2020. This is

because, based on the current growth records (1990-2007), Ghana can only double its real GDP growth by the year 2023, approximately. That is, by the rule of 72, Ghana has fourteen years to reach the goal attainment year, ceteris paribus (the rule of 72 means dividing the annual growth rate into 72 to approximate the doubling time). This implies that there is an urgent need to boost GDP growth in Ghana for the attainment of the international development goals by the year 2015. This requires policies that can push GDP growth rates above 8 to 10% over the medium to long term, which can only be done if policymakers understand the determinants of growth, as well as how policies affect growth.

Unfortunately, there have not been thorough studies on the determinants of economic growth in Ghana, as well as on specific areas that most policies and strategies should be geared towards in order to achieve the desired rate of growth and even if there is, according to Easterly (2001), over the last decades, the issue of economic growth has attracted increasing attention and empirical research. Yet the process underlying economic performance and growth is poorly understood. It also seems there is no specific model for Ghana, hence the need to develop one by ourselves. The country has adopted models of growth presented by IMF, World Bank and other institutions which have been heeded, but the country still remains at the stage of underdevelopment though she claims that she is in the lower middle income status.

Consequently, failure in the understanding of the causes of economic growth and prosperity has caused massive political, economic and social upheaval in the Ghanaian economy. As a result, many questions have arisen. For instance, what are the macroeconomic determinants that would drive Ghana's real GDP per capita growth to attain the targeted middle income status by the year 2015? In other words, what factors are important in explaining long-term growth in Ghana? In which ways would these factors influence economic policy formulation and implementation?

In this regard, this study seeks to critically analyse the macroeconomic determinants of economic growth in Ghana using the neoclassical growth model by applying the Johansen approach to cointegration which was developed by Johansen (1988); and thereby determine the extent to which capital stock, labour stock and other determinants of interest based on theoretical and empirical grounds, are contributing to the real GDP per capita growth within the context of the neoclassical school, both in the long-run and the short-run. It is only by studying the sources and causative factors of economic growth that policy makers can be moved to embark on the proper paths to achieve rapid, sustainable, broad-based economic growth, and prosperity in Ghana, hence, the need for this study.

Objective of the Study

The main objective of this study is to examine the major macroeconomic determinants of economic growth in Ghana between the periods 1970 and 2011, applying the Johansen method of cointegration developed by Johansen (1988). In order to achieve this broad objective, this paper is specifically designed:

i. to examine the major macroeconomic determinants of real GDP per capita growth in Ghana and
ii. to recommend actions that must be taken to speed up the process of economic growth and prosperity in Ghana.

Hypotheses

To guide the study, the following hypotheses are being tested:

H_0: Physical capital does not determine real gross domestic product per capita growth.

H_1: Physical capital is a determinant of real gross domestic product per capita growth.

H_0: Labour force does not determine real gross domestic product per capita growth.

H_1: Labour force is a determinant of real gross domestic product per capita growth.

H_0: Foreign direct investment does not determine real gross domestic product per capita growth.

H_1: Foreign direct investment is a determinant of real gross domestic product per capita growth.

H_0: Foreign aid does not determine real gross domestic product per capita growth.

H_1: Foreign Aid is a determinant of real gross domestic product per capita growth.

H_0: Consumer price index does not determine real gross domestic product per capita growth.

H_1: Consumer price index is a determinant of real gross domestic product per capita growth.

H_0: Government expenditure does not determine real gross domestic product per capita growth.

H_1: Government Expenditure is a determinant of real gross domestic product per capita growth.

H_0: Periods of military rule does not determine real gross domestic product per capita growth.

H_1: Periods of military rule is a determinant of real gross domestic product per capita growth.

Sources of Data and Methods of Data Collection

The secondary data used for this study were obtained from World Development Indicators from 1970 and 2011. The World Bank collected these data from Ghanaian officials and World Bank Representatives in Ghana, annually.

2.0 Empirical Literature Review

In connection with the above discussions, numerous researchers have examined sources of growth for cross country differences in developed and developing economies using a wide variety of explanatory variables. However, there are few widely agreed on results.

One of the most interesting recent approaches to understanding what causes sustained increase in economic growth is the work by Ricardo H. et al (2004), who studied eighty-three cases in which a country rapidly increased its growth rate and sustained the increase for at least eight years. Their most statistically significant results are that financial liberalisation raises the probability of growth by around 7 percent, and that a political regime change towards autocracy (from democracy or less-strict autocracy) raises the probability of increased growth by almost 11 percent. They concluded that the vast majority of growth accelerations are unrelated to standard determinants such as political change and economic reform, and that most instances of economic reform do not produce growth acceleration.

Benito (2009) also analysed the determinants of economic growth for countries. The method of analyses employed by Benito was the Bayesian Model Averaging. The study used panel data. The empirical results showed that the most robust growth determinants of the cross-country growth were the price of investment, distance to major world cities, and political rights. The study concluded that growth-promoting policy strategies should aim to reduce taxes and distortions that raise the prices of investment goods, improve access to international markets and promote democracy enhancing institutional reforms.

Dewan et al. (2001) examined the determinants of economic growth in developing countries. They used a sample of 41 middle income developing countries to develop an empirical model for growth. Both cross country and time variation specifics were used in an attempt to explain the determinants for sustained economic growth in developing countries. They found out that, apart from the natural rate of growth of labour force, investment in both physical and human capital, as well as low inflation and open trade policies (to encourage efficiency through assessing better foreign technologies) were necessary for economic growth. They again found out that, since many of the developing countries have large agricultural sector, adverse supply shocks were found to have a negative impact on growth.

Baily (2003) conducted a research on "sources of economic growth in the Organisation for Economic Cooperation and Development (OECD) countries". The methodology employed was aggregate regression analysis with particular emphasis on the ways in which policies affect outcomes. Baily (2003) found out that investment in physical and human capital, sound macroeconomic policies, government spending, research and development by the business sector, financial market, and international trade were all important factors to economic growth in OECDs. On the other hand, Baily (2003) found out that a larger sized government spending, direct taxes and research and development by the public sector all contributed negatively to economic growth.

Teixeira and Fortuna (2003) examined the interaction between human capital, innovation capability and economic growth in the Portuguese economy during the period 1960 to 2001. In their study, the Vector Autoregressive (VAR) and cointegration analyses were employed to estimate the equation specified. They obtained 0.42 long run estimates for human capital elasticity, 0.30 long run estimates for internal knowledge elasticity related with the composite variable that measures the interaction between human capital and innovation capacity. The results of the estimate confirmed that human capital and indigenous innovation efforts were enormously important to the process of Portuguese economic growth during the period 1960 to 2001.

Dobronogov and Iqbah (2005) investigated the key determinants of economic growth in Egypt by combining the growth diagnostics framework with econometric time series analysis. They argued that trends in government consumption, private sector credit and Organisation of Economic Cooperation and Development's (OECD) GDP were among the major growth determinants in Egypt since 1986. They also found out that the inefficiency of the financial intermediation was an important constraint on growth. They concluded that an improvement in the quality of financial intermediation may bring a sustained growth dividend to Egypt in the long-run.

Khungwa (2007) analysed the determinants of economic growth in Malawi. Her research work employed a growth framework that emanated from the Cobb-Douglas production function. She used time series data from the period 1970 to 2003. She found out that terms of trade, openness, and human capital all had a significant effect on economic growth in Malawi. She suggested that in order to boost future economic growth in Malawi, policies and strategies that are to be implemented should aim at increasing human capital and creating a conducive macroeconomic environment. Above all, the government should continue to pursue stable macroeconomic policy.

Anaman (2006) examined the determinants of economic growth in Ghana. The study used neoclassical growth model based on available data from 1966 to 2000. The dependent variable of the long-run growth model was the annual growth of real gross domestic product (GDP). The independent variables were an annual growth of total exports, annual growth of total labour, total investment-GDP ratio and government size. The other independent variables were a dummy variable for world oil mark price shock of the mid 1970s and early 1980s and a military coup or extreme political upheaval related to major droughts. The short run error correction model, based on the long-run cointegrating function, was also estimated. The results showed that the long run economic growth was positively influenced by political stability. The world oil price shocks of the mid 1970s and early 1980s led to reduce economic growth in Ghana. Government size influenced economic growth in quadratic equation fashion with increasing government size resulting in increasing growth until a point was reached beyond which growth would actually fall with increasing government size. Growth of exports strongly affected economic growth. However, increase in total investment-GDP ratio did not significantly affect long-run economic growth though the expected positive relationship between the two variables was captured by the analysis. Growth of labour did not influence economic growth suggesting insignificant marginal labour productivity at the aggregate level. Short-run economic growth was mainly influenced by political stability. Overall, the results indicated that political stability was a major catalyst for achieving long-run economic growth in Ghana.

In conclusion, several works have examined the sources of economic growth.Most of these works concentrated on the interrelationship between real GDP growth and its determinants without necessarily paying much attention to particular areas where most policies and strategies should be geared towards in order to achieve the desired rate of growth. This in effect has left some gaps in the economic growth-determinants literature. In the light of this and many others, this study attempts to examine the major determinants of GDP growth in Ghana during the period 1970-2011. Consequently, it attempts to contribute to the limited existing literature by focusing mainly on areas that most policy issues should be geared towards in the Ghanaian economy as far as economic growth is concerned.

3.0 Model Specification

Macroeconomic theory has identified various factors that influence the growth of a country from the classical, neoclassical and the new growth theories. These factors include natural resources, investment, human capital, innovation, technology, economic policies, governmental factors, foreign aid, trade openness, institutional framework, foreign direct investment, political factors, socio-cultural factors, geography, demography and many

others. In order to examine the empirical evidence of the macroeconomic determinants of economic growth in Ghana, the study considers most of these factors.

Following broadly the approach adopted in Lucas (1988), the researchers specify the economic growth function for Ghana as follows: Real (GDP) per capita growth is a function of physical capital, labour force, foreign direct investment, foreign aid, inflation, government expenditure and military rule.

It is mathematically expressed as follows:

$$RPCGDP = f(K, L, FDI, Aid, INF, GE) \text{.....(1)}$$

Thus, our growth function becomes;

$$RPCGDPG_t = \beta_0 + \beta_1 K_t + \beta_2 L_t + \beta_3 FDI_t + \beta_4 Aid_t + \beta_5 INF_t + \beta_6 GE_t + \beta_7 D_t + \varepsilon_t \text{ , ...(2)}$$

where $RPCGDPG_t$ represents the log of Real GDP Per Capita at time t ≡ real GDP per capita growth;

K_t represents Physical Capital at time t, measured as Gross Fixed Capital Formation as a percentage of GDP;

L_t represents Labour Force at time t, measured as the % of total population aged 15-64;

FDI_t represents Foreign Direct Investment at time t, measured as Foreign Direct Investment as a percentage of GDP;

Aid_t represents Foreign Aid at time t, measured as Foreign Aid as a percentage of GDP;

CPI_t represents the Consumer Price Index at time t;

GE_t represents Government Expenditure at time t, measured as Government Expenditure as a percentage of GDP;

D represents dummy variable where D = 1 represents periods of military rule and D = 0 stands for periods of democratic rule.

t = time

ε_t is the error term assumed to be normally and independently distributed with zero mean and constant variance, which captures all other explanatory variables which influence economic growth but are not captured in this model.

β_1, β_2, β_3, β_4, β_5,β_6,β_7 are the partial elasticities of real GDP per capita growth with respect to K_t,L_t, FDI_t, Aid_t, INF_t, $GE_t$and $D_t$respectively.

At the end of the study, the following signs are expected to be met.

Explanatory Variables	Expected Sign
Physical Capital	+
Labour Force	+
Foreign Direct Investment	+
Foreign Aid	+
Inflation	-
Government Expenditure	-
Military rule	-

The error correction term lagged one period, which integrates short-run dynamics in the long-run growth function is shown below through the error correction model (ECM):

$$\Delta RPCGDPG_t = \alpha_1 + \sum_{i=1}^{p} b_{2i}\Delta RPCGDPG_{t-i} + \sum_{i=0}^{p} c_{3i}\Delta K_{t-i} + \sum_{i=0}^{p} d_{4i}\Delta L_{t-i} + \sum_{i=0}^{p} e_{5i}\Delta FDI_{t-i} + \sum_{i=0}^{p} f_{6i}\Delta Aid_{t-i} + \sum_{i=0}^{p} g_{7i}\Delta INF_{t-i} + \sum_{i=0}^{p} h_{8i}\Delta GE_{t-i} + \sum_{i=0}^{p} m_{9i}\Delta D_{t-i} + \lambda_9 ECM_{t-i} + \varepsilon_{2t} \quad \text{.....(3)}$$

where, ECM_{t-1} is the error correction term (the residuals that are obtained from the estimated cointegrating model of equation (3)). The ECMis the feedback and adjustment effect which indicates how much of the disequilibrium is being corrected. It further proves the stability of the long-run relationship when it is highly statistically significant (Bannerjee, et al., 1998). The composition of ε_{2t} is similar to that of ε_{1t} as observed in equation (3). The symbol Δ represents the first-differenced form of the variables in the model. The coefficient of the various explanatory variables, $b_{2i,}$ c_{3i}, $d_{4i,}$ e_{5i}, f_{6i}, $g_{7i,}$ $h_{8i,}$ are the impact multipliers that measure the immediate impact that a change in the explanatory variable has on a change in the dependent variable. λ_9 represents the speed of the adjustment parameter. The value of λ must be between the range $-1 \leq \lambda_9 \leq 0$ and must be statistically significant.

Notably, the appropriate number of lags, which offers the value of *'p'*, is chosen automatically by E-views (Version 5) according to the AIC or Schwarz Bayesian Criterion (SBC). The Parsimonious empirical model will be determined based on the concurrent least value of SBC at the instance of no autocorrelation with reference to Durbin-Watson (DW) statistic. With this, the appropriate empirical method for estimation is selected. To ascertain the goodness of fit of the long run model, the diagnostic test is conducted. The diagnostic test examines the serial correlation associated with the model.

Estimation Procedures

Unit Root Tests

This study began with the test for stationarity of the endogenous and exogenous variables within the framework of Augmented-Dickey-Fuller (ADF) test procedure. This test is important in order to avoid spurious regression which is a common problem when estimating a regression line with data whose generated process follows a time trend. The ADF test requires estimating an equation of the form:

$$\Delta y_t = B_0 + B_1 y_{t-1} + B_2 t + \sum_{i=1}^{p} A_1 \Delta y_{t-1} + Z_t; \qquad H_0 : B_1 = 0;\ H_1 : B_1 > 0$$

where,y_t is a vector for all-time series variables under consideration in a particular regression model (our variables of interest); t is a time trend variable;Δ denotes the first difference operator; z_t is the error term; *p* is the optimal lag length of each variable chosen such that first-differenced terms make z_t a white noise.

The ADF test is principally concerned with the estimate of B_1, that is, the study tests the hypothesis H_0: B_1= 0. The rejection of the null hypothesis in favor of the alternative hypothesis implies that y_t is stationary and integrated of order zero, that is, I(0). If the null hypothesis of unit root for the first difference is rejected, then the first difference is stationary and the variable is integrated of order one, that is, I(1) (Johansen 1988; Maddala, 1977; Adenutsi, et al., 2007). The objective of this unit root test is to check whether the macroeconomic variables of interest are integrated of order one (I(1)) or otherwise before proceeding to the estimation procedure (Engle and Granger, 1987).

The Johansen Cointegration Test

After checking univariate time series of all-time series properties of each of the variables in the specified model and found to be integrated of the same order, the study proceeded with testing of cointegration among the variables of interest. The purpose of the cointegration test is to determine whether a group of non-stationary series is cointegrated or not.

This study applied the Johansen Cointegration Maximum Likelihood Method of Cointegration developed by Johansen (1988) and applied by Johansen and Juselius (1990) to determine the number of cointegrating vectors. In this case, the study applied the trace test and maximum eigenvalue test. If these tests give contradictory results at 5% significance level, the researchers would check whether they give similar results at 10% significance level instead. If yes, then, the researcher would keep results based on 10% significance level. However, if at 10% significance level the tests still give condictionary results, the researchers would stick to the results based on maximum eignvalue test, which is usually preferred for try to pin down the number of cointegrating vectors (Ender, 2004).

On the other hand, if the variables are found to be integrated of different orders, we will make them integrated of the same order through differencing before determining the number of cointegrating vectors. For instance, if some variables are I(1) and some variables are I(2), we can first-difference I(2) variables in order to make them I(1), and then check for the number of cointegrating vectors. On the other hand, if some variables (except dependent variable) are I(0) and some variables are I(1), ignore I(0)

variables while conducting Johansen-Juselius (1990, 1992, 1994) maximum likelihood method of cointegration. In case where the dependent variable itself is I(0) regardless of the order of integration of the other variables, it is not possible to conduct cointegration analysis, implying that there exist no long run relationship among the variables. In this case, the research can run OLS after differencing the I(1) variables.

If the variables are found to be cointegrated, the researchers would estimate the error correction model using standard methods and diagnostic tests.

4.0 Empirical Results and Discussion

The result of the Augmented Dickey-Fuller (ADF) test for the variables under consideration is shown in table 1 below. From the table, all the variables are stationary at 5 percent level of significance with constant but no trend. Therefore, all the variables, real GDP per capita growth,physical capital,labour force,foreign direct investment,foreign aid,consumer price index, and government expenditure are integrated at first order, I(1). As a result, the Johanson's cointegration approach can be used to determine the number of cointegrating equation.

Table 1: The results of Augmented Dickey-Fuller test (ADF) for unit root.

	None			Constant			Constant and Trend		
Variable	Level	1st difference	Conclusion	Level	1st diff	Conclusion	Level	1st diff	Conclusion
	t-obs	t-obs		t-obs	t-obs		t-obs	t-obs	
PCGDPG	-4.5993*	-5.5262*	I(1)	-4.5813*	-5.4404*	I(1)	-3.6896*	-5.6042*	I(1)
K	1.9410	-7.8929*	I(1)	0.8191	-6.5932*	I(1)	-1.2703	-7.1114*	I(1)
L	-0.8615	-2.9572*	I(1)	-0.9351	-3.0413*	I(1)	-3.6265*	-2.8596	I(1)
FDI	-0.2164	-7.0985*	I(1)	-0.9142	-7.0827*	I(1)	-1.3638	-7.6285*	I(1)
FAID	-0.3725	-8.8090*	I(1)	-1.5218	-8.7337*	I(1)	-2.3697	-8.7617*	I(1)
CPI	-0.5654	-1.7720**	I(1)	-0.5901	-1.4905	I(1)	-0.6531	-1.1236	I(1)
GE	-0.1997	-5.3055*	I(1)	-2.6559**	-5.2409*	I(1)	-2.4478	-5.2382*	I(1)

* significant at 5 percent ** significant at 10 percent

Note: The null hypothesis is that the variable has a unit root. The rejection of the null hypothesis for ADF test is based on the Mackimon(1996) critical values at 5 or 10 percent.

Vector Autoregressive, VAR, is used to determine the optimal lag length for the Johanson cointegration test which is based on the AIC as shown in table 2. From the result, the optimal lag length based on AIC is 3.

Using the selected optimal lag length of 3, the likelihood ratio test which depends on the maximum Eigen values of the stochastic matrix of the Johanson (1991) procedure for exploring the number of cointegrating vectors was used.

Table 2: Selection of Optimal Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-721.8340	NA	171279.9	34.75400	35.08498	34.87532
1	-473.5967	390.0871	27.98737	25.98080	28.95966*	27.07267
2	-413.4765	71.57171	47.25855	26.16555	31.79229	28.22797
3	-300.1795	91.71663*	12.97571*	23.81807*	32.09269	26.85105*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 3 shows the results for the cointegrating test. From the table, the Maximum Eigenvalue statistics show that there are six (6) cointegrating vectors at 5 percent level of significance. The null hypothesis of zero cointegrating vector is rejected against the alternative of one cointegrating vector. Similarly the null hypothesis of at most 1, at most 2,... and at most five cointegrating vectors are also rejected against the alternative hypothesis. Therefore, it is concluded that there are six cointegrating vectors specified in the model.

Table 3: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.999778	344.8846	52.36261	0.0001
At most 1 *	0.910093	98.76801	46.23142	0.0000
At most 2 *	0.888377	89.89792	40.07757	0.0000
At most 3 *	0.715380	51.52059	33.87687	0.0002
At most 4 *	0.553441	33.05351	27.58434	0.0089
At most 5 *	0.407276	21.44410	21.13162	0.0452
At most 6	0.260590	12.37803	14.26460	0.0972

At most 7	0.031674	1.319656	3.841466	0.2507

Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4 below shows the results of the coefficient of β matrices in terms of normalised cointegrating coefficient of first equation. This results shows the long run relationship among the variables. All the variables turn out to be significant and have the expected signs except labour force and foreign aid.

From the results, physical capital and foreign direct investment had direct impact on growth in real GDP per capita.This shows that as physical capital increases by a unit, growth in real GDP per capita also increases by 8.4 units while a unit increase in foreign direct investment causes growth in real GDP per capita to increase by18.4 units. This means that in both cases a percentage increase in any of these variables lead to more than a percentage increase in real GDP per capita growth.Labour force influenced growth of real GDP per capita negatively.As a result, a unit increase in labour force will cause growth of real GDP per capita to decrease by 65.7 units. This shows that a percentage increase in the type of labour force being produced now will lead to a more than percentage fall in real GDP per capita growth.

Foreign aid influenced growth of real GDP per capita negatively. A unit increase in foreign aid will cause growth of real GDP per capita to decline by 8.5 units.This shows that a percentage increase in foreign aid will lead to a more than percentage fall in real GDP per capita growth. This means that foreign aid is being channeled to wrong sectors of the economy which do not lead to economic expansion. Consumer price index influenced growth of real GDP per capita negatively. A unit increase in consumer price index will cause growth of real GDP per capita to decrease by 2.4 units. Government expenditure influenced growth of real GDP per capita negatively, as a result, a unit increase in Government expenditure will cause growth of real GDP per capita to decrease by 18.3 units. Military rule influenced growth of real GDP per capita negatively. Therefore, improvement in democracy will cause growth in real GDP per capita to improve.

Finally,physical capital and foreign aid had a positive effect on growth of real GDP per capita, hence, an increase in these variables will lead to improvement in growth of real GDP per capita. On the other hand, labour force, foreign aid, consumer price index, government expenditure and military rule had negative impact on growth of real GDP per capita.Therefore, decline in these variables will cause improvement in

growth of real GDP per capita.Therefore we conclude that, in the long run, physical capital, labour force, foreign direct investment, foreign aid, consumer price index, government expenditure and military rule are the significant determinants of growth in real GDP per capita in Ghana.

Table 4: Normalised Cointegrating Coefficients: 1 Cointegrating Equation (s)

Variables	Coefficients	Standard Errors	T - Statistic
K	8.4197	0.0431	195.3527
L	-65.6796	0.5003	-131.28
FDI	18.4495	0.1326	139.1365
FAID	-9.5315	0.0585	-162.932
CPI	-2.3913	0.0271	-88.2399
GE	-18.329	0.0892	-205.482
D01	-16.1964	0.418	-38.7474

The stationarity of the residuals obtained from the cointegration regression of the dependent variable (growth of real GDP per capita) on the independent variables (physical capital,labour force, foreign direct investment, foreign aid, consumer price index, government expenditure anddummy variable, military rule) has been tested using the ADF test. The result shown in table 6 revealed that the residuals is stationary at 5% level of significance with trend and intercept at level.

Table 5: Testing for the stationarity of the residuals/error

Variable	None	Constant	Constant and Trend	Conclusion
	t-obs	t-obs	t-obs	
residuals/error term	-6.8852	-6.8167	-6.7673	I(0)

The short run dynamics among the variables are explored by employing vector error correction model (VECM). Error correction model allows the introduction of previous disequilibrium as independent variables in the dynamic behaviour of existing variables. Table 6 presents the short run dynamic relationship and the set of short run coefficients in the vector error correction model. VECM associates the changes in growth in GDP per capita to the change with the other lagged variables and the disturbance term of lagged periods. The coefficient of the speed of adjustment is negative and significant at 5 percent. This shows that there is 36.8 percentage point adjustment taking place each year towards the long run periods. From table 6, the immediate impact of the explanatory variables shows that the past two years of foreign direct investment and government expenditure had negative and positive impact on the growth in real GDP per capita, respectively. These impacts were statistically significant.Therefore, an increase in the past two years of foreign direct investment will cause growth in real GDP per capita to decrease by 2.9 units while an increase in the past two years of

government expenditure will cause growth in real GDP per capita to increase by 1.3 units. On the other hand, the past records of growth in real GDP per capita, physical capital and consumer price index had negative impact on current growth in real GDP per capita. However, the past records of foreign aid had a positive impact on current growth in real GDP per capita.While the immediate past record of military rule had a negative impact, the past two years record of military rule had a positive impact on growth in real GDP per capita. However, the impact of these variables are not statistically significant. Therefore, in the short run, foreign direct investment and government expenditure are significant determinants of growth in real GDP per capita.

Table 6: The Result of Error Correction Model for Short Run Dynamics

Error Correction: D(GDP)			
The speed of adjustment	-0.368328	(0.15872)	[-2.32056]
D(GDP(-1))	-0.11402	(0.18808)	[-0.60625]
D(GDP(-2))	-0.159099	(0.19031)	[-0.83602
D(K(-1))	-0.272478	(0.34364)	[-0.79291]
D(K(-2))	-0.349671	(0.34947)	[-1.00058]
D(L(-1))	3.170185	(4.29729)	[0.73772]
D(L(-2))	0.403499	(4.64657)	[0.08684]
D(FDI(-1))	-1.279571	(1.14274)	[-1.11974]
D(FDI(-2))	-2.894166	(1.01520)	[-2.85084]
D(FAID(-1))	0.370377	(0.46895)	[0.78979]
D(FAID(-2))	0.683839	(0.49519)	[1.38097]
D(CPI(-1))	-1.170697	(0.69132)	[-1.69341]
D(CPI(-2))	-1.135297	(0.64742)	[-1.75357]
D(GE(-1))	-0.100417	(0.65608)	[-0.15306]
D(GE(-2))	1.319512	(0.61098)	[2.15967]
D(D01(-1))	-0.454865	(2.43159)	[-0.18706]
D(D01(-2))	0.259277	(2.46281)	[0.10528]
C	7.157505	(3.20448)	[2.23360]
R-squared: 0.486481 Adj. R-squared: 0.122738 F-statistic: 1.337431			

Granger (1996) causality test has been performed in order to examine the linear causation between the concerned variables. Granger causality is useful in determining the direction of the relationships. The test is based on the model specified below.

$$Y_i = \alpha_0 + \sum_{j=1}^{m} \beta_i Y_{t-j} + \sum_{i=1}^{n} \delta X_{t-i} + \mu_t,$$

If X_t Granger cause Y_t then the current values of Y_t are determined by past values of $X_{t-1.}$ The test of H_0: $\delta_i = 0$, can be carried out with the F-

test. In the view of Granger, the presence of cointegration vector shows that Granger causality must exist in at least one direction. Using the optimum lag length of 3 based on AIC, table 7 presents the results of Granger casualty test. From the table, the result shows that there is unilateral directional causality between labour force and physical capital, physical capital and foreign direct investment, foreign aid and physical capital, physical capital and consumer price index, physical capital and military rule, labour force and foreign direct investment, consumer price index and labour force, foreign direct investment and foreign aid. Also, there is bidirectional causality between consumer price index and foreign direct investment.

Table 7: The Results of Granger Causality Test

Pairwise Granger Causality Tests Sample: 1964 2008 Lags: 3			
Null Hypothesis:	Obs	F-Statistic	Probability
K does not Granger Cause GDP	42	1.56766	0.21459
GDP does not Granger Cause K		0.74086	0.53488
L does not Granger Cause GDP	42	0.35230	0.78772
GDP does not Granger Cause L		0.27499	0.84303
FDI does not Granger Cause GDP	42	1.71952	0.18086
GDP does not Granger Cause FDI		2.23383	0.10152
FAID does not Granger Cause GDP	42	1.61117	0.20433
GDP does not Granger Cause FAID		0.43391	0.73006
CPI does not Granger Cause GDP	42	1.05318	0.38136
GDP does not Granger Cause CPI		0.09723	0.96104
GE does not Granger Cause GDP	42	1.07353	0.37289
GDP does not Granger Cause GE		0.48041	0.69800
D01 does not Granger Cause GDP	42	0.32781	0.80524
GDP does not Granger Cause D01		1.21586	0.31839
L does not Granger Cause K	42	4.35841	0.01039
K does not Granger Cause L		0.95689	0.42388
FDI does not Granger Cause K	42	2.01389	0.12988
K does not Granger Cause FDI		3.72884	0.01997
FAID does not Granger Cause K	42	2.94427	0.04632
K does not Granger Cause FAID		1.48657	0.23509
CPI does not Granger Cause K	42	0.57291	0.63661
K does not Granger Cause CPI		2.96093	0.04548
GE does not Granger Cause K	42	2.48845	0.07647
K does not Granger Cause GE		0.38417	0.76504
D01 does not Granger Cause K	42	1.06842	0.37500
K does not Granger Cause D01		4.48412	0.00914
FDI does not Granger Cause L	42	0.93362	0.43478

L does not Granger Cause FDI		4.31620	0.01085
FAID does not Granger Cause L	42	1.19980	0.32414
L does not Granger Cause FAID		2.21886	0.10323
CPI does not Granger Cause L	42	4.86725	0.00621
L does not Granger Cause CPI		2.36275	0.08793
GE does not Granger Cause L	42	0.35975	0.78241
L does not Granger Cause GE		1.05548	0.38039
D01 does not Granger Cause L	42	0.36095	0.78156
L does not Granger Cause D01		0.21787	0.88334
FDI does not Granger Cause FAID	42	7.47691	0.00054
FAID does not Granger Cause FDI		0.59267	0.62396
CPI does not Granger Cause FDI	42	9.11078	0.00014
FDI does not Granger Cause CPI		3.55485	0.02400
GE does not Granger Cause FDI	42	0.65125	0.58751
FDI does not Granger Cause GE		0.92062	0.44098
D01 does not Granger Cause FDI	42	1.28228	0.29563
FDI does not Granger Cause D01		1.10328	0.36082
CPI does not Granger Cause FAID	42	1.26521	0.30133
FAID does not Granger Cause CPI		0.48256	0.69653
GE does not Granger Cause FAID	42	1.38889	0.26235
FAID does not Granger Cause GE		0.47475	0.70187
D01 does not Granger Cause FAID	42	0.25982	0.85382
FAID does not Granger Cause D01		1.40241	0.25840
GE does not Granger Cause CPI	42	0.14578	0.93170
CPI does not Granger Cause GE		0.29243	0.83057
D01 does not Granger Cause CPI	42	1.21690	0.31802
CPI does not Granger Cause D01		1.31478	0.28508
D01 does not Granger Cause GE	42	1.21513	0.31865
GE does not Granger Cause D01		0.79506	0.50494

5.0 Conclusion and Policy Recommendations

The study examined the macroeconomic determinants of economic growth in Ghana using cointegration approach. The empirical analysis is based on time series econometrics. It is found in the current study that all variables; growth in real GDP per capita, physical capital, labour force, foreign direct investment, foreign aid, consumer price index, government expenditure and military rule turned out to be non stationary at their levels but became stationary at their first difference. The results of Johansens's cointegration test indicates that there exist a long run and short run relationship between growth in real GDP per capita, physical capital , labour

force , foreign direct investment , foreign aid , consumer price index , government expenditure and military rule in Ghana.

The study finds out that in the long run physical capital and foreign direct investment had a positive effect on growth in real GDP per capita.As a result, increase in these variables lead to improvement in real GDP per capita growth. However, labour force, foreign aid, consumer price index, government expenditure and military rule had negative effect on growth in real GDP per capita.Therefore, decline in these variables will cause improvement in real GDP per capita growth. Hence, in the long run, physical capital, labour force, foreign direct investment, foreign aid, consumer price index, government expenditure and military rule are significant determinants of growth in real GDP per capita in Ghana. However, in the short run, there is 36.8 percentage point adjustment taking place each year towards the long run periods.The past two years record of foreign direct investment had a negative impact while government expenditure had a positive impact on the growth in real GDP per capita. These impacts were statistically significant. Therefore, in the short run, foreign direct investment and government expenditure are significant determinants of growth in real GDP per capita in Ghana.

The Granger Causality test also showed that there is unilateral directional causality between labour force and physical capital, physical capital and foreign direct investment, foreign aid and physical capital, physical capital and consumer price index, physical capital and military rule labour force and foreign direct investment, consumer price index and labour force, foreign direct investment and foreign aid. Also, there is bidirectional causality between consumer price index and foreign direct investment.

Finally, the following policy recommendations are made based on the findings:

1. Policies should be put in place to increase physical capital and foreign aid in Ghana since these have positive effects on growth in real GDP per capita.
2. Since labour force had negative impact on growth in real GDP per capita, educational institutions should link up with the corporate organisations to know what corporate institutions need in terms of the labour force.
3. Government should device strategies to mobilise money domestically for her developmental projects rather than to rely on foreign direct investment.
4. Government should also spend on the most productive sectors of the economy like the health sector, educational sector, agricultural sector and so on.

5. Military rule had negative impact on growth in real GDP per capita.Therefore, the Government must put in place strategies to protect and sustain democratic rule in Ghana.

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