The DDT Effect: The case of Economic Growth, Public Debt and Democracy Relationship

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ABSTRACT

This study contributes to the research on the economic growth, public debt and democracy relationship using the case of Ghana. We posit that, (1) the capacity of a country to tolerate higher debt is dependent on the quality of institutions, and (2) the growth enhancing effect of democracy depends on the initial debt levels. The results point to an inverse relationship between the quality of institution and the capacity of the country to tolerate higher debt. Further, the growth enhancing effect of democracy is crucially dependent on the initial debt-to-GDP ratio. Several robustness checks conducted confirmed these results.

Keywords: Economic growth; Public debt; Democracy

JEL: H63, Q4, Q43

1. INTRODUCTION

The highly unlikely event of a country running a surplus budget makes the acquisition of public debt a necessity. However, building-up debt to unsustainable levels can be growth-inhibiting in any economy. The theoretical literature points to an inverse relationship between debt and economic growth (Barro, 1990, 1979; Saint-Paul, 1992; Aizenman et al., 2007), albeit positive growth impacts of debt are also likely but only under special conditions (Aizenman et al., 2007; Aschauer, 2000). Others have argued the existence of a tipping point in fiscal sustainability makes the impact of debt on economic growth non-linear. On the other hand, improving upon the quality of institution has been associated with economic growth, but this result is not very conclusive as positive (Kurzman et al., 2002; Ghosh and Gregoriou, 2009), negative (Tavares and Wacziang, 2001; Heo et al., 2008) and no impact (Rodrik, 1999; Przeworski and Limongi, 1993) have be found in the literature. Though improving the quality of institution has been linked to strengthening the fiscal position of the government, the empirical evidence have shown otherwise (Ashworth et al., 2005; Reinhart et al., 2003; Manasse and Roubini, 2009; Kraay and Nehru, 2006; Persson and Svensson, 1989; Alesina and Tabellini, 1990, *inter alia*). Plumper and Martin (2003) provide public perspective of what is now called the Barro effect by Barro (1996), which postulates an inverted U-shaped/concave relationship between democracy and economic growth. Plumper and Martin (2003) explain that, in an autocratic regime, the ruling party provides rent to the smaller elite to maintain power. As a result, the size of government is limited. Hence, private consumption and investment are not affected adversely. However, as the country transition to a democratic regime, the political participation increases and the survival of the ruling party becomes dependent on the amount of public goods provided. Consequently, according to Plumper and Martin (2003), the size of the government increases as the democratic process grows (see Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Woo, 2003), and this may crowd-out private consumption and investment and subsequently harm economic growth. In their empirical framework, they find a positive interaction effect between democracy and government expenditure and a U-shaped relationship between government expenditure and democracy.

In an economy where there is a serious restraint on internal revenue mobilization, increase in government size due to democratization will translate to higher government debt since the provision of public goods would have to be financed by public borrowing. Therefore, following from the argument of Plumper and Martin (2003), it is reasonable to argue that democracy is likely to increase government debt (see Elgin and Uras, 2013). The rationalization is this; if government expenditure interacts positively with democracy to promote economic growth on one hand as argued by Plumper and Martin, and the size of public debt grows directly with the size of the

government on the other hand, then it follows directly that, in developing countries where internal revenue generation is seriously constraint, (1) democratization will increase the size of the government debt and cause economic growth reduction, and (2) the growth enhancing effect of democracy will be dependent on the initial debt position of the economy. The following deductions can be made from (1) and (2). From (1), the capacity of a country to tolerate higher debt will be constraint by the democratic process in the country. Therefore, studies that test for the non-linearity in the debt-economic growth relationship should condition this relation on the quality of institution. From (2), the democracy-economic growth nexus should be conditioned on the initial debt-to-GDP ratio in the country.

This study investigates the economic growth, public debt and democracy relationship using data from Ghana. The study makes the following contribution to the literature. First, we provide a political explanation to the non-linearity in the debt-economic growth relationship. We condition the non-linearity in the relationship on the quality of institution. We relate the impact dynamics of quality of institution to the *DDT effect*. *DDT* (dichloro-diphenyl-trichloroethane) was first introduced in 1940. It was used for the control of malaria, typhus, and other insect-borne human diseases. The chemical was also used for pest control and farming activities. Despite the numerous benefits of *DDT*, later research showed that the chemical has a long-term adverse effect on humans and the environment. It has been associated with birth effects, fertility problems, and cancer. Second, we conditioned the democracy-economic growth nexus on the initial debt-to-GDP ratio. Third, we use a more cumulative measure of democracy (i.e. Unified Democracy Scores [UDS] by Pemstein et al., 2010) that leverages the efforts of several scholars simultaneously. This measure solves the problem of ignoring some dimensions of institutions which is often the problem when the researcher settles on one measure of democracy. Finally, we use the trend/potential economic growth variable devoid of cyclicality as our dependent variable. First, of the reasons, is to capture the true long-run effect, second, is to deal with the issue of endogeneity and especially reverse causality, and third, is to make our model compatible with the requirements of a cointegration model. To complement our approach of dealing with endogeneity and reverse causality, we adopt two cointegration techniques that correct for serial correlation and the simultaneity problems. Several robustness checks are also conducted which includes using trend/potential GDP per capita growth as the dependent variable, using the lag of debt instead of the contemporaneous data, and including additional covariates such as investment and political stability.

Ghana is a front runner of democracy in Africa, and therefore presents an interesting case study for other African countries. Ghana's economic growth trajectory has been impressive in the last

three decades. From negative levels in 1983, economic growth has hit positive heights since then, albeit this trend is not devoid of occasional cyclicality. The success in economic growth has also come along with some institutional reforms. From a military and coup detat rule in the 1970s and 1980s, the country transitioned to a democratic regime in 1994 when the first constitutional election was held. While some are quick to link the economic success to the institutional change, the feeling is one of uncertainty among others. The reason is that public debt has also grown to astronomical levels during this period. Recent debt levels are so high that (about 70% and more of GDP) the International Monetary Fund (IMF) has recently identified Ghana as a high risk country. There are some aspects of the democratic process in Ghana which could explain the recent phenomenon and thus deserve attention. Though the democratic process in Ghana is characterised by an electoral competitiveness, there is weak and check balances in the country, and this has contributed to the high corruption incidence in the country. For example, a case of corruption in the judicial sector has been unfolded. Also, the majoritarian system in the country increases the tendency of the majority to vote for greater redistribution and thereby increasing the size of the government. Unfortunately, the country is seriously constraint in terms of internal revenue generation. Therefore, debt build-up increases in order to finance the provision of most public goods in the country. The prevailing conditions in Ghana raises the following concerns: (1) democracy may affect the country's capacity to tolerate higher debt, and (2) high initial debt-to-GDP ratio may inhibit the growth enhancing effect of democracy in the country. The potential positive effect of democracy on public debt could be growth-inhibiting; a phenomena that likens the impact dynamics of democracy to the *DDT effect*.

The rest of the study is organized as follows. Section 2 reviews the theoretical and empirical literature. Section 3 presents the method and Data. Section 4 discusses the results of the study. Section 5 concludes with some policy recommendations.

2. LITERATURE REVIEW

The impact of debt and democracy on economic growth has been widely investigated in the literature. While the theoretical arguments are somewhat conclusive for debt, it remains inconclusive for democracy and economic growth. Generally, the theoretical literature points to an inverse relationship between economic growth and public debt (Barro, 1990; Saint-Paul, 1992; Aizenman et al., 2007). However, a positive effect of debt has not been ruled out. Some endogenous growth models have shown that in the transition stage to steady-state, the impact of debt on growth can be positive depending on the type of public goods that the debt is used to finance (Aizenman et al., 2007). Aschauer (2000) also assert that the impact can be positive up to

a certain limit when the debt is used to finance productive public capital. In the case of democracy, three effects have been identified: *conflict effect* (i.e. democracy reduces economy growth as a result of the implementation of myopic policies such as welfare policies and state benefits at the expense of accumulation [Tavares and Wacziang, 2001; Heo et al., 2008]), *compatibility effect* (i.e. democracy promotes economic growth since it reduces the redistribution conflicts, promotes equitable distribution of resources and power, and promotes civil and property rights [Kurzman et al., 2002; Ghosh and Gregoriou, 2009]) and *sceptical effect* (i.e. no systematic relationship between economic growth and democracy is identified [Rodrik, 1999; Przeworski and Limongi, 1993]).

The empirical literature is flooded with studies examining the debt-economic growth on one hand, and the democracy-economic growth nexus on the other hand. The literature on the debt impacts on economic growth span from linear impacts to nonlinear impacts. Studies examining the linear impact of debt generally shows that rising debt in a country impact negatively on economic growth. Kumar and Woo (2010) examine the long-run impact of high debt on economic growth in advanced and emerging countries. The results reveal high debt has an inverse relationship with economic growth. Greiner (2012) investigates the long-run effect of public debt on resource allocation. The result shows that long-run growth is smaller the high debt ratio if the government adjusts public spending to fulfil its inter-temporal budget. However, no effect of debt on growth is realized if the government adjusts lump-sum. Qayyum et al (2014) investigate the impact of debt on economic growth and find that external debt decreases economic growth. Ramzan and Ahamad (2014) also examine the external debt-economic growth relationship. Their result confirms that external debt decreases economic growth, but it is only the bilateral component and not the multilateral component that retards growth. Dogan and Bilgili (2014) also find that the public and private components of external borrowing affects economic adversely, but the negative impact for the former is greater. In contrast, Spiloti and Vamvoukas (2015) find the impact of government debt on economic growth to be positive. Schclarck (2004) rather find no evidence of a statistically significant relationship between debt and economic growth for 24 industrialized countries.

It has been argued that the existence of a tipping point in fiscal sustainability generates a non-linear impact of debt on economic growth. Several studies have tested for the nonlinearity in the debt-economic growth relationships. Pattillo et al (2002) examine the non-linear impact of debt on economic growth for 93 developing countries. They find that debt has a significant concave relationship with economic growth with a turning point of 35-40% of GDP. Similarly, Clements et al (2003) tests for the non-linear impact of debt on economic growth for 55 low-income countries. Their result also confirm a concave relationship between debt and economic growth with threshold level of 20-25% of GDP. Kumar and Woo (2010) examine the case for emerging

and developed countries. They find evidence of a non-linear effect of public debt on economic growth with a threshold level of 90%. Checherita-Westphal and Rother (2012) examine the impact of high debt levels on economic growth and the channels in the euro area. The results confirm that debt has a non-linear significant effect on economic growth with a turning point of 90-100% of GDP. According to them, the channels include private savings, public investment, and total factor productivity. Baum et al (2013) also investigate the relationship between public debt and economic growth in the euro area. In the short-run, they find the impact of debt on economic growth to be positive but up to 67% debt-to-GDP ratio. Beyond threshold levels of 95%, additional accumulation of debt generate negative growth outcomes. Mencinger et al (2014) also test for non-linearity in the debt-economic growth relationship in the European Union. They find evidence of a significant concave effect of debt on economic growth.

Afonso and Jalles (2013) investigate the link between growth, productivity and government debt for 155 countries. Their results show an inverse relationship between debt and economic growth with a threshold level of 59% of GDP. Woo and Kumar (2015) also investigates the debt and growth relationship for a large panel consisting of emerging and advanced countries. They find that high initial debt lowers economic growth. Also, they find evidence of a concave relationship between debt and economic growth with a threshold level of 90% of GDP. Other studies have found less support for the debt-economic growth link and the non-linearity as a result. Reinhart and Rogoff (2010) examine the developments of public debt and long-term economic growth in 20 developed countries. They find weak effect for debt on economic growth with a threshold level of 90% of GDP. Egert (2015) tests the negative non-linear effect of debt on growth if public debt exceeds 90% of GDP. The author reveals that finding a negative non-linear relationship is extremely difficult and sensitive to modelling choices and data coverage. In the instance where non-linearity is detected, it is found at a very low level of about 20-60% of GDP. Eberhardt and Presbitero (2015) also examine the debt and growth relationship in large panel consisting of emerging and developing countries accounting for the heterogeneity and non-linearity in the relationship. Their results show a negative linear effect of public debt on economic growth with significant heterogeneity in the debt impact, which suggests that average analyses of the problem may be misleading. They find no evidence of non-linearity in the debt-economic growth relationship.

Likewise, both linear and non-linear impacts of democracy on economic growth have been examined empirically in the literature; the latter referred to as the Barro effect from the seminal work of Barro (1996). The Barro effect posits that democratic control of government promotes economic growth only up to a certain level of political participation. Once this level is achieved,

an increase in the share of constituents to the population will limit economic growth. Kurzman et al (2002) reviews 47 empirical studies on the growth-democracy nexus. Nineteen (19) of these studies provide evidence in support of the compatibility hypothesis. Six (6) confirm the conflict hypothesis, and ten (10) find evidence of the sceptical hypothesis. A total of eleven (11) studies reveal a combination of positive and insignificant result, negative and insignificant result, and a mix of positive and negative results. Only one (1) study confirm the Barro effect. Narayan et al (2011) investigate the growth-democracy nexus in sub-Saharan Africa. The authors used the Freedom House measure of democracy and the legislative index of electoral competitiveness. They find both evidence in support of the compatibility and conflict hypotheses. However, for most of the sample, their result confirms the sceptical hypothesis.

Jaunky (2013) also examine the growth-democracy nexus in sub-Saharan Africa. The author used the freedom house measure of democracy. The result confirms that while democracy promotes economic growth on one hand, economic growth also promotes democracy; a result that confirms the existence of the virtuous cycle hypothesis. Bates et al (2013) investigate the same relationship in Africa. At the macro level, the authors find that political reform granger causes per capita GDP growth. Masaki and van de Walle (2014) examine the growth-democracy nexus in sub-Saharan Africa. The result shows that democracy promotes economic growth, but this positive impact is more pronounced for countries that have remained democratic for a longer period of time. Carbone et al (2016) also investigate the growth-democracy nexus in sub-Saharan Africa. They used the polity2 measure of democracy. The authors confirm that the region has derived economic dividends from the democratic process in the region. In Ghana, Raggi (2014) concludes that improvement in the quality of institution has been favourable and lead to higher per capita GDP growth. In contrast, Sakyi and Adam (2012) find evidence of the conflict hypothesis in Ghana. Fosu (2008) investigates the link between electoral competitiveness and economic growth in Africa. The author finds rather a u-shaped relationship between electoral competitiveness and economic growth. According to the author, initial transition to democracy can be fraught with risk of political instability which could be growth-inhibiting. However, at advanced level of democracy, economic growth improves.

Plumper and Martin (2003) provides an explanation of the Barro effect. According to them, in autocratic regime, ruling parties only have to provide rents to the few elite to ensure survival. However, as the economy transition to a democratic process, the provision of public goods become crucial for the survival of the ruling party. Consequently, the authors argue that the size of the government grows proportionally. In their growth model they found that democracy interacts positively with government expenditure. Sakyi and Adams (2012) confirm this for Ghana.

Perssan and Tabellini (1999) reveal that majoritarian elections lead to more redistribution and greater government size. According to them, a budgetary process that gives the minister of finance dominant position over spending ministries and restraint the amendment of parliament ensures fiscal discipline. Alesina and Rodrik (1994) and Perssan and Tabellini (1994) assert that there is the tendency for the majority to vote for bigger redistributive spending in a democratic economy.

In a developing country like Ghana, where resource mobilization is seriously constrained, the provision of public goods will have to be financed via public borrowing. Therefore, the growth in government size due to the process of democratization will suggest rising public debt. Thus, following from the argument of Plumper and Martin, we also argue that the interaction effect between democracy and public debt in a growth equation should be negative. There are several studies that have linked the process of democratization to the public finance in an economy. Woo (2003) finds a weak link between democracy and public deficit, but this effect is significantly different from zero. Woo (2003) further reveals that public deficit is higher in countries with more frequent changes from one party to another. According to the authors, such uncertainty in the political system, causes the ruling party to implement myopic policies knowing that debt accumulated will be borne by succeeding government. Gonzalez-Fernandez and Gonzalez-Velasco (2014) find that corruption has a direct impact on public debt. As asserted by Woo (2003), democracy can fuel corruption especially in economies with weak check and balances. This follows that democracy can increase public debt. Elgin and Uras (2013) find a significant positive impact of the quality of institution on public debt levels. In Africa, Muhanji and Ojah (2011) attribute the persistence of unsustainable indebtedness to poor domestic resource mobilization, inadequate debt management capacity and the quality of institution.

The current study makes the following contributions to the literature. First, we investigate a variant of the argument of Plumper and Martin (2003). We interact public debt and democracy and include it as an additional variable in the growth equation. This approach has two main advantages. First, we are able to explain how a country's capacity to tolerate higher debt is dependent on the quality of institution. This leads us to derive what we call the DDT (Democracy-Debt tolerable) curve, which slopes downward from left to right. Thus, our study provides a political explanation of the concave effect of debt on economic growth. Second, we condition the impact of democracy on the initial level of debt-to-GDP ratio. From this we assert that the effect of democracy on growth is dependent on a country's initial debt-to-GDP ratio.

The second major contribution is related to data. One of the difficult problems researchers have to face is choosing the appropriate single measure of democracy. Since the plethora of measures

existing are found to be highly correlated, researchers have had to use one of those measures with the certainty that the results remain robust. However, Casper and Tufis (2003) noted that though these measures are highly correlated, they do not produce a robust result; a reason that could underline the debates on democracy effects. Even though measures such as polity (Marshall and Jaggers, 2000), Freedom House (Freedom house, 2001) and polityarchy (Vanhanen, 2000) are highly correlated, they cover different dimensions of the political process. Therefore, the researcher runs the risk of ignoring other important dimensions embedded in another measure once he/she settles for another. Pemstein et al (2010) have developed a more cumulative approach that leverages the efforts of the numerous scholars simultaneously. Their measure, which is called the Unified Democracy Scores (UDS), *average over the uncertainty that is inherent in each of the constituent measures, taking advantage of each scale's tendency to capture similar, but often distinct, aspects of what makes states more or less democratic. The UDS improves measurement confidence and also minimize the impact of idiosyncratic errors that occur in individual measures and take advantage of the level of agreement between raters to perform a form of intercoder validation across major democracy scales (Pemstein et al., 2010, pp. 427)*. We use this measure of democracy in this study and compare it with the outcomes of the polity measure of democracy.

Third, we use the trend/potential economic growth devoid of cyclicality as the dependent variable, first, to deal with the issue of endogeneity and especially reverse causality, second, to capture the true long-run effect, and third, to make our dependent variable compatible with our cointegration regression requirement. As a robustness check, we also use the trend/potential GDP per capita growth as the dependent variable. The lag of debt is also used in this study to deal with the problem of endogeneity (see Egert, 2015), albeit such an approach is problematic given the persistent nature of debt. To complement our approach to deal with reverse causality and endogeneity, we adopt the fully modified OLS and Canonical cointegration techniques as our estimation techniques. These methods correct for the simultaneity and serial correlation in errors problems. Asymptotically, they are equivalent, albeit their mode of correction differs. While the FMOLS corrects both the estimates and variables, the CCR corrects only the data and selects a canonical regression from among the class of models representing the same cointegration relation (Adom et al., 2015; Park, 1992).

3. MODEL AND DATA

3.1 Model

Our empirical model is motivated by the empirical models of Plumper and Martin (2003), Checherita-Westphal and Rother (2012), Mencinger et al (2014), Kumar and Woo (2010), and

Egert (2015). We model economic growth as a function of public debt, square of public debt, quality of institution and a set of controls (X). This is depicted in equation 1. We estimate another variant of equation 1 in which we test for the Barro effect. This is shown in equation 2.

$$EGr_t = \alpha_0 + \alpha_1 debt_t + \alpha_2 debt_t^2 + \alpha_3 democracy_t + \alpha_{4i,t} X_t + \varepsilon_t \quad (1)$$

$$EGr_t = \alpha_0 + \alpha_1 debt_t + \alpha_2 democracy_t + \alpha_3 democracy_t^2 + \alpha_{4i,t} X_t + \varepsilon_t \quad (2)$$

First, we assume that these hypotheses are independent of each other. EGr is economic growth, which is measured as trend/potential economic growth. Equations 1 and 2 suggest the following. In equation 1, a negative effect of the quadratic debt term will suggest a non-linear impact of debt on economic growth. Thus, there is a debt-to-GDP ratio that the country can tolerate. The literature have argued that the debt limit is due to the existence of a tipping point in fiscal sustainability. Beyond this level, fiscal solvency fails and growth decreases with further debt accumulation. In equation 2, a negative effect of the quadratic democracy term will confirm the Barro effect. Plumper and Martin (2003) have provided a government perspective to the non-linearity in the relationship between economic growth and democracy.

According to Plumper and Martin (2003), political parties resort to rent during periods of autocratic rule to ensure survival. During this time, the growth of government size is limited. However, as the population gains popularity and decides the faith of the ruling political party, ruling parties resort to providing more public goods to ensure their survival. Consequently, the size of the government grows and this crowds-out private consumption and investment, which may harm economic growth. In developing economies like Ghana, where internal revenue mobilization is seriously constrained, the size of the government will move directly with government debt since most of these expenditures on public goods would have to be financed through public borrowing. Thus, Plumper and Martin claim of interaction between democracy and government expenditure can also be extended to public debt. The rationalization is this; if government expenditure interacts positively with democracy to promote economic growth on one hand as argued by Plumper and Martin, and the size of public debt grows directly with the size of the government especially in developing countries where less internal revenues are generated, then it follows directly that, in developing countries like Ghana, (1) democratization will increase the size of the government debt and cause economic growth reduction, and (2) the growth enhancing effect of democracy will be dependent on the initial debt position of the economy. From (1), we posit that democracy and a country's capacity to tolerate higher debt are related, and (2), the growth

enhancing effect of democracy is crucially dependent on the initial debt levels. These revelations lead us to estimate equation 3, which is a metamorphosed version of equations 1 and 2, intuitively.

$$EGr_t = \alpha_0 + \alpha_1 debt_t + \alpha_2 debt_t^2 + \alpha_3 democracy_t + \alpha_4 debt_t * democracy_t + \alpha_{5i,t} X_t + \varepsilon_t \quad (3)$$

Equation 3 is very different from the empirical specifications in the literature that tests the non-linearity in the economic growth-debt relationship and economic growth-democracy relationship. Equation 3 conditions the non-linear effect of debt on the equality of institution. We postulate the interaction effect of debt and democracy to be negative. Thus, the effect of debt on economic growth is derived from 3 as follows.

$$\frac{\partial EGr_t}{\partial debt_t} = \alpha_1 + 2\alpha_2 debt_t - \alpha_4 democracy_t \quad (4)$$

Three variants of equation 3 can be derived depending on the political regime. Let autocratic regime take the value of 0, mild democracy take 0.5, and pure democracy take 1. The following expressions emerge.

$$\frac{\partial EGr_t}{\partial debt_t} = \alpha_1 - \alpha_4 * 0 + 2\alpha_2 debt_t \quad \text{(4a) Autocratic regime}$$

$$\frac{\partial EGr_t}{\partial debt_t} = \alpha_1 - \alpha_4 * 0.5 + 2\alpha_2 debt_t \quad \text{(4b) Mild democracy}$$

$$\frac{\partial EGr_t}{\partial debt_t} = \alpha_1 - \alpha_4 * 1 + 2\alpha_2 debt_t \quad \text{(4c) Pure democracy}$$

From 4a to 4c, the capacity of the country to tolerate higher debt levels are computed as follows by setting each equation to zero.

Capacity to tolerate higher debt in autocratic regime: $debt_t = \frac{\alpha_1}{2\alpha_2}$

Capacity to tolerate higher debt in mild democracy: $debt_t = \frac{\alpha_1 - \alpha_4 * 0.5}{2\alpha_2}$

Capacity to tolerate higher debt in pure democracy: $debt_t = \frac{\alpha_1 - \alpha_4 * 1}{2\alpha_2}$

where $\frac{\alpha_1}{2\alpha_2} > \frac{\alpha_1 - \alpha_4 * 0.5}{2\alpha_2} > \frac{\alpha_1 - \alpha_4 * 1}{2\alpha_2}$. Thus, we have something like a downward sloping curve, which states that as the process of democratization intensifies, the capacity of the country

to tolerate higher debt reduces. We derive this curve later in this study with our results and call it the DDT (Democracy-Debt tolerable Curve).

Finally from equation 3, the effect of democracy on economic growth can be derived as equation 5. Equation 5 states that as the level of initial debt-to-GDP ratio increases, the growth enhancing effect of democracy decreases.

$$\frac{\partial EGr_t}{\partial democracy_t} = \alpha_3 - \alpha_4 debt_t \qquad (5)$$

As our empirical approach, we proceeded as follows. First, we estimate a simple growth model that has debt (measured as total public debt as a percent of GDP), democracy (measured using UDS measure), economic openness (measured as trade as per cent of GDP), and population growth as arguments. Second, separately, we estimate equations 1 and 2. Third, we estimate equation 3. Several robustness checks were conducted. First, we estimated the same models using the trend/potential GDP per capita growth as the dependent variable. Second, for equation 3, we included the effects of regime durability and gross investment (measured as gross fixed capital formation) systematically. Third, we used the lag of debt instead of the contemporaneous debt information. This approached was adopted by Egert (2015). Though this approach is problematic due to the persistent nature of debt, we still adopt it as a further check on our results. To complement our above approaches of dealing with the endogeneity issues, we apply the fully modified OLS by Phillip and Hansen (1990) and Canonical cointegration regression by Park (1992) to estimate the long-run growth model. These techniques are designed to solve the second-order bias problem which often plague ordinary least square estimates. These methods apply different correction mechanisms for endogeneity and serial correlation, however, asymptotically they are equivalent and hence produce an identical results. The detail technical description of these techniques can be found in Phillip and Hansen (1990) and Park (1992). Interested readers should therefore consult these materials for further mathematical treatment of these methods. The variables in the model are not in log.

3.2 Data

This study used annual time series data that covered 1962-2012. Data on investment, population growth, trade openness, economic growth, and GDP per capita growth are sourced from the World Bank Development Indicator database. Data on public debt as a percent of GDP is taken from the IMF fiscal Affairs Department Database and WEO. Data on polity2 is taken from Polity database, and data on Unified democracy scores is taken from the UDS project.

4. RESULTS AND DISCUSSION

4.1 Unit root and Cointegration tests

Table 1.1 shows the test of stationarity of the series. Except for the population growth variable, we conclude on stationarity of the variables after first difference. Thus, we have variables with I (1) and I (0) orders of integration. We applied the Bounds approach to cointegration test to test for cointegration relations. This technique is applicable whether the series are I (1) or I (0) or mutually cointegrated. The result is shown in Table 1.2. The calculated F-statistic lies above the upper critical values at all levels of significance. Therefore, we fail to accept the null hypothesis of no level relationship; suggesting that the regressors can indeed be treated as the "long-run forcing variables" explaining the changes in trend economic growth.

Table 1.1: KPSS (Kwiatkowski-Phillips-Schmidt-Shin, 1992) unit root test
Null Hypothesis: Stationarity

	Constant and no Trend		Constant and Trend	
Variables	Levels	First difference	Levels	First difference
Debt	0.508**	0.056	0.099	----------
UDS	0.745***	0.107	0.127*	0.102
Polity2	0.768***	0.289	0.154**	0.044
Economic Openness	0.650**	0.181	0.150**	0.087
Population growth	0.070	--------	0.074	-------
Trend economic growth	0.664**	0.298	0.161**	0.088
Trend GDP per capita growth	0.672**	0.304	0.176**	0.080
Gross Investment	0.650**	0.224	0.185**	0.087
Regime Durability	0.399*	0.140	0.157**	0.058

Table 1.2: Bounds Approach to cointegration Test
Null Hypothesis: there is no level relationship

	1% critical values		5% critical values		10% critical values	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
	3.29	4.27	2.56	3.49	2.2	3.09
Calculated F-statistic = 5.115						

4.2 Economic Growth, Public Debt and Democracy

Table 2 shows the estimate of the marginal effects of the regressors. Results both when we use the UDS and Polity2 as institutional measures are presented. Democracy unambiguously has a significant positive effect on growth irrespective of the measure of democracy. However, the growth enhancing effect of democracy is much bigger when we use the UDS measure than the polity2 measure. Thus, in terms of the size of the effect, it does matter what the researcher uses as a measure of democracy. The two coefficients should be interpreted as the lower and upper bound growth effects of democracy. The positive effect of democracy on economic growth is in contrast to other literature that claims democracy on its own cannot promote economic growth (see: Sakyi

and Adams, 2012; Heo et al., 2008; Tavares and Wacziang, 2001) but confirms results from the other spectrum of the debate (Raggi, 2014; Bates et al., 2013; Jaunky, 2013; Carbone et al., 2016). Public debt, on the other hand, has a significant negative effect on economic growth, and the result remain robust irrespective of our measure of democracy. This result speaks directly to the current debt crisis in the country. Thus, high debt levels deteriorate economic growth. The growth-inhibiting effect of public debt is also confirmed by Kumar and Woo (2010), Greiner (2012), and Qayyum et al (2014). Economic openness also stimulate economic growth significantly, and the result is robust irrespective of our measure of democracy. This result confirms the conclusion of Egert (2015), Sakyi and Adams (2012), Adams and Atsu (2014), Checherita-Westphal and Rother (2012). Finally, in the baseline model, growth in population also significantly stimulate economic growth.

Next, we tested the non-linear effect of debt on economic growth. Model 2 shows the result. The coefficient of the square debt term is significantly negative, which suggests that the economic growth-debt relationship is an inverted U-shaped. Thus, there is a debt threshold that the country can tolerate. The estimate suggests a debt threshold of 36-55%. Pattillo et al (2002), Clements et al (2003), Checherita-Westphal and Rother (2012), Afonso and Jalles (2013), Woo and Kumar (2015), and Baum et al (2013) have all confirmed the non-linearity in the debt-economic growth relationship. The political regime may matter as suggested above. However, we do not condition the estimate of the debt threshold on the nature of political regime of the country at this stage. We relax this assumption later in this study. Further, the results reveal democracy, economic openness, and population growth exert a significant positive effect on economic growth. This result remains robust irrespective of our measure of democracy.

We also tested for the Baro effect. The results are shown in model III. The results confirm the non-linear effect of democracy on economic growth. As argued by Barro (1996) and Plumper and Martin (2003), for a country that has been under autocracy rule, a move to democratic regime will spur economic growth but only up to a certain point. Beyond that point, further democratization will harm economic growth. Further results in model III show debt reduces economic growth while economic openness and population growth increase economic growth. These results are robust to our measure of democracy.

Finally, in Table 2, we tested for the interaction effect between democracy and debt. Our results confirm the negative interaction effect between democracy and debt only for the model that uses UDS as a political regime measure. Other results such as the non-linear effect of debt on economic

growth and the growth enhancing effect of economic openness and population growth remain robust.

Before going into the details of the results presented in model IV, we estimated the same models in Table 2 using the Canonical cointegration regression (CCR). Table 3 shows the results as provided by the CCR. Models I to IV in Table 3 are asymptotically equivalent to that provided in Table 2. Debt and democracy have a nonlinear effect on economic growth while the effects of economic openness and population growth on economic growth are significantly positive. The interaction between democracy and debt is significantly negative. The results presented in model IV of Table 3 suggest the following. The growth enhancing effect of democracy significantly depends on the initial debt-to-GDP ratio of the economy. According to the result (as provided by the CCR), this relation is depicted by equation 6 which is the estimate of equation 5.

$$\frac{\partial Growth}{\partial Democracy} = 2.296 - 0.033Debt \qquad (6)$$

The above equation suggests that high initial debt-to-GDP ratio will limit the growth enhancing effect of democracy. As the debt position of the country increases, the less likely is it that democracy will be a success in such an economy. As noted by Pumper and Martin (2003), democracy combined with increased government spending leads to economic growth. With high initial debt-to-GDP ratios, it means the economy becomes less solvent and credible. This makes it difficult for the government to expand her core functions; a situation that constraints the growth potentials of democracy. Graphically, this relationship is displayed in Figure 1. According to the Figure, for initial debt-to-GDP ratios of 0-69%, the inherent growth potential of democracy is likely to materialize. However, for initial debt-to-GDP ratios of above 70%, democracy is less likely to promote economic growth. This result speaks directly to the current situation in Ghana. Debt-to-GDP ratio is said to be around 70% and above; a situation that has led the World Bank and IMF to declare Ghana as a high risk country. The IMF predicts the debt-to-GDP ratio of the country to hit 74.1%. As a result, growth is projected to decline in the coming year.

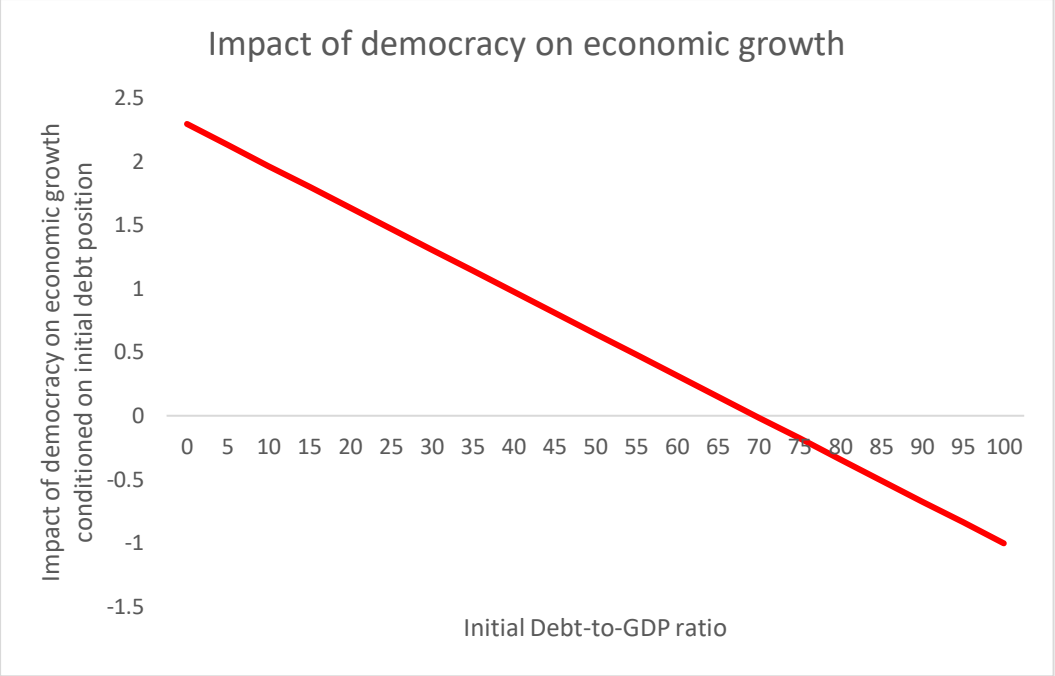

Figure 1: Plot of democracy-growth nexus conditioned on initial debt-to-GDP ratio

Finally, model IV reveals that the debt threshold that might harm economic growth is dependent on the political regime. This relationship is depicted by equation 7 (estimate of equation 4) and Figure 2.

$$\frac{\partial Growth}{\partial Debt} = 0.046 - 0.002Debt - 0.033Democracy \qquad (7)$$

The type of political regime shifts the intercept term and affect the debt threshold beyond which further increases in debt decreases economic growth. We examine the case for three political regimes; autocratic regime (with a UDS score of 0), mild democracy (with a UDS score of 0.5), and pure democracy (with a UDS score of 1). For an autocratic regime, a debt threshold of 23% is tolerable, but beyond this threshold, further increases in debt will decrease economic growth. This is shown by the green curve in Figure 2. For mild democracy, a debt threshold of 15% is tolerable, but beyond this threshold, further increases in debt will decrease economic growth. This is shown by the yellow curve in figure 2. Last, the debt threshold for pure democracy is at 7% (see the brown curve in Figure 2). Beyond this debt threshold, further increase in debt in a pure democratic state will be harmful to economic growth. Our result suggest that debt management have to be intensified as the country democratize. As argued by Pumper and Martin (2003), democratization moves proportionally with government expenditure and subsequently public debt as found in this study. Therefore, for developing countries like Ghana, where less revenue is

generated internally and public goods are largely financed via public debt, debt management may have to be kept at very low levels for the growth enhancing effect of democracy to be realised.

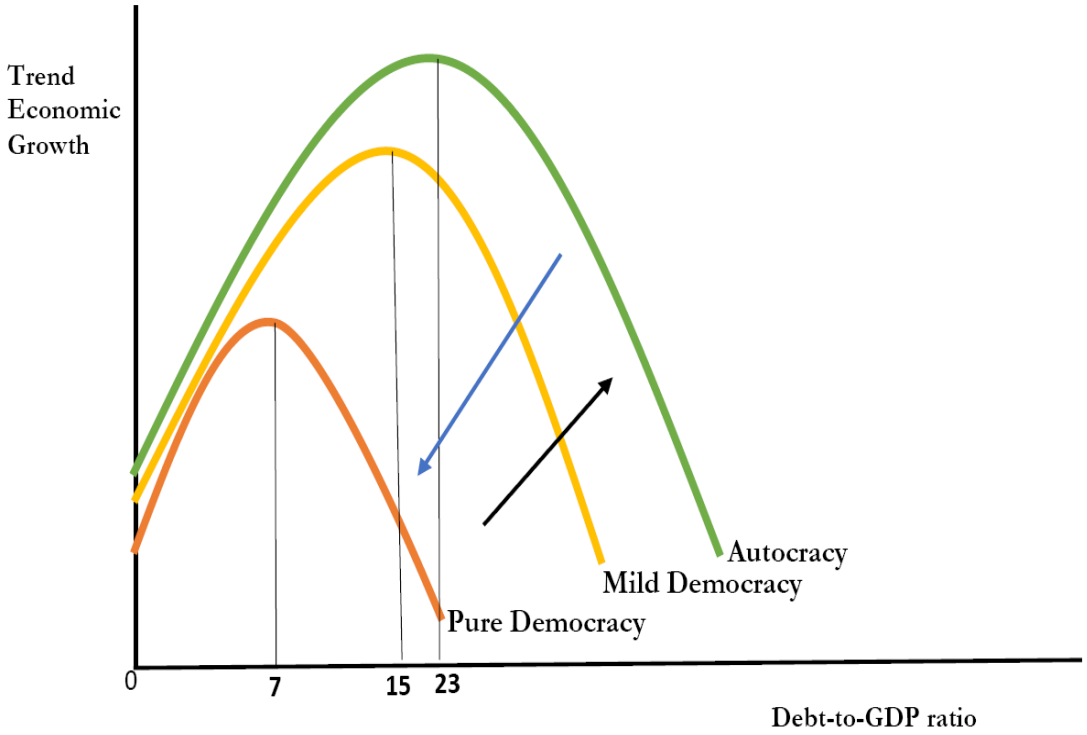

Figure 2: Plot of Trend Economic Growth and Debt-to-GDP ratio under different political regimes

From figure 2, we derive what we call the Democracy- Debt tolerable curve shortened here as the DDT curve. This curve basically shows the relationship between political regimes and the capacity to tolerable higher debt. This is depicted in Figure 3. It shows an inverse relationship between the quality of institution and the capacity to tolerate higher debt. The following are some of the plausible reasons that might underline this relationship. Democracy improves overall efficiency in the economy by causing governments to embark on policies that improves overall wellbeing. However, it is a costly venture and countries that start the process must have their institutions well equipped and functioning. Where there are loopholes in the system such as lack of check and balances and corruption in the Judiciary, the process of democratization, in an economy with constraint on Tax revenue or internal revenue generation, will increase the size of government and hence public debt to such an unsustainable level that the capacity of the country to tolerate higher debt becomes restrained. Majoritarian elections and non-centrality of authority of the budgetary process in the minister of finance, such as practiced in Ghana, can also cause more redistribution

and larger government size. Constraint by limited internal revenue generation, this could build-up the debt profile of the country to significant levels that further democratization in such an economy will reduce the capacity of the country to tolerate higher debt levels. Rising indebtedness can also be used as a strategic tool by sitting governments to influence the policy options of future governments (Ashworth et al., 2005; Alesina and Tabellini, 1990; Persson and Svensson, 1989). With rising uncertainty surrounding the sitting government, raising the level of indebtedness become a strategic tool employed by the ruling government to limit the choice sets for the future government. In the case of Ghana and for that matter developing economies, the experience of the finance minister, his/her background, and length of stay in office could matter greatly for the country's capacity to tolerate higher debt. Moessinger (2014) notes that the experience of the finance minister does matter especially during election years and periods of negative growth rates.

This adverse indirect effect of democracy can be likened to the *DDT effect*. Though democracy has a direct positive effects on economic growth, in the long-term it has the consequences of increasing the size of the government. This could generate negative growth impacts especially for economies that lack efficient internal resource mobilization as debt may have to grow proportionally to be able to sustain or finance a lot of the government activities. The negative consequences of rising debt levels can be very persistent for a longer time, albeit some countries may escape this earlier than others. As a result, democracy may inhibit growth in the end.

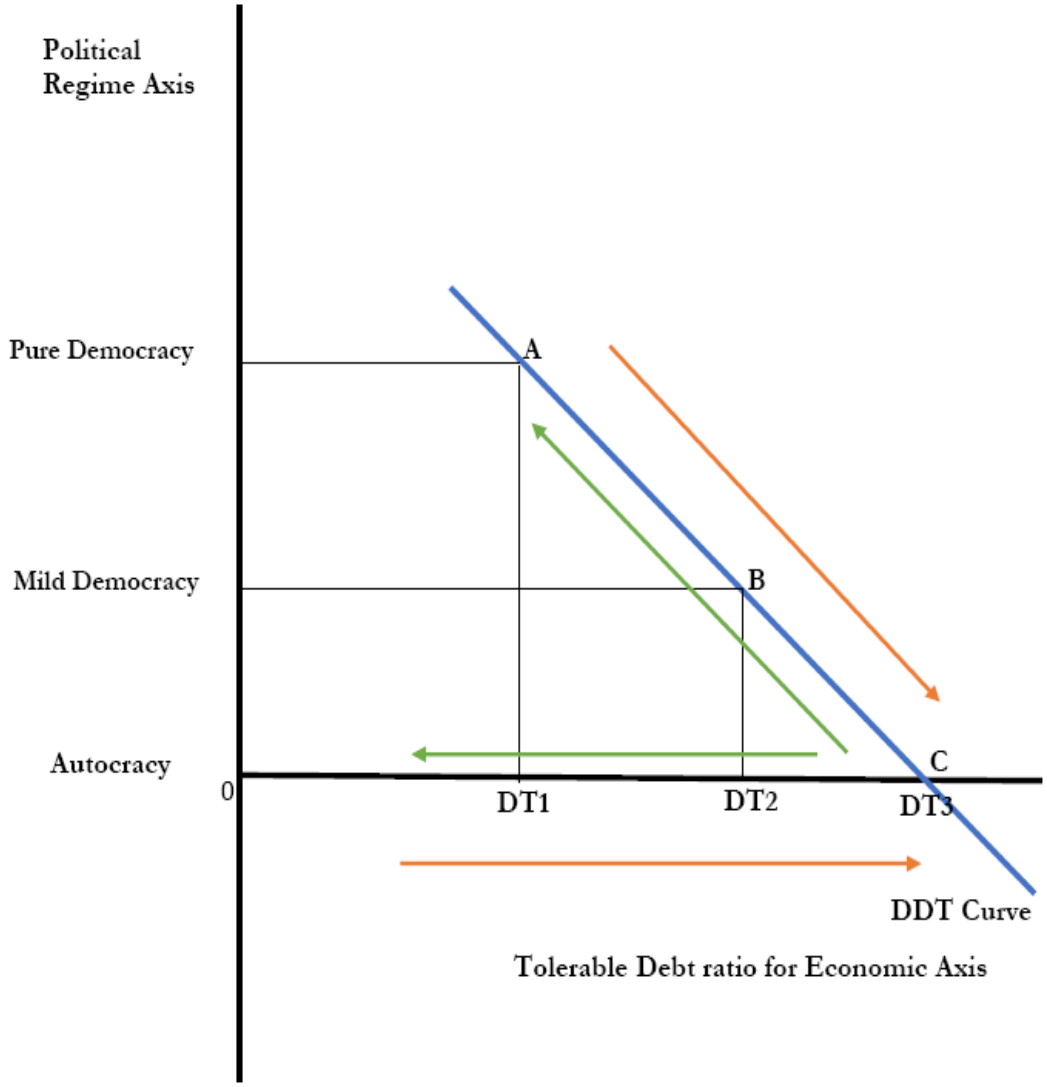

Figure 3: Plot of the DDT curve

Table 2:
Dependent variable: Trend/Potential Economic growth

FMOLS	Unified Democracy Scores				Polity2 Scores			
	I	II	III	IV	I	II	III	IV
Debt	-0.041***	0.071***	-0.044***	0.036	-0.027***	0.109***	-0.045***	0.103***
	(0.0069)	(0.0217)	(0.0072)	(0.0219)	(0.0090)	(0.0158)	(0.0072)	(0.0262)
$Debt^2$	---------	-0.001***	--------	-0.0006***	---------	-0.001***	----------	-0.001***
		(0.0001)		(0.0002)		(0.0001)		(0.0002)
Democracy	1.616***	1.421***	0.717**	2.233***	0.210***	0.177***	0.163***	1.335***
	(0.2144)	(0.2485)	(0.3147)	(0.3446)	(0.0302)	(0.0196)	(0.0213)	(0.3401)
$Democracy^2$	----------	---------	-1.040***	----------	--------	---------	-0.013***	---------
			(0.3835)				(0.0043)	
Debt*Democracy	---------	---------	---------	-0.038***	--------	---------	---------	0.001
				(0.0120)				(0.0012)
Openness	0.081**	0.057***	0.098***	0.077***	0.068***	0.054***	0.089***	0.040***
	(0.0084)	(0.0109)	(0.0095)	(0.0097)	(0.0109)	(0.0080)	(0.0083)	(0.0120)
Population growth	1.436***	1.382***	1.334***	1.510***	1.722***	1.562***	1.740***	1.136***
	(0.2593)	(0.2932)	(0.2158)	(0.2046)	(0.3400)	(0.2127)	(0.2420)	(0.2682)
Constant	-2.488***	-3.573***	-2.676***	-4.052***	-3.227***	-4.864***	-3.279***	-2.944***
	(0.7401)	(0.8573)	(0.6189)	(0.5911)	(0.9349)	(0.6029)	(0.6480)	(0.7804)
R-Square	0.670	0.781	0.667	0.807	0.696	0.768	0.660	0.778
Adj. R-square	0.640	0.755	0.628	0.780	0.669	0.741	0.620	0.747
S.E. Regression	1.393	1.149	1.416	1.090	1.40	1.181	1.431	1.168
Long run variance	0.476	0.608	0.325	0.289	0.795	0.310	0.382	0.503
Lag	3	2	3	2	3	3	3	2
Bandwidth	1.684	1.427	1.739	1.394	1.626	1.703	1.480	1.044

Dependent variable is economic growth. Cointegration equation deterministic: constant. Regressor equations estimated using differences. Additional regressor deterministic: Trend. Long-run covariance estimate: Bandwidth method – Andrews; Kernel option- Quadratic-Spectral kernel. The maximum lag length for pre-whitening was 3. The SIC was used to select the optimal lag length.

Table 3: Canonical Cointegration Regression (CCR)
Dependent variable: Trend/Potential Economic growth

CCR	Unified Democracy Scores				Polity2			
	I	II	III	IV	I	II	III	IV
Debt	-0.037***	0.077***	-0.053***	0.046***	-0.033***	0.109***	-0.055***	0.135**
	(0.0081)	(0.0226)	(0.0092)	(0.0252)	(0.0653)	(0.0171)	(0.0097)	(0.0352)
$Debt^2$	---------	-0.001***	--------	-0.001***	---------	-0.001***	----------	-0.001***
		(0.0001)		(0.0002)		(0.0001)		(0.0003)
Democracy	2.296***	1.868***	0.698	2.296***	0.231***	0.186***	0.186***	1.592***
	(0.2978)	(0.3346)	(0.4276)	(0.4417)	(0.0375)	(0.0260)	(0.0293)	(0.5021)
$Democracy^2$	----------	---------	-1.640***	----------	--------	---------	-0.022***	---------
			(0.4720)				(0.0056)	
Debt*Democracy	---------	---------	---------	-0.033**	--------	---------	---------	-0.002
				(0.0134)				(0.0019)
Openness	0.064***	0.049***	0.101***	0.073***	0.066***	0.054***	0.093***	0.020
	(0.0112)	(0.0129)	(0.0130)	(0.0104)	(0.0136)	(0.0097)	(0.0117)	(0.0173)
Population growth	1.651***	1.521***	1.500***	1.529***	1.525***	1.751***	2.106***	1.200***
	(0.2904)	(0.3344)	(0.2448)	(0.2402)	(0.3384)	(0.2250)	(0.2678)	(0.3185)
Constant	-2.168**	-3.507***	-2.637***	-4.008***	-2.431***	-5.299***	-3.663***	-2.728***
	(0.8328)	(0.8299)	(0.6915)	(0.5929)	(0.9193)	(0.6527)	(0.7012)	(0.7888)
R-Square	0.596	0.748	0.619	0.789	0.631	0.760	0.597	0.733
Adj. R-square	0.559	0.718	0.574	0.759	0.597	0.732	0.550	0.695
S.E. Regression	1.541	1.233	1.515	1.140	1.474	1.202	1.557	1.283
Long run variance	0.476	0.608	0.325	0.289	0.690	0.310	0.382	0.503
Lag	3	2	3	2	3	3	3	2
Bandwidth	1.684	1.427	1.729	1.394	1.635	1.703	1.480	1.044

Dependent variable is economic growth. Cointegration equation deterministic: constant. Regressor equations estimated using differences. Additional regressor deterministic: Trend. Long-run covariance estimate: Bandwidth method – Andrews; Kernel option- Quadratic-Spectral kernel. The maximum lag length for pre-whitening was 3. The SIC was used to select the optimal lag length.

4.3 Robustness Check

4.3.1 Using Trend GDP per capita Growth as the dependent variable

As our first check of robustness, we use the trend GDP per capita growth variable as the dependent variable. Tables 4 and 5 contain the results based on FMOLS and CCR, respectively. For the baseline model, we reach similar conclusion as above. Debt decreases economic growth but democracy, economic openness and population growth promote economic growth. Here too, we find that the growth enhancing effect of democracy is higher when we use the UDS as our democracy measure. In models II and III, debt and democracy have a nonlinear (i.e. concave) effect on economic growth, but the nonlinearity in the effects of democracy is only confirmed when we use the UDS as our measure of democracy. The growth enhancing effects of population growth and economic openness are also confirmed in models II and III.

Finally, the results confirm the negative interaction effect between democracy and debt; suggesting that (1) the initial debt levels of the country constraint the growth enhancing effect of democracy, and (2) the tolerable debt threshold moves inversely with the quality of institution. These results are also confirmed only for the case when we use the UDS measure of democracy. According to the results based on the CCR estimate, the tolerable debt ratio is 21% for autocracy, 14.25% for mild democracy, and 7.5% for pure democracy. By implication, the quality of institution and the capacity to tolerate debt are inversely related. Further, the results suggest that debt-to-GDP ratios of more than 70% will inhibit the growth enhancing effect of democracy. Thus, the results remain robust even when we use trend GDP per capita growth as the dependent variable.

Table 4:
Dependent variable: Trend/Potential GDP Per capita growth

FMOLS	Unified Democracy Scores				Polity2			
	I	II	III	IV	I	II	III	IV
Debt	-0.041***	0.062***	-0.045***	0.033	-0.028***	0.086***	-0.032***	0.092***
	(0.0064)	(0.0199)	(0.0067)	(0.0206)	(0.0083)	(0.0170)	(0.0070)	(0.0242)
$Debt^2$	---------	-0.001***	--------	-0.001***	---------	-0.001***	----------	-0.001***
		(0.0001)		(0.0002)		(0.0001)		(0.0002)
Democracy	1.657***	1.357***	0.773***	2.017***	0.204***	0.159***	0.197***	1.233***
	(0.2002)	(0.2278)	(0.2936)	(0.3247)	(0.0279)	(0.0209)	(0.0205)	(0.3141)
$Democracy^2$	----------	---------	-1.025***	----------	--------	---------	0.002	---------
			(0.3578)				(0.0041)	
Debt*Democracy	---------	---------	---------	-0.033***	--------	---------	---------	0.001
				(0.0114)				(0.0011)
Openness	0.079**	0.059***	0.096***	0.078***	0.068***	0.057***	0.074***	0.043***
	(0.0078)	(0.0010)	(0.0089)	(0.0091)	(0.0101)	(0.0086)	(0.0081)	(0.0111)
Population growth	1.035***	1.023***	0.884***	1.103***	1.303***	1.065***	1.470***	0.813***
	(0.2422)	(0.2689)	(0.2013)	(0.1928)	(0.3146)	(0.2291)	(0.2348)	(0.2478)
Constant	-3.973***	-5.199***	-4.015***	-5.591***	-4.760***	-5.971***	-5.427***	-4.647***
	(0.6912)	(0.7860)	(0.5774)	(0.5571)	(0.8652)	(0.6496)	(0.6302)	(0.7209)
R-Square	0.689	0.803	0.686	0.826	0.722	0.831	0.726	0.802
Adj. R-square	0.661	0.780	0.649	0.801	0.698	0.812	0.696	0.774
S.E. Regression	1.310	1.056	1.334	1.003	1.303	1.028	1.308	1.070
Long run variance	0.416	0.511	0.283	0.257	0.681	0.359	0.361	0.429
Lag	3	2	3	2	3	3	3	2
Bandwidth	1.683	1.444	1.730	1.367	1.635	1.719	1.494	1.085

Dependent variable is economic growth. Cointegration equation deterministic: constant. Regressor equations estimated using differences. Additional regressor deterministic: Trend. Long-run covariance estimate: Bandwidth method – Andrews; Kernel option- Quadratic-Spectral kernel. The maximum lag length for pre-whitening was 3. The SIC was used to select the optimal lag length.

Table 5:
Dependent variable: Trend/Potential GDP Per capita growth

CCR	Unified Democracy Scores				Polity2			
	I	II	III	IV	I	II	III	IV
Debt	-0.037***	0.068***	-0.054***	0.042****	-0.016***	0.083***	-0.026***	0.120***
	(0.0076)	(0.0302)	(0.0085)	(0.0237)	(0.0099)	(0.0183)	(0.0094)	(0.0319)
$Debt^2$	---------	-0.001***	--------	-0.001***	---------	-0.001***	----------	-0.001***
		(0.0001)		(0.0002)		(0.0001)		(0.0002)
Democracy	2.357***	1.754***	0.735**	2.013***	0.266***	0.168***	0.240***	1.505***
	(0.2790)	(0.3067)	(0.3930)	(0.4172)	(0.036)	(0.0269)	(0.0271)	(0.4650)
$Democracy^2$	----------	---------	-1.658***	----------	--------	---------	-0.002	---------
			(0.4379)				(0.0054)	
Debt*Democracy	---------	---------	---------	-0.027**	--------	---------	---------	-0.002
				(0.0126)				(0.0017)
Openness	0.062***	0.053***	0.100***	0.074***	0.047***	0.054***	0.063***	0.027
	(0.0105)	(0.0119)	(0.0119)	(0.0098)	(0.0134)	(0.0103)	(0.0113)	(0.0160)
Population growth	1.268***	1.131***	1.071***	1.074***	1.414***	1.075***	1.648***	0.872***
	(0.2714)	(0.3078)	(0.2280)	(0.2271)	(0.3407)	(0.2519)	(0.2603)	(0.2955)
Constant	-3.667***	-5.130***	-4.024***	-5.459***	-4.369***	-5.834***	-5.419***	-4.482***
	(0.7741)	(0.7549)	(0.6359)	(0.0552)	(0.9493)	(0.7376)	(0.6994)	(0.7215)
R-Square	0.607	0.774	0.632	0.810	0.667	0.829	0.688	0.763
Adj. R-square	0.572	0.748	0.589	0.783	0.638	0.810	0.653	0.729
S.E. Regression	1.473	1.130	1.443	1.048	1.427	1.033	1.397	1.172
Long run variance	0.416	0.511	0.283	0.257	0.681	0.359	0.361	0.429
Lag	3	2	3	2	3	3	3	2
Bandwidth	1.683	1.444	1.730	1.367	1.635	1.719	1.494	1.085

Dependent variable is economic growth. Cointegration equation deterministic: constant. Regressor equations estimated using differences. Additional regressor deterministic: Trend. Long-run covariance estimate: Bandwidth method – Andrews; Kernel option- Quadratic-Spectral kernel. The maximum lag length for pre-whitening was 3. The SIC was used to select the optimal lag length.

4.3.2 Including Investment in the growth model

Next, we include investment measured as gross fixed capital formation as percent of GDP in the growth model. Growth in developing countries like Ghana has close association with the investment drive in the economy. Therefore, excluding such an important variable could create omitted variable bias and that could bias the results obtained. Here we only provide the estimates for the model that includes the UDS as the democracy measure; since this model has proven to be consistent in their results throughout the paper. We re-estimate only model IV. Both estimates based on FMOLS and CCR are provided. Also, we show the estimates when we use both trend economic growth and trend GDP per capita growth as the dependent variables. Table 6 shows the results.

First, the effect of gross investment on economic growth is significantly positive. According to the estimate, 10 percentage point increase in investment will cause economic growth to increase by about 1.3 percentage points in the long-run. The significance of the investment variable suggests that the results above could be vulnerable to omission variable bias. Though investment is an important growth driver in the country, its inclusion does not change the outcome of the results as obtained previously. The interaction effect between democracy and government debt is significantly negative. This results imply that (1) higher initial debt-to-GDP ratios will limit the growth enhancing effect of democracy, and (2) the quality of institution varies inversely with the country's ability/capacity to tolerate higher debt levels in the country. The result remains robust irrespective of the method and the measure of growth. According to the estimate based on the CCR and trend economic growth model, the capacity to tolerate debt decreases from 33% in autocratic regime to 20% in mild democratic regime and to 7% in a pure democratic regime. A debt threshold of 55% of GDP is considered a binding constraint for the growth enhancing effect of democracy, according to CCR estimate. Further, economic openness and population growth significantly causes economic growth in the country. Again, the result remain robust even though the thresholds level differ.

Table 6: Long-run estimates

CCR	Trend Economic Growth		Trend GDP per capita Growth	
	FMOLS	CCR	FMOLS	CCR
Debt	0.019	0.033**	0.012****	0.024
	(0.0135)	(0.0162)	(0.0131)	(0.0157)
$Debt^2$	-0.0004***	-0.0005***	-0.0003***	-0.0005***
	(0.0001)	(0.0001)	(9.97E-05)	(0.0001)
Democracy	1.794***	1.420***	1.639***	1.259***
	(0.2143)	(0.2870)	(0.2087)	(0.2790)

Debt*Democracy	-0.035***	-0.026***	-0.031***	-0.022***
	(0.0074)	(0.0084)	(0.0072)	(0.0082)
Openness	0.049***	0.050***	0.049***	0.050***
	(0.0073)	(0.0077)	(0.0071)	(0.0076)
Population growth	1.339***	1.241***	0.951***	0.839***
	(0.1256)	(0.1519)	(0.1223)	(0.1488)
Gross Investment	0.126***	0.128***	0.124***	0.131***
	(0.0179)	(0.0232)	(0.0174)	(0.0224)
Constant	-3.971***	-4.113***	-5.477***	-5.590***
	(0.3620)	(0.3940)	(0.3525)	(0.3783)
R-Square	0.828	0.818	0.846	0.836
Adj. R-square	0.798	0.787	0.820	0.808
S.E. Regression	1.043	1.072	0.956	0.985
Long run variance	0.108	0.108	0.103	0.103
Lag	2	2	2	2
Bandwidth	0.4416	0.4416	0.249	0.249

***.**,* denote 1%, 5% and 10% significance levels.

4.3.3 Controlling for the effects of regime durability

The result obtained above could be explained by other factors either than democracy. One such important factor is regime durability. This indicates political stability of the economy. If the ruling party knows that their political rule is at risk, they care less about the public finances of the economy. In this case, they engage in unproductive activities that build-up government debt and affect economic growth adversely. We control for political instability in our model using regime durability measure provided by Polity. Table 7 shows the results.

First, the results reveal that regime durability has a significant direct effect on economic growth. Thus, political stability promotes economic growth. The inclusion of the political stability variable also does not affect the outcome of the result. Government debt has a significant concave effect on economic growth, and this effect is significantly dependent on the quality of institution. The interaction effect between democracy and government debt is negative and significant. According to the estimate based on the CCR and trend economic growth model, the capacity to tolerate debt decreases from 60% of GDP in autocratic regime to 48% in mild democratic regime and to 35% in pure democracy. Thus, the capacity to tolerate higher debt varies inversely with the quality of institution. Democracy has a direct significant impact on economic growth, but this is also constraint by the initial debt-to-GDP ratio level. Further, the results confirm the growth enhancing effect of population growth, economic growth, and gross investment. Thus, the results remain robust.

Table 7: Long-run estimates

CCR	Trend Economic Growth		Trend GDP per capita Growth	
	FMOLS	CCR	FMOLS	CCR
Debt	0.041***	0.049***	0.046****	0.057***
	(0.0114)	(0.0136)	(0.0128)	(0.0154)
$Debt^2$	-0.0003***	-0.0004***	-0.0003***	-0.0004***
	(8.51E-05)	(0.0001)	(9.60E-05)	(0.0001)
Democracy	1.850***	2.185***	2.033***	2.499***
	(0.1783)	(0.2433)	(0.2010)	(0.2740)
Debt*Democracy	-0.019**	-0.021***	-0.023***	-0.026***
	(0.0063)	(0.0072)	(0.0071)	(0.0081)
Openness	0.021***	0.022***	0.019***	0.021**
	(0.0064)	(0.0074)	(0.0072)	(0.0083)
Population growth	1.236***	1.376***	1.631***	1.822***
	(0.1044)	(0.1383)	(0.1177)	(0.1558)
Gross Investment	0.069***	0.042**	0.062***	0.021
	(0.0150)	(0.0196)	(0.0169)	(0.0222)
Regime Durability	0.216***	0.219***	0.239***	0.243***
	(0.0164)	(0.0178)	(0.0185)	(0.0199)
Constant	-5.740***	-5.804***	-4.157***	-4.205***
	(0.3012)	(0.3567)	(0.3395)	(0.4007)
R-Square	0.904	0.895	0.896	0.881
Adj. R-square	0.885	0.874	0.875	0.858
S.E. Regression	.765	0.800	0.820	0.878
Long run variance	0.075	0.075	0.095	0.095
Lag	2	2	2	2
Bandwidth	0.672	0.672	0.773	0.773

***.**,* denote 1%, 5% and 10% significance levels.

4.3.4 Using lag of Public debt

Finally, we use the lag of public of debt instead of instantaneous public debt. This is to address the issue of reverse causality (see Egert, 2015). This approach is problematic since debt has a persistent effect. However, we still adopt this approach as a further robustness check of our result. Table 8 shows the results as provided by the FMOLS and CCR. Debt has a concave effect on economic growth, and this relationship is significantly influenced by the quality of institution. As shown in the table, the interaction effect between democracy and debt is significant and negative. The capacity to tolerate higher debt according to trend economic growth model and CCR estimates decreases from 97% in Autocratic regime to 74.2% in mild democratic regime and to 52% in pure democratic regime. Thus, our results confirm that the capacity of the country to tolerate higher debt levels varies inversely with the quality of institution. Further, the results show that high initial debt levels limit the growth enhancing effect of democracy. Economic openness, population growth, investment and regime durability have a significant positive effect on economic growth. Again our results remain robust even when we use the lag of public debt.

Table 8: Long-run estimates

CCR	Trend Economic Growth		Trend GDP per capita Growth	
	FMOLS	CCR	FMOLS	CCR
Debt	0.041***	0.058***	0.038****	0.051***
	(0.0117)	(0.0149)	(0.0109)	(0.0137)
$Debt^2$	-0.0002***	-0.0003***	-0.0002***	-0.0003***
	(9.22E-05)	(0.0001)	(8.63E-05)	(0.0001)
Democracy	2.055***	2.573***	1.856***	2.135***
	(0.2013)	(0.2796)	(0.1885)	(0.2617)
Debt*Democracy	-0.026***	-0.027***	-0.022***	-0.021***
	(0.0062)	(0.0074)	(0.0058)	(0.0069)
Openness	0.013***	0.012	0.013**	0.011
	(0.0062)	(0.0077)	(0.0058)	(0.0072)
Population growth	1.869***	1.969***	1.419***	1.463***
	(0.1270)	(0.1679)	(0.1189)	(0.1561)
Gross Investment	0.071***	0.015	0.082***	0.051**
	(0.0197)	(0.0267)	(0.0184)	(0.0249)
Regime Durability	0.280***	0.279***	0.254***	0.257***
	(0.0186)	(0.0208)	(0.0174)	(0.0196)
Constant	-4.716***	-4.327***	-6.202***	-5.958***
	(0.3697)	(0.4540)	(0.3460)	(0.4221)
R-Square	0.896	0.876	0.904	0.896
Adj. R-square	0.874	0.851	0.884	0.875
S.E. Regression	.831	0.905	0.772	0.803
Long run variance	0.103	0.103	0.091	0.091
Lag	2	2	2	2
Bandwidth	1.515	1.515	1.520	1.520

***.**,* denote 1%, 5% and 10% significance levels.

4.4 Diagnostic Statistics

We conducted some diagnostic statistics on our results. Specifically, we tested for serial correlation and heteroscedasticity, as well as multicollinearity and parameter stability. These tests were applied to the results in Table 7. Table 9 shows the test for serial correlation and heteroscedasticity. We fail to reject the null hypothesis of no serial correlation and homoscedasticity. Table 10 shows the coefficient variance decomposition. We follow the recommendations of Belsely et al (2004). According to Belsely et al (2004), we should look out for the lowest condition number (s) and examine their associated eigenvalues. If the eigenvalues of two or more variables are greater than 0.5, then it means there is high collinearity between/among those variables; suggesting a multicollinearity problem. From Table 10, the lowest condition number is 9.63E-10. So we check the corresponding eigenvalues for the set of regressors. We only have the eigenvalue of population growth exceeding 0.5 with the rest of the variables having eigenvalues of less than 0.1. Therefore, we conclude that there is no collinearity between/among the set of independent variables, which

suggests no multicollinearity problem. CUSUM and CUSUM of squares plot also confirm stability of the parameters (see Figure 4).

Table 9: Residual Diagnostics

Test	Type	F-Statistic	Probability
Serial correlation	Breusch-Godfrey	1.1196	0.3422
Heteroscedasticity	ARCH	0.0310	0.9695

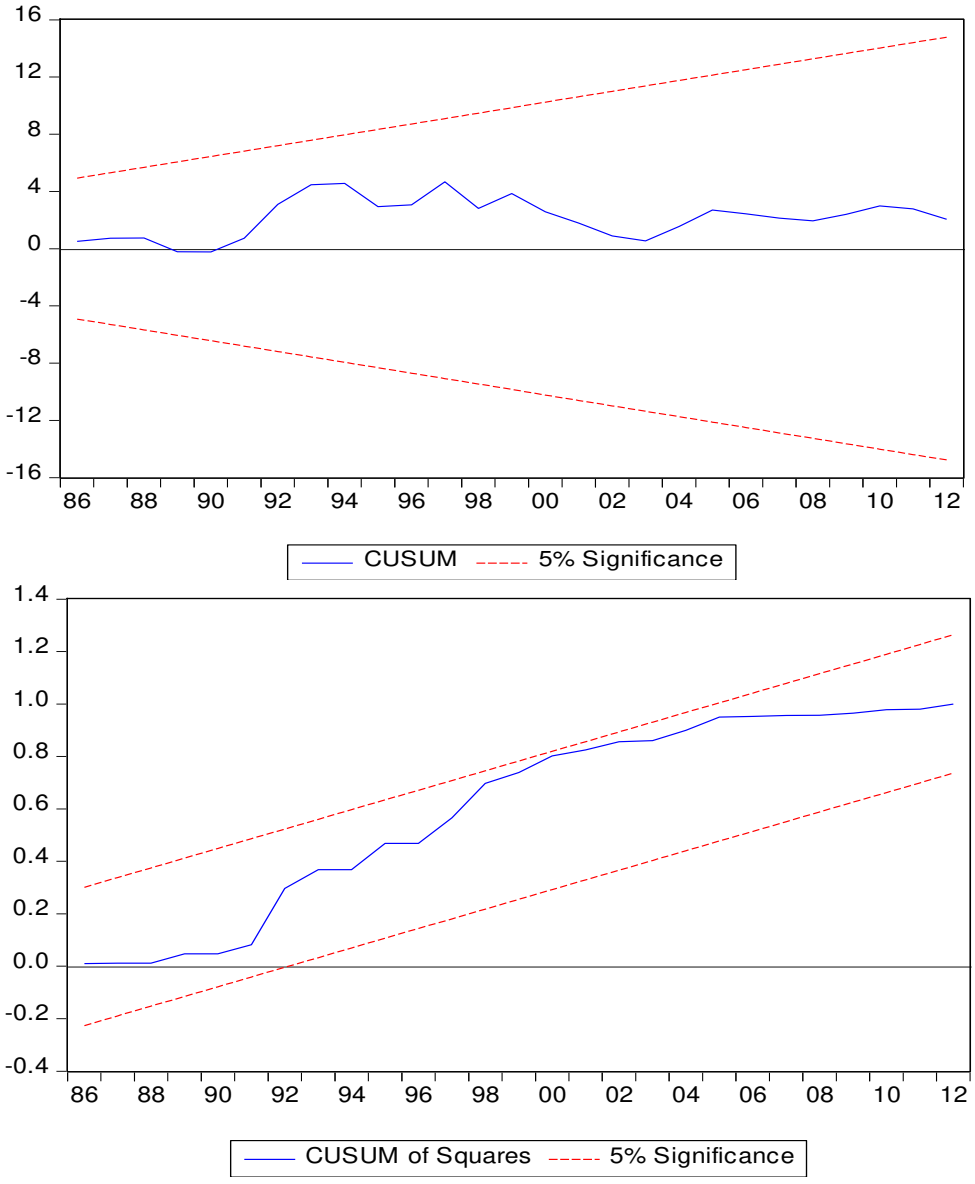

Figure 4: CUSUM and CUSUM of Squares plot

Table 10: Coefficient variance Decomposition

Eigenvalues	0.126106	0.041338	0.002146	0.000365	0.000278	0.000133	3.92E-06	1.15E-06	1.21E-10
Condition	9.63E-10	2.94E-09	5.66E-08	3.33E-07	4.37E-07	9.11E-07	3.10E-05	0.000105	1.000000
Variance Decomposition Proportions									
					Associated Eigenvalue				
Variable	1	2	3	4	5	6	7	8	9
Debt	0.012399	0.236444	0.000548	0.115679	0.036990	0.596271	0.000454	0.001215	9.53E-11
$Debt^2$	0.018255	0.292489	0.004649	0.059528	0.097305	0.476411	0.007874	0.030313	0.013176
Democracy	0.010556	0.987901	0.001534	2.94E-06	8.17E-07	4.76E-06	7.16E-08	7.20E-10	2.74E-18
Debt*Democracy	0.000459	0.719740	0.067460	0.034266	0.000441	0.103624	0.073670	0.000339	2.94E-11
Economic openness	0.007227	0.119960	0.054993	0.009014	0.343211	0.446404	0.002977	0.016215	3.47E-10
Population growth	0.766855	0.097535	0.135455	0.000154	8.31E-07	6.26E-07	1.57E-07	1.67E-07	1.20E-15
Gross Investment	0.001122	0.031731	0.022167	0.264138	0.672335	0.008169	1.65E-05	0.000321	4.50E-12
Regime Durability	0.000622	0.000296	0.025862	0.778064	0.180845	0.014280	3.43E-06	2.67E-05	5.78E-14
Constant	0.998376	8.93E-06	0.001613	2.03E-06	2.28E-09	1.47E-08	2.47E-09	3.06E-09	2.32E-17

5. CONCLUSION AND RECOMMENDATION

This study investigates the tripartite relationships of economic growth, democracy and public debt using data from Ghana. We derive an extension of the original contributions of Barro (1996) and Pumper and Martin (2003). We posit that democracy and debt move hand in hand. Therefore, the following phenomenon are possible. First, the initial debt ratio level will act as an important constraint to the growth enhancing effect of democracy. Second, the quality of institution determines the capacity of a country to tolerate higher debt. Contrary to previous attempts that used economic growth/GDP per capita growth with cyclicality, we used the trend economic growth/trend GDP per capita growth. First of the reasons is to deal with the issue of reverse causality, and second is to capture the true/actual long-run effect. Our models were estimated using the fully modified OLS and Canonical cointegration regression since these methods are known to deal effectively with the second-order bias problem, which often plagues ordinary least squares estimate. Several robustness checks were conducted. We found the following results.

Debt and democracy have a nonlinear (i.e. concave) effect on economic growth; the latter confirming what is called the Barro effect in the literature. Democracy does promote economic growth, but this has implications for the debt position of the economy since the size of the government grows proportionally as claimed by Pumper and Martin. Debt and democracy move together, and their interaction generates negative effects on economic growth. We found two interesting results in this regard. On one hand, high initial debt ratio limits/restraints the growth enhancing effect of democracy. On the other hand, the quality of institution affects the capacity of the country to tolerate higher debt. We found an inverse relationship between the quality of institution and the capacity of the economy to tolerate higher debt. Further, our results revealed that economic openness, population growth, investment, and political stability promote economic growth in the country. Several robustness checks confirmed these results.

Our results have the following implications for policy direction. Democracy is not cheap, and developing countries that follow this process must be aware of the indirect consequences such a move can have like raising debt levels and subsequent reduction in the capacity to tolerate higher debt. Though democracy is taking roots in the Ghanaian economy, there are so many loopholes that needs to be fixed such as the non-centralisation of authority in the minister of finance and lack of effective and efficient check and balances in the system. For example, there is a case in Ghana where the National Democratic Congress (NDC) paid huge sums of judgement debt to an individual without following the due processes of the land. Also, there have been cases of

corruption in the Judiciary which is expected to act as the overseer and enforcement of law and justice in the country. Such acts cannot continuously be encouraged if the capacity of the country to tolerate high debt levels is to be improved. Government has to be very proactive in equipping institutions charged with the responsibilities to ensure law and order and accountability. Interferences from government in these institutions should be highly discouraged if we are to make significant progress as a country. Could this result be seen as only applicable in the case of Ghana or extended to other developing countries in Africa? The answer to this question requires further research that seeks to test for what we call the *DDT effect* of democracy in other economies.

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