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# Corruption, EU Aid Inflows and Economic Growth in Ghana: Cointegration and Causality Analysis

Joseph Ato Forson<sup>1</sup>, Ponlapat Buracom<sup>1</sup>, Theresa Yaaba Baah-Ennumh<sup>2</sup>, Guojin Chen<sup>3</sup>, Emmanuel Carsamer<sup>4</sup>

## ABSTRACT

In this paper, we examine the causal relationship between aid inflows and economic growth for Ghana during the period from 1970-2013, taking into account structural breaks. To better reflect causality, corruption and trade are included as control variables. To test for causality in the face of cointegration, a vector error correction model (VECM) is used in place of a vector autoregressive (VAR) model. This approach is complemented with Toda and Yamamoto's method to indicate the causal direction. Our estimation results suggest GDP growth has one cointegrating vector relationship with corruption, EU aid inflows and trade in both the short and long runs. There is a long-run unidirectional causal relationship from EU aid inflows to GDP growth and a short-run unidirectional causal relationship from trade to GDP growth. Corruption (which is a governance issue) was ineffective in inducing GDP growth. The error correction terms are the source of causation in the long run. The results indeed confirm the popular conjecture that corruption in Ghana is endemic and stifles development. Therefore, the decision by the government to launch a national anti-corruption campaign in 2011, though long overdue, was justifiable. We urge all stakeholders to work together to deepen good governance to promote sustainable growth and serve as inducement for continued aid inflows from multilateral donors to sustain efforts at achieving the national development thrust of poverty reduction and sustainable development in Ghana.

## KEY WORDS:

Ghana; Corruption; EU Aid Inflows; Economic Growth; Governance; Multivariate Cointegration

**JEL Classification:** O1; H7

<sup>1</sup> Graduate School of Public Administration, National Institute of Development Administration (NIDA), Thailand; <sup>2</sup> Department of Planning, Kwame Nkrumah University of Science and Technology (KNUST), Ghana; <sup>3</sup> Wang Yanan Institute for Studies in Economics (WISE), Xiamen University, China; <sup>4</sup> Graduate School of Development Economics, National Institute of Development Administration (NIDA), Thailand

## 1 Introduction

Corruption as a social issue is widespread and continues to dominate many discussions in academic and policy circles due to its devastating effects on devel-

opment. The subject has also been revisited in recent years following the massive looting reported by the European Union anti-corruption watchdog. The agency reveals that corruption alone costs the EU over EUR 120 billion per year, which is just less than the EU's annual budget (European Commission, 2014). A similar report from the World Bank estimates that every year, between USD \$20 and \$40 billion is lost from developing countries due to corruption and bribery, but it emphasized that corruption and bribery also

Correspondence concerning this article should be addressed to: **Joseph Ato Forson**, Graduate School of Public Administration, National Institute of Development Administration (NIDA), 118 Moo3, Seri thai Road, Klong Chan, Bangkapi, Bangkok 10240 Thailand, T: +66-840-724-426. E-mail: [datoeagle@yahoo.com](mailto:datoeagle@yahoo.com)

impact developed economies through globalization (UN, 2013). The scourge on developed economies is a result of the commitments they make in the form of Overseas Development Assistance (ODA), which is often captured as aid, grants and loans to promote development in disadvantaged economies. In Ghana, incidental and systematic corruption is perceived to be high and is considered to be responsible for the slow pace of development (Lamprey, 2013). The causes of corruption are manifold, but in the case of developing economies such as Ghana, whose budgetary demands depend on the fluidity of financial pledges from development partners, its sources are increasingly important to investigate. Ghana currently ranks 98<sup>th</sup> out of 144 countries on a global percentile measure of irregular payments of bribes in public contracts based on a World Economic Forum (WEF) executive opinion, which is a trend that suggests weak institutional structure (WEF, 2014).

Foreign aid comes in different forms for different purposes. Currently, the world's poorer countries' activities are funded with aid from foreign governments and international organizations. Foreign aid may include billion dollar reconstruction projects in war-torn countries, microfinance programs for impoverished women, international research to find more productive crops and less polluting energy sources, expansion of primary education in rural regions, financing for health budgets, support for economic reforms, debt relief and civil society development programs in Africa. The number of participants involved in providing foreign aid has increased in recent years (see Lancaster, 2007).

The upsurge in aid flow has mainly been due to international attention paid to the Millennium Development Goals (MDGs). The United Nations Millennium Declaration and Monterrey Consensus in Mexico in 2002 explicitly committed industrialized countries to "grant more generous development assistance because substantial increases in Overseas Development Assistance (ODA) would be required to achieve the MDGs" (United Nations Department of Economic and Social Affairs, 2003). These types of international agreements have helped to increase aid commitments following a substantial weakening during the 1990s. In 2010, net ODA inflows from members of the Development Assistance Committee (DAC) of the OECD reached

a staggering \$128.7 billion, the highest level ever in nominal terms (OECD, 2010), with the bulk of this investment going to the social sector as opposed to productive sectors such as agriculture. Studies on multilateral aid allocation have shown that the European Union is the largest aid donor in the world over the last decade. Before the Cold War, when EU members' preferences were largely heterogeneous, EU multilateral aid generally benefited the poorest states, particularly in Sub-Saharan Africa (SSA), but this trend changed after EU preferences converged on aiding the integration of Central and Eastern European countries into the European Union. African countries have lost out on important aid inflows since then. Africa receives the largest volume of ODA relative to other regions, yet it is the region where the most Least Developed Countries (LDCs) are located and where most countries are "off-track" on achieving the MDGs. Total ODA as of 2009 stood at \$165.4 billion, with SSA receiving 25.5 per cent (see OECD, 2010).

As a developing country, Ghana depends on aid to remain solvent in meeting its annual budgetary demands. Foreign aid constituted the third largest source of foreign capital inflows in Ghana in 1999, with a dollar value of \$451.7 million (Bhasin & Obeng, 2007). There was a steady increase in the inflow of aid from 2004 until late 2008, when there was a marginal decline. The EU condition that enjoins recipient economies to undertake policies to reform institutions and ensure macroeconomic stability and security to attract development aid have been embraced by Ghana. The Public Procurement Act 2003 (Act 663), implemented in December 2003, the Fair Wages Salary Commission Act 2007 (Act 737) and the adoption of democracy in 1992 resulted in the strengthening of ombudsman institutions such as the Economic and Organized Crime Office (EOCO) and the maintenance of a sound and resilient macroeconomic environment (Forson & Opoku, 2014). All of these reforms and achievements have led to unprecedented inflows of aid, but a 2012 country report suggests that out of the eight MDGs, only reducing extreme poverty by half is on track (GoG, 2012). Concerns about how these inflows from multilateral agencies have benefited the ordinary Ghanaian in the broader sense have been raised, and it is a question that has not been adequately addressed. Although a series of inductive studies have at-

tempted to link the state of Ghana's underdevelopment to elements of governance, none have actually used a deductive approach such as cointegration and Toda and Yamamoto's causality technique to empirically prove such conjectures. One is therefore left to wonder whether there is any causal relationship between aid inflows and economic development in Ghana or between aid inflows and institutional reforms. This research seeks to address these concerns by capitalizing on the availability of longitudinal data on institutional quality and macroeconomic variables.

Motivated by the fore-going perspectives, this study is driven by three objectives. First, the paper assesses the effect of aid inflows on Ghana's economy. Second, the paper investigates whether multilateral donors' selective policies that require recipient countries to undertake institutional reforms to curb corruption and inefficiencies in the government machinery are indeed responsible for the continued inflows of aid to Ghana's economy and the implications for development. In the light of these findings, a discussion on the policy implications and recommendations is provided. To achieve these aims, the study employs appropriate econometric approaches that are able to capture the cause and effect mechanisms of selected variables. Because most macroeconomic variables are considered to be stationary, the use of conventional regression estimators such as OLS technique tends to produce misleading results. To overcome this problem, Granger (1986) and Johansen (1991) developed a tool based on the concept of cointegration that is now commonly used to analyze long-run equilibrium relationships. Through this approach, non-stationary data can be examined in the long run. It also indicates the order of integration among variables. Among other things, the approach captures the short-term adjustment mechanisms that occur when variables converge at the long-run equilibrium position (Forsen & Janrattanagul, 2014).

The literature on the triggers of corruption in developing economies has changed course in recent years, with aid inflows being touted as an emerging addition to the sources of corruption in SSA. The principles of aid-giving can be categorized under two central approaches: need-based and strategic-based. Need-based aid looks at the poor economic characteristics of recipient economies, while strategic-based aid focuses on

the economic interest of the donor by aligning it with the developmental needs of recipients. Governments and institutions direct their assistance to countries that are strategically important in terms of national politics and military and commercial interests. The drawback of strategy-driven aid is the enforcement of conditions associated with the aid because the objective of such aid is achieved immediately upon disbursement. Therefore, the recipient countries are not motivated to comply with the conditions associated with such aid disbursements, which has direct consequences on aid effectiveness. This ineffectiveness has led to increased attention on multilateral aid institutions that implement and supervise the development goals established by contract.

Meanwhile, the subject of aid effectiveness has also been examined, especially in SSA. In an empirical paper presented by Gomanee, Girma and Morrissey (2002) at a conference on the effectiveness of aid and investment for economic growth on 25 economies in SSA, it was noted that for each 1 per cent in aid received as a share of GNI, there is one-quarter of a percentage point increase in growth among the sample. The authors therefore concluded that the state of poorer African countries should not be attributed to aid ineffectiveness, yet the study failed to propose an alternate reason accounting for these countries conditions. According to Maizels and Nissanke (1984), in a recipient-needs model, "aid is given to compensate for the shortfalls in domestic resources," whereas in the donor-interests model, aid serves donors' political and commercial investments and trade interests. However, evidence on the linkage between aid inflows and institutional reform to mitigate corruption still remains a fallacy, as this notion has been proven otherwise in recent studies. For instance, Ohler, Nunnenkamp and Dreher (2012) investigate whether the Millennium Challenge Corporation (MCC) was successful in promoting better control of corruption using a difference-in-difference-in-difference (DDD) approach. They find a strong anticipation effect soon after the announcement of the MCC, while increasing uncertainty about the timing and amount of MCC aid appears to weaken the incentives to fight corruption over time (Knack, 2013).

With the emergence of the "New Public Administration" (NPA), there has been increasing focus on

strengthening institutional frameworks to reduce corruption. Nevertheless, this goal has been viewed in policy circles with mixed reactions. For instance, Alesina and Weder (2002) assert that corrupt governments do not tend to receive less aid than clean governments. Conversely, Dollar and Levin (2004) observe that over time, aid has been directed more toward countries with sound institutions and policies. Thus, in recent times, good governance has become a condition for the disbursement of development assistance to less developed nations (Fayissa & Nsiah, 2010). The debate on conditionality was further intensified following a World Bank publication in 1998 on the assessment of aid policies to poorer countries with institutional challenges. The publication's policy decision was to adopt a selectivity approach because the effectiveness of aid can be increased if more is allocated to countries with good policies. The argument is that "aid does not work" in the sense that the amount of aid alone has no effect on growth, but aid makes a positive contribution to growth in those countries with good policies (Burnside & Dollar, 2000). Additionally, policy reform conditionality does not work because donors have less power to influence policies and institutions in the recipients' economies, let alone to bypass the government in implementing expenditures (Collier & Dollar, 2004). Hence, more aid should go to nations that are already implementing good policies to boost the poverty alleviation process. However, opponents have challenged selective aid allocation (Dalgaard, Hansen, & Tarp, 2004; Hansen & Tarp, 2001). Their contention is that aid has contributed to poverty reduction and has improved the welfare of the poor independent of the recipients' policies (Gomanee et al., 2002; Mosley, Hudson, & Verschoor, 2004).

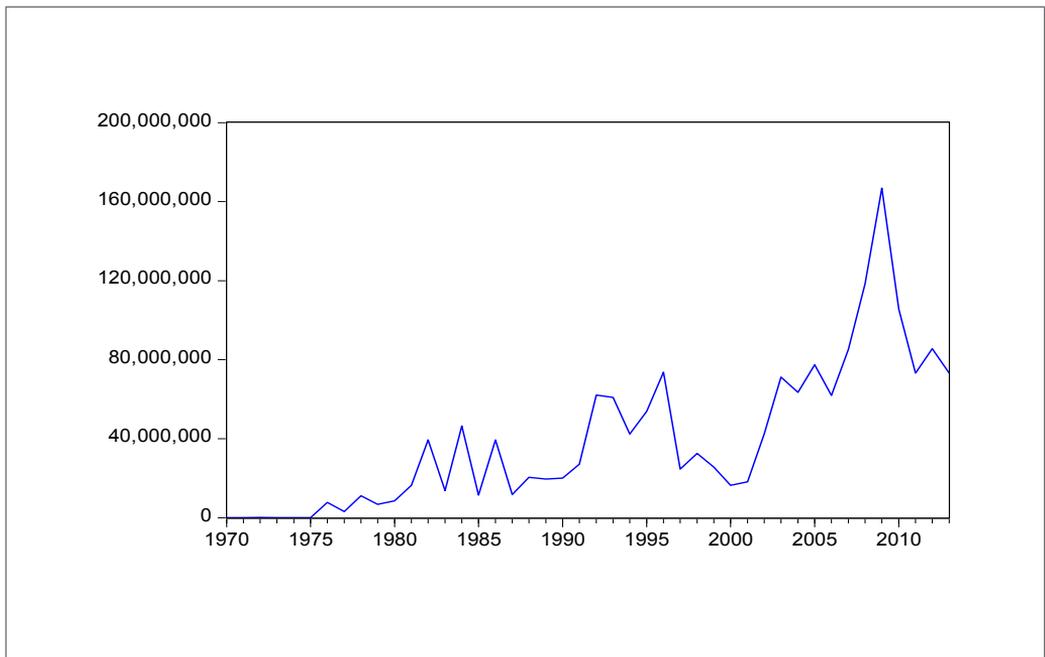
The ineffectiveness of conditionality is also contested on the ground that the specific reforms advocated by donors are hardly ever implemented fully within the relatively short time period of the associated aid program (Koeberle et al., 2005; Lensink & Morrissey, 2000; Mosley et al., 2004). In an attempt to contextualize this problem in Ghana, Lloyd, Morrissey and Osei (2001) investigate the relationship between aid inflows, trade and growth and contend that exports, aid and public investment are all positively related to long-run growth. However, in the pre-1983 era, they

find that exports and public investment had a negative impact on short-run growth, with no significant impact reported on aid. The authors assert that the results for the post-reform era (after 1983) show a significant improvement in the statistical significance of these variables, which they attribute to institutional reforms that enhanced the governmental machinery. However, we find a gap in the type of proxy used to measure governance (or institutional inputs); hence, we argue that such a linkage cannot be precisely made unless the deficiency in variable measurement is reconciled. Our argument is borne out of the fact that inducing efficiency in the governmental machinery has always been the central focus of administrative reforms in Ghana. Consequently, making such a concluding remark without reference to elements of governance in their model makes their latter finding untenable. Moreover, the goals of aid are achieved when the existing institutions are proactive. This paper addresses this flaw by incorporating corruption as a component of governance.

From the findings above, it is clear that the aid-growth nexus is mediated by an avalanche of factors embedded in the quality of the existing institutions, trade, imports, exports and public investment. Thus, in this paper, we explore this connection using two of the identified factors (corruption and trade) in Ghana.

## 2. Foreign Aid in Ghana

From 1970 to 2002, total ODA to SSA stood at \$318.8 billion compared with \$214.1 billion to Asia over the same period. The pattern of aid flow to SSA is not very different from that to Ghana. Specifically, ODA to Ghana increased from 9.5 per cent of GDP to 10.4 per cent of GDP between 1970 and 2005 (Ashong & Gerster, 2010). Aid as a share of GDP increased from 13.2 per cent in 2003 to 14.6 per cent in 2009 before dropping slightly to 12.8 per cent in 2010. Successful implementation of economic reforms in the 1980s under the Structural Adjustment Program (SAP) and the Economic Recovery Program (ERP), coupled with a subsequent return to constitutional rule in 1992, was the driving force for the substantial aid inflows to Ghana. Development aid to Ghana comes in the form of debt relief from the Multilateral Debt Relief Initiative (MDRI) and the Highly Indebted Poor Countries (HIPC) initiative; project aid (loans and grants supporting specific projects



**Figure 1.** EU annual aid allocation to Ghana, 1970-2013

and activities); general sector and budgetary support; and balance-of-payments support from the International Monetary Fund (IMF). Both traditional and non-traditional donors provide aid to Ghana. Traditional donors currently include 23 multilateral and 24 bilateral donors (Ashong & Gerster, 2010).

The World Bank and the European Union are the largest multilateral donors and provide approximately 45 per cent of the multilateral aid to Ghana (Quartey et al., 2010). Regarding the apportionment of aid inflows, project aid dominates, at US \$494.4 million in 2003. This amount exponentially increased to \$912.5 million in 2009, but it fell to \$841.8 million in 2008. Aid for the budget mimicked this trend. Aid from the EU increased from 2003 (\$154.2 million) to 2007 (\$246.1 million), but it began to decline after the financial meltdown in 2008. The EU crisis in late 2010 led to a reduction in EU aid to Ghana. Total ODA as a share of GDP fell from 13.2 per cent in 2003 to 12.8 per cent at the end of 2010. Figure 1 shows the trend of EU aid inflows to Ghana from 1970 to 2013.

Inflows from the EU and other multilateral agencies have led to significant developmental-aid-related projects. For instance, under the Millennium Challenge Account (MCA), the Kufour's administration signed a five-year contract worth US\$547 million in 2006 with the Bush administration in the US. The total fund earmarked under the MCA was in excess of US \$1.2 billion, which was shared among selected developing countries. Working to meet the eight MDGs was central to Ghana's contract. Among other things, reducing poverty through the mechanization of rural agriculture, aid for transportation, and the provision of services for the rural poor were some of the specifications included (MiDA, 2010). Regardless of these inflows, growth in Ghana has not been as dramatic as expected. Figure 2 shows the performance of Ghana's economy from 1970 to 2013.

A cursory look at the graph for Per Capita GDP Income in Figure 2 shows fluctuations between 1970 and 2013. For instance, GDP per capita was low in the late 1970s and early 1980s, with a corresponding drop in aid inflows from multilateral donors (see Figure 1).

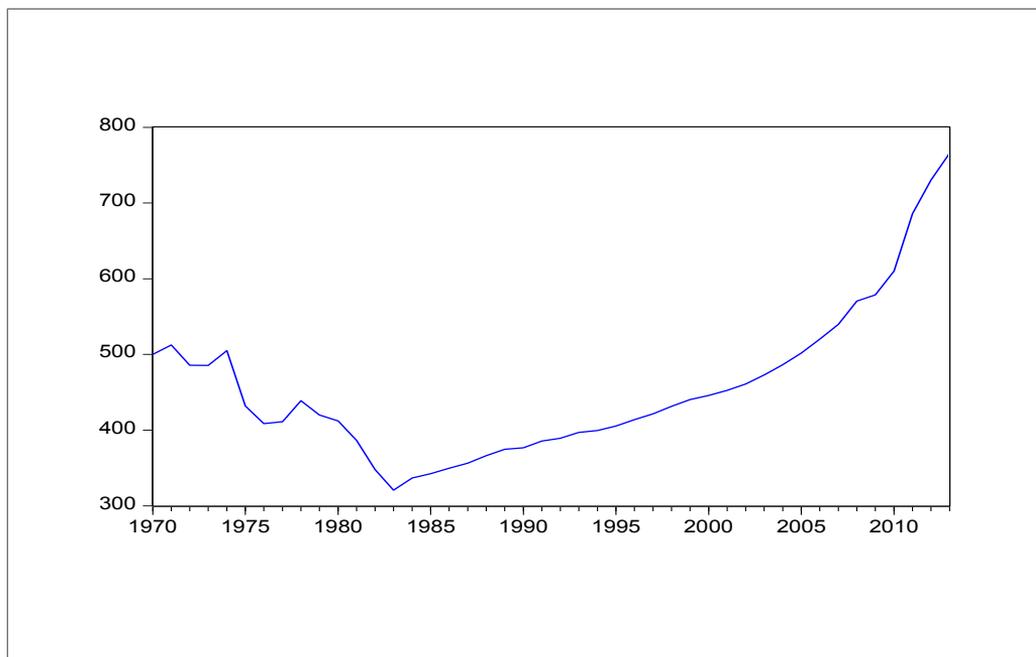


Figure 2. GDP per capita of Ghana, 1970-2013

The 1979 violent coup d'état by the Armed Forces Revolutionary Council (AFRC) is one of the many factors that led to this result (see US Department of State, 2014). Moreover, there was a devastating drought in the early 1980s in Ghana (see Ofori-Sarpong, 1986) that affected total output, but aid inflows then increased as multilateral donors such as the IMF and the World Bank were consulted for assistance. Nevertheless, this aid came with conditions. Key structural reforms were required to access donor funds. The introduction of programs such as the ERP and the SAP became the common approach to help Ghana's ailing economy recover at that time.

### 3 Research Methodology: Hypotheses and Model Specification

#### 3.1 Research Hypotheses

**Governance:** Governance is the exercise of economic, political and administrative authority to manage a country's affairs at all levels (United Nation Develop-

ment Programme [UNDP], 1997). However, the concept has been defined in different ways, which highlights how subjective it can be. The term is sometimes synonymous with corruption, which is the abuse of entrusted power for private gain (Hardoon & Heinrich, 2013; Kaufmann, Kraay, & Mastruzzi, 2006). Corruption is considered to be inimical to development, although this relationship has received mixed reactions from both the grease-in-the-wheel and sand-in-the-wheel perspectives. Thus, the model relationship between governance (corruption) and aid inflows and for that matter, economic growth, has received mixed reactions (see Burnside & Dollar, 2000; Dietz, Neumayer, & De Soysa, 2007; Fayissa & Nsiah, 2010; Gyimah-Brempong, 2002; Lensink & Morrissey, 2000; Próchniak, 2013; Svensson, 2000). Therefore, we hypothesize that good governance (reduction in corruption) is associated with EU aid inflows, trade and economic growth in Ghana.

**Aid Inflow:** Aid inflow is the transfer of capital for the benefit of the recipient country or its popula-

tion (see Lancaster, 2007). EU aid comes in different forms for different purposes (i.e., economic, military, or even emergency humanitarian assistance). Evidence on selective aid allocation as a sine qua non for good governance and economic expansion is widespread but not straightforward (see Easterly 2007; Fayissa and Nsiah, 2010; Hout 2007a; 2007b; Kargbo, 2012; Knack, 2013; Nunnenkamp & Thiele, 2006; Ohler et al., 2012). However, in this study, we envision a strong association between EU aid inflows and the three regressors (corruption, trade and economic growth) in Ghana.

**GDP Per Capita Income:** GDP per capita is an indicator of a country's standard of living (Cypher & Dietz, 2009). The effect of per capita income on economic growth has been extensively discussed in related studies within the growth nexus. However, an improved standard of living as reflected in per capita income is spurred by other factors that may be either explicit or implicit. Both the neoclassical and endogenous perspectives highlight the importance of initial income within the convergence discussion on growth, with mixed reactions (see Forson, Janratatagul, & Carsamer, 2013; Kargbo, 2012; Mankiw, Romer, & Weil, 1992). We examine this relationship by hypothesizing that foreign aid inflows promote growth by supplementing limited domestic savings as well as foreign exchange constraints in Ghana. We therefore expect a significant, direct relationship between economic growth and the three regressors in the model.

**Trade Openness:** Trade openness is the removal of barriers or restrictions on the free exchange of goods and services (Dowling & Valenzuela, 2009). Discussions on policy-induced barriers to international trade to promote economic growth in countries with poorly developed institutions have changed, with varied findings on causes. Several studies find a general and positive relationship between trade openness and growth on average. Thus, even when there is significant increase in trade openness, countries with weak institutions may experience reduced growth (see Federici & Montalbano, 2010; Haddad et al., 2012; Stensnes, 2006; Ulaşan, 2012). On the basis of the numerous institutional reforms undertaken in Ghana, we expect a significant, direct relationship between trade openness and the three regressors.

### 3.2 Data Description

Data for the analysis are obtained from reputable organizations such as the Bank of Ghana, the World Bank and Transparency International. These sources are considered to be reliable for any research project. The annual series is used for all of the variables. The study uses GDP per capita income as a measure of economic growth, while corruption is a perceptual measure of corporate and political corruption from Transparency International (TI). To fill in the missing data (i.e., from 1970 to 1996), we used the average corruption perception index (CPI) from 1996 to 2013. Trade as a percentage of GDP is used as a proxy for fiscal deficits to capture insufficiency of government revenue. GDP per capita and aid inflows are deflated by the GDP implicit price deflator at the base year 2005 constant price. Aid inflows and trade are converted into natural logarithms to avoid heteroskedasticity and to provide elasticity to the estimations for easy interpretation. The time series data span from 1970 to 2013, covering 44 years (see Table 1 for data summary).

In Table 1, all of the macroeconomic variables are statistically significant at 5 per cent, except for the institutional variable corruption. In terms of skewness and kurtosis, all of the variables are within the acceptable range, which means that the series does not have a serious problem with outliers. Corruption has a mean value of 3.423 and a standard deviation of 0.507. Per capita income shows a mean of \$456.248 USD and a standard deviation of \$100.559 USD. EU aid inflow shows a mean of \$7.098 million USD, with a corresponding standard deviation of \$1.119 million USD. Trade has a mean of 1.665 per cent and a standard deviation of 0.299 per cent. However, in terms of correlation, we find GDP per capita and EU aid inflows to be mildly correlated (0.076). Correspondingly, the correlation between corruption and EU aid inflows is comparatively high (0.640).

### 3.3 Model Specification

Following Johansen (1991), a test for cointegration is undertaken and linked to the VECM. The cointegration approach makes it possible to assess changes in the long-run equilibrium dynamics among selected variables for Ghana. The augmented Dickey-Fuller and Phillip Peron's test techniques are commonly used in testing for stationarity (see Dickey & Fuller, 1979;

**Table 1.** Summary statistics data (at level specification)

	Y	COR	AID	TRD
Mean	456.248	3.423	7.098	1.665
Median	431.706	3.400	7.421	1.662
Maximum	766.051	4.500	8.222	2.065
Minimum	320.772	2.400	4.000	0.801
Std. Deviation	100.559	0.507	1.119	0.299
Skewness	1.339	0.036	-1.737	-0.888
Kurtosis	4.659	2.395	4.796	3.351
Jarque-Bera	18.187	0.680	28.028	6.006
Probability	0.000112	0.711626	0.00001	0.049642
Observation	44	44	44	44

Note: A statistical summary of the selected indicators at level, where Y= GDP per capita income, COR=Corruption perception index, AID=European Union aid allocation, and TRD=Trade.

Phillips & Perron, 1988). The ADF test is estimated in three different forms, each of which is based on a different hypothesis (Gujarati, 2003). These forms are specified below.

$Y_t$  is a random walk and assumes the following form:

$$\Delta Y_t = \delta Y_{t-1} + \alpha_i \sum_{i=1}^m \Delta Y_{t-1} + \varepsilon_i \tag{1}$$

$Y_t$  is a random walk with an intercept:

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \alpha_i \sum_{i=1}^m \Delta Y_{t-1} + \varepsilon_i \tag{2}$$

$Y_t$  is a random walk with an intercept and a time trend:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + \alpha_i \sum_{i=1}^m \Delta Y_{t-1} + \varepsilon_i \tag{3}$$

In addition, one can use the Phillips-Perron (PP) approach to detect the unit root. Intuitively, the PP test is the same as the ADF, except the PP test uses a non-parametric statistical method to handle serial correlation in the error term and does not include the

lagged differences in the model. We describe the PP model as follows:

$Y_t$  is a random walk and assumes the following form:

$$\Delta Y_t = \delta Y_{t-1} + \varepsilon_i \tag{4}$$

$Y_t$  is a random walk with an intercept:

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \varepsilon_i \tag{5}$$

$Y_t$  is a random walk with an intercept and a time trend:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + \varepsilon_i \tag{6}$$

In each of the cases outlined above, the null hypothesis  $\delta = 0$  implies that there is a unit root and the time series is non-stationary. The alternative hypothesis  $\delta < 0$  implies that the time series is stationary. In the case where the null hypothesis is rejected, it presupposes that  $Y_t$  is a stationary time series at I (0). Otherwise, sequential differences are taken until the null hypothesis is rejected.

However, the conventional stationarity tests of PP and ADF have been criticized in related studies that imply that the tests can be misleading when there are breaks in the series (see Waheed, Alam, & Pervaiz, 2006; Zivot & Andrews, 1992). Consequently, there is a need to augment the traditional unit root test with an alternative that incorporates breakpoints in the series. Thus, to test for unit roots against the alternative of a one-time structural break, Zivot and Andrews propose three approaches. However, the third approach is considered to be superior, as the loss in power is substantially low (see Sen 2003; Waheed et al., 2006). The test equation is adopted and outlined below:

$$\Delta y_t = c + \alpha y_{t-1} + \beta_1 + \theta DU_t + \gamma DT_t + \sum_{j=1}^k d_j \Delta y_{t-j} + \varepsilon_t \quad (7)$$

where  $DU_t$  is a dummy variable for a mean shift occurring at each possible break date (TB), while  $DT_t$  is a corresponding trend shift variable.  $DU_t$  and  $DT_t$  are formally defined as:

$$DU_t = \begin{cases} 1 & \dots \dots \dots \text{if } t > TB \\ 0 & \dots \dots \dots \text{Otherwise} \end{cases} \quad \text{and}$$

$$DT_t = \begin{cases} t - TB & \dots \dots \dots \text{if } t > TB \\ 0 & \dots \dots \dots \text{otherwise} \end{cases}$$

The null hypothesis in this model is that  $\alpha = 0$  and an alternate hypothesis is that  $\alpha < 0$ . The former implies that the series contains a unit root with drift that excludes a structural break, while the latter implies that the series is a trend-stationary process with a one-time break occurring at an unknown point in time. This approach is able to fix all possible points as potential time breaks, with subsequent estimations through regression to determine the break points (Shahbaz et al., 2014).

After the stationarity tests, the cointegration method is linked to the vector error correction model (VECM). We describe the vector error correction model (VECM) having included a dummy variable for a break in the series below:

$$\Delta Y_t = \mu + \sum_{j=1}^{k-1} \Gamma_j \Delta Y_{t-j} + d_0 D_t + \alpha \beta' Y_{t-k} + \varepsilon_t \quad (8)$$

where  $\Delta$  denotes the first difference order, for example,  $\Delta Y_t = (Y_t - Y_{t-1})$ . The term  $Y_t$  represents variables on GDP, corruption, EU aid, and trade in the model, and

each variable is  $ap \times 1$  vector integrated of the same order.  $\mu$  is a  $p \times 1$  vector of constants. The mechanism

$$\sum_{j=1}^{k-1} \Gamma_j \Delta Y_{t-j} - 1$$

comprises the vector of autoregressive

components, where the  $pxp$  matrix denotes the coefficients of the variables' short-run adjustments toward a long-term equilibrium.  $D_t$  is the dummy variable, where  $D_t = 1$  if  $t \geq 1979$  and  $D_t = 0$  if  $t \leq 1979$ . The equation  $\alpha \beta' Y_{t-k}$  describes the long-term equilibrium relationship (stationary linear combination of  $\beta' Y$ ), where  $\alpha$  stands for the  $p \times r$  speed of adjustment coefficient,  $\beta'$  denotes the cointegration vector with  $Y_t$  integrated of the same order, and  $k$  denotes the lag structure.  $\varepsilon_t$  is the vector white-noise error term.

Although determining the exact order of cointegration is necessary, it might not be sufficient to establish the causal relationship among the variables of interest. As a consequence, there is a need to use the traditional Granger causality approach to unearth this possible relationship. This approach is the most common way to test for a causal relationship between two variables and thus involves estimating a simple vector auto regression (VAR) equation, as shown below:

$$X_t = \sum_{i=1}^n \alpha_i Y_{t-i} + \sum_{j=1}^n \beta_j X_{t-i} + \mu_{1t} \quad (9)$$

$$Y_t = \sum_{i=1}^m \lambda_i Y_{t-i} + \sum_{j=1}^m \delta_j X_{t-i} + \mu_{2t} \quad (10)$$

where the disturbances  $\mu_{1t}$  and  $\mu_{2t}$  are assumed to be uncorrelated. The two equations above, (9) and (10), posit that variable  $X$  is decided by lagged variable  $Y$  and  $X$ , except that the dependent variables are interchanged in each case. Granger causality means that the lagged  $Y$  significantly influences  $X$  in equation (9) and vice-versa in equation (10); thus, researchers can jointly test if the estimated lagged coefficients  $\sum \alpha_i$  and  $\sum \lambda_i$  are different from zero with F-statistics. However, the traditional Granger causality test is plagued with many bottlenecks.

First, most pairwise granger causality tests do not factor in the influence of other variables; as a result, they may suffer from specification bias. More precisely, causality tests are sensitive to the model specification and the number of lags, which makes evidence of pairwise causality more fragile and less credible (see Guja-

rati, 2003). Moreover, time series data are in most cases non-stationary, which could increase the probability of having a spurious regression. Additionally, whenever the variables are integrated, the F-test procedure ceases to be valid because the test statistics do not have a standard distribution.

To resolve these shortcomings, Toda and Yamamoto (1995) present an alternative approach that accounts for the described limitations. Among other things, this test can be used irrespective of whether  $Y_t$  and  $X_t$  are cointegrated of the order I(0), I(1) or I(2) or whether they are non-cointegrated. The name of the method is the Toda and Yamamoto (T-Y) augmented Granger causality test, and it is based on the following equations:

$$Y_t = \alpha + \sum_{i=1}^{h+d} \beta_i Y_{t-i} + \sum_{j=1}^{k+d} \gamma_j X_{t-j} + \mu_{yt} \tag{11}$$

$$Y_t = \alpha + \sum_{i=1}^{h+d} \theta_i Y_{t-i} + \sum_{j=1}^{k+d} \delta_j Y_{t-j} + \mu_{xt} \tag{12}$$

where  $d$  is the maximal order of integration of the variables in the system,  $h$  and  $k$  are the optimal lag lengths of  $Y_t$  and  $X_t$  and are error terms that are assumed to be white noise with zero mean, a constant variance and no autocorrelation. We are required to determine the lag order of integration, which by default occurs in the model, and to construct a VAR in their levels with a total of  $(k + d)$  lags.

## 4 Empirical Results and Analysis

### 4.1 Structural Break Test

We begin the analysis with a validation test using Chow's (1960) approach to investigate whether there is a break in the series, as suspected. Based on the statistical results, the test statistic is less than the 5 per cent significance level. Therefore, the null hypothesis of no structural break in the series is rejected. Thus, our suspicion is validated, but we are unable to exactly indicate the break points in the series. Using the 1979 coup d'état as the beginning of a major event, we incorporate the period thereafter as a dummy in our model.

The data are analyzed by modifying the VECM model. That is, by identifying the data generating process (DGP), the characteristics of each variable are as-

sessed. A decision regarding whether the model should include components of an intercept and a time trend is made. A stationarity test is run on the variables GDP, governance, EU aid inflows, trade and the dummy. The order of integration and the appropriate lag length are considered. Once these steps are taken, the long-term equilibrium relationship can be predicted.

### 4.2 Stationarity Tests

The rule of thumb is that when time series data are stationary at level, it is known to be integrated of the degree 0 or I (0), but when an arbitrary number of differences is taken (say first, second, or third) to make it stationary, it is known to be integrated at I(1), I(2), or I(3), respectively. The ADF and the PP tests are commonly used in stationarity tests and thus are used in this paper. The unit root tests are estimated based on eqn. (1)-(7) for the intercept with time trend and an intercept only. The t-statistics and p-values of the unit root test results are presented in Tables 2-4 below.

The values in Tables 2 and 3 show the t-statistics and p-values at level and first difference, respectively. The results of the ADF and PP tests suggest that the variables are cointegrated at the order I(1). This result means that all of the variables have unit roots at first difference. Nevertheless, as noted, in the face of structural breaks or shocks, the ADF and PP tests can be misleading; thus, the stationarity test is subject to a second opinion using Zivot and Andrews' test in eqn. (7) with trend and intercept. The test results partly confirm the ADF and PP test results, except they reject the variable corruption at a 5 per cent significant level, which was not the case in the former tests. Nevertheless, the variable corruption endogenously identifies an important breakpoint that coincides with the beginning of the fourth republic after the democratic election in 1993. Moreover, the 2003 breakpoint on aid inflows from the EU signifies the EU economic crisis in the 2000s, which impacted the remittance of aid to Ghana. Conversely, the 1992 breakpoint on trade coincides with the regime change from military rule to democracy, which meant that all trade embargoes were lifted. A significant implication of this result is that all of the important break dates occurred after the 1979 coup d'état in Ghana, which is in line with our priori expectation (see Table 4 and Figure 3). To determine the long and short-run

**Null Hypothesis:**  $\delta = 0$  (each variable has a unit root).

**Alternative Hypothesis:**  $\delta < 0$  (each variable does not have a unit root).

**Table 2.** Results of unit root test (level specifications)

	ADF		PP		ADF		PP	
	<i>Intercept</i>		<i>Intercept</i>		<i>Intercept and Trend</i>		<i>Intercept and Trend</i>	
<i>At Level</i>	<i>t-stats</i>	<i>p-value</i>	<i>Adj. t-stat</i>	<i>p-value</i>	<i>t-statistics</i>	<i>p-value</i>	<i>Adj. t-stat</i>	<i>p-value</i>
<b>Y</b>	-3.597	0.9981	-2.007	0.9998	-4.192	0.9976	-1.549	0.979
<b>COR</b>	-3.081	0.355	-2.928	0.503	-3.519	0.499	-3.492	0.530
<b>AID</b>	-2.248	0.1930	-2.985	0.443	-2.911	0.169	-2.689	0.246
<b>TRD</b>	-1.526	0.511	-1.101	0.707	-2.531	0.313	-2.062	0.552

**Table 3.** Results of unit root test (first difference)

	ADF		PP		ADF		PP	
	<i>Intercept</i>		<i>Intercept</i>		<i>Intercept and Trend</i>		<i>Intercept and Trend</i>	
<i>First Difference</i>	<i>t-stats</i>	<i>p-value</i>	<i>Adj. t-stat</i>	<i>p-value</i>	<i>t-stats</i>	<i>p-value</i>	<i>Adj. t-stat</i>	<i>p-value</i>
<b>Y</b>	-3.703	0.0076**	-19.194	0.000**	-5.926	0.000**	-23.403	0.000**
<b>COR</b>	-9.717	0.000**	-9.686	0.000**	-9.601	0.000**	-9.571	0.000**
<b>AID</b>	-9.303	0.000**	-9.681	0.001**	-9.429	0.000**	-13.093	0.001**
<b>TRD</b>	-4.867	0.000**	-4.198	0.002**	-4.834	0.000**	-4.102	0.013**

Note: \*\* $p < 0.05$

equilibrium relationships, an appropriate lag length should be selected to facilitate the estimation of the long-run equilibrium relationship.

#### 4.2.1 Appropriate Lag Length Selection

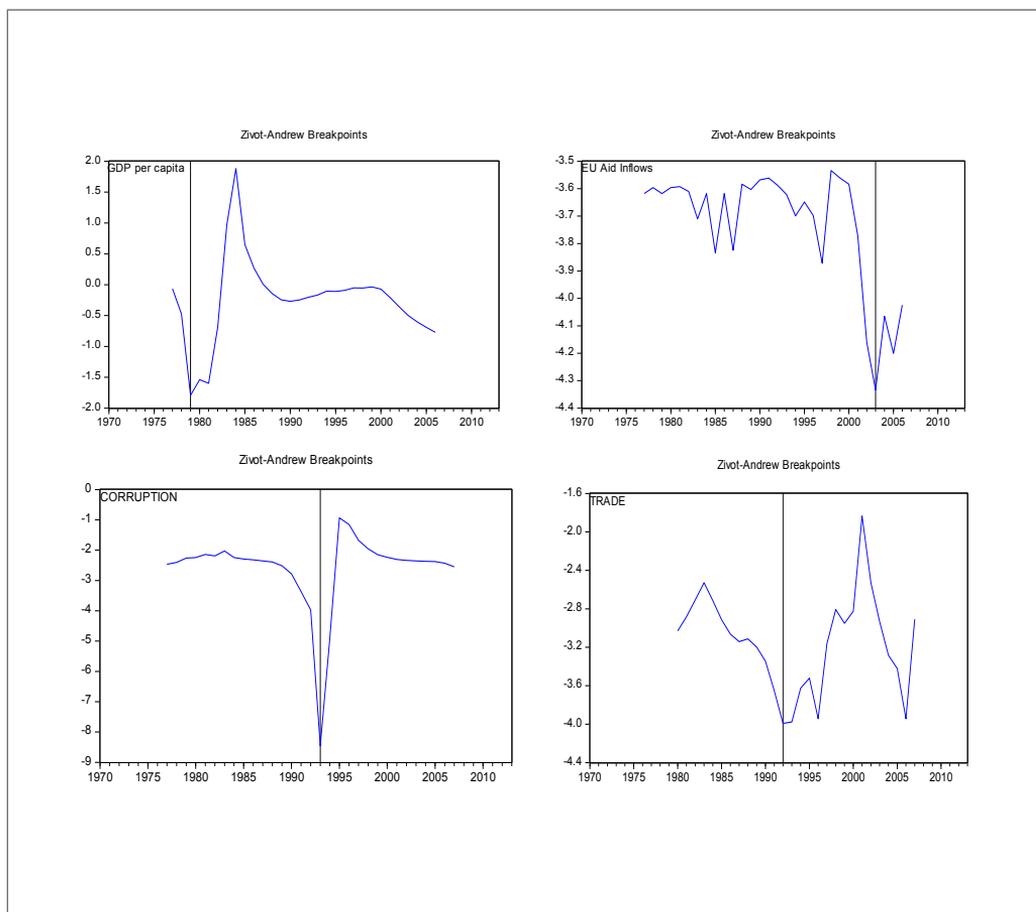
There are many ways to choose the optimal lag length in statistics, but the most commonly used methods are the Akaike information criterion (AIC) and the Schwarz information criterion (SIC). We use these methods to select the appropriate lag length for the model. The estimation results indicate that LR, FPE, AIC, SIC and HQ show significant results at 1, 2 and 4 lag length periods.

This result is straightforward and makes our work quite easy. The numbers with asterisks are the smallest values in each of the criteria. Before selecting the lag length, two issues must be addressed. One must understand that a lag length that is too short in VAR may not capture the dynamic behavior of the variables. Conversely, it is also argued that a lag length that is too long may distort the data and lead to a decrease in the explanatory power. Guided by these principles, the optimal lag length selected for these four variables is based on the SIC (Schwarz information criterion), which indicates a lag length of 1 period (see Table 5).

**Table 4.** Results of Zivot and Andrews's one-break test

Variables	Intercept and Trend		
	<i>k</i>	<i>t</i> -statistics	Break Year
Y	[1]	-0.287**	1979
COR	[1]	-7.996	1993
AID	[1]	-4.334**	2003
TRD	[1]	-3.076**	1992

Note: The critical values for Zivot and Andrews' test for GDP growth are -5.34, -4.93, and 4.58 at 1%, 5% and 10% levels of significance, respectively. \*\*Denotes statistical significance at the 5% level. *K* denotes the lag order in parentheses.



**Figure 3.** Breakpoints for the series GDP per capita, EU aid inflows, corruption and trade. All series except corruption are significant at the 5 per cent level. The vertical line shows the break date on the x-axis.

**Table 5.** Results of the appropriate lag length

Lag	Log L	LR	FPE	AIC	SIC	HQ
0	-183.4008	NA	0.137873	9.370041	9.538929	9.431105
1	-99.90233	146.1223	0.004743	5.995117	6.839556*	6.300439*
2	-81.11048	29.12737*	0.004234	5.855524	7.375515	6.405105
3	-41.81454	22.83569	0.004322	5.809758	8.361822	6.528824
4	-41.81454	25.73770	0.003587*	5.490727*	8.361822	6.528824

Note: \* indicates lag order selected by the criterion (each test at the 5% level). LR: *sequential modified LR test statistic*; FPE: *Final prediction error*; AIC: *Akaike information criterion*; SIC: *Schwarz information criterion*; HQ: *Hannan-Quinn information criteria*.

#### 4.2.2 Cointegration Test for Long-run Equilibrium Relationships

The empirical analysis in this paper is subject to a linear relationship; hence, less emphasis is paid to whether the variables have a time trend. We reached this conclusion due to the existence of one cointegrating relationship among the variables (see Table 6).

Table 6 shows the trace and max-eigen statistics. The trace statistic of 97.892 is greater than the critical value of 68.819. This result implies that the null hypothesis  $r = 0$  can be rejected, while the alternate hypothesis  $r > 0$  accepted. The max-eigen value confirms the trace test results. The max-eigen value statistic of 56.027 is larger than the critical value of 33.877. Thus, the null hypothesis  $r = 0$  is rejected, and the alternate hypothesis  $r = 1$  accepted at a 5 per cent significant level. The long- and short-run dynamics are estimated using the VECM.

#### 4.3 Long-term Cointegration Analysis

The cointegration test is conducted for Ghana's economic growth using GDP as the dependent variable lagged on selected independent variables. Several tests for causality are performed here: (1) long-run causality – the significance of the error-correction terms is determined by a t-test; (2) short run causality – the joint significance of the coefficients of the lagged terms of each independent variable are determined by Wald Chi-square tests; and (3) Toda and Yamamoto causality tests – the joint significance of the four sources of causation is determined.

We begin by evaluating the robustness of the VECM against the normality residual test of Jarque-Bera, the ARCH test of serial correlation and the heteroskedasticity test. Using the histogram normality test, the Jarque-Bera is 14.69 with a p-value of 0.00065, which indicates that we reject the null hypothesis of the normally distributed residual at a 5 per cent confidence level. This result suggests that the residual is not normally distributed. However, the other two tests passed the robustness checks. The ARCH test of heteroskedasticity indicates that the p-value of the observed R-squared is 0.4872, which is greater than the 5 per cent confidence level. Thus, we accept the null hypothesis that there is no ARCH in this model. This result is desirable, as the model does not have an ARCH effect. Using the Breusch-Godfrey serial correlation LM test, the p-value of the observed R-squared is 0.7103, which is greater than the 5 per cent confidence level. Thus, we accept the null hypothesis that there is no serial correlation. On the basis of these two tests, the model is acceptable, as the residuals are almost Gaussian white noise.

The estimation of the VECM gives the long-run cointegrating vectors as (1, -2.873, -0.868, -1.465, 10.519) to represent GDP, corruption, EU aid inflows, trade, and the dummy variable, respectively. This result means that when corruption is high, it negatively affects GDP. Similarly, when EU aid inflows to Ghana fall, there is a corresponding decrease in the level of per capita growth in income. A drastic reduction in trade may negatively impact GDP. There is substantial theo-

**Table 6.** Number of cointegration vectors

<b>Unrestricted Co-integration Rank Test (Trace)</b>					
$H_o$	$H_A$	<i>Eigen value</i>	<i>Trace Statistic</i>	<i>0.05 Critical Value</i>	<i>p-value</i>
$r = 0$	$r > 0$	0.737	97.892	68.819*	0.000**
$r \leq 1$	$r > 1$	0.457	41.864	47.856	0.1625
$r \leq 2$	$r > 2$	0.169	16.186	29.797	0.699
$r \leq 3$	$r > 3$	0.136	8.381	15.495	0.426
$r \leq 4$	$r = 0$	0.052	2.249	3.841	0.134

<b>Unrestricted Co-integration Rank Test (Maximum Eigen value)</b>					
$H_o$	$H_A$	<i>Eigen value</i>	<i>Max-eigen stats</i>	<i>0.05 Critical Value</i>	<i>p-value</i>
$r = 0$	$r = 1$	0.737	56.027	33.877*	0.000**
$r = 1$	$r = 2$	0.457	25.678	27.584	0.086
$r = 2$	$r = 3$	0.169	7.805	21.132	0.915
$r = 3$	$r = 4$	0.136	6.132	14.264	0.596
$r = 4$	$r = 5$	0.052	2.249	3.841	0.134

Note: Trace test and Max-eigen value test indicate 1 co-integrating equation(s) at the 5% level.  
 \*denotes rejection of the null hypothesis at the 5% level; \*\* MacKinnon p-value.

retical soundness in the cointegrating vectors, which confirms related works in the literature (see Haddad et al.2012; Knack 2013; Ohler et al. 2012; Próchniak 2013; Stensnes 2006; Ulaşan 2012). The cointegration test is normalized with respect to GDP. The coefficient of the one period lagged residual confirms that there is a long-run causal relationship from the regressors to GDP with a significantly negative sign. This result implies that the four regressors share a long-run causal relationship with the dependent variable GDP. In other words, corruption, EU aid inflows, trade and the dummy variable share a long-run relationship with GDP.

However, to estimate the short-run relationship, the Chi-square value of the Wald statistic is used. The rule of thumb for determining the short-run causality is that if the coefficients of the cointegrating residuals jointly influence GDP, then we can conclude that there is short-run causality from these variables to GDP. From the test result, we find the p-value of the chi

square to be less than 5 per cent (0.0429), which implies that the null hypothesis can be rejected. We interpret this result to mean that corruption, EU aid inflows and trade jointly cause GDP growth in the short run.

However, according to the Granger theorem, when variables are cointegrated, there must be an error correction (EC) that describes the short-run adjustments of the cointegrated variables as they move toward their long-run equilibrium positions (see Table 7).

The findings are statistically significant at 1 per cent, 5 per cent and 10 per cent, which suggests that GDP, EU aid, trade and the dummy variable are responsible for the error correction adjustment process when the variables are out of equilibrium. The speed of the adjustments for GDP per capita, trade and the dummy are negative. Thus, when these variables are in disequilibrium from their long-term equilibrium in the short run or are too high to be in equilibrium, they will begin falling in the following year by 1.298, 0.0168

**Table 7.** Error correction adjustment

Co-Integrating Equation	D(Y)	D(COR)	D(AID)	D(TRD)	D(DUMMY)
Adjustment Coefficient	-1.298*	0.083	6.00E-02**	-0.0168***	-0.328***
Standard Error	0.247	0.067	2.40E-02	0.009	1.8E-01
t- values	-5.249	1.232	2.530	-1.902	-1.795

Note: \*denotes  $p < 0.01$ , \*\* $p < 0.05$ , \*\*\* $p < 0.10$ .

**Table 8.** Toda and Yamamoto augmented Granger causality test

Dependent variable	Excluded Variables	$\chi^2$	Prob.
Y	AID	0.847	0.357
	COR	0.049	0.825
	TRD	2.552	0.110
	DUMMY	1.324	0.249
AID	Y	<b>13.95</b>	<b>0.000*</b>
	COR	0.576	0.448
	TRD	0.158	0.691
	DUMMY	1.993	0.158
COR	Y	1.096	0.295
	TRD	0.274	0.708
	AID	0.14	0.600
	DUMMY	0.188	0.665
TRD	Y	<b>4.536</b>	<b>0.033**</b>
	COR	2.171	0.140
	AID	0.62	0.431
	DUMMY	4.423	0.035*
DUMMY	Y	<b>3.198</b>	<b>0.074***</b>
	COR	0.382	0.536
	AID	0.323	0.569
	TRD	<b>8.503</b>	<b>0.004*</b>

Note: \*denotes  $p < 0.01$ , \*\* $p < 0.05$ , \*\*\* $p < 0.10$ .

and 0.328 percentage points, respectively, to return to equilibrium. However, the error correction term of EU aid inflows is positive. This result implies that when EU aid inflow to Ghana is too low in equilibrium, it will begin increasing in the following year by 0.06 percentage points to correct the equilibrium error. In general, the model confirms both long- and short-run causation but is unable to determine the direction of causality. To determine the direction of causality, Toda and Yamamoto's test model in equations (11) and (12) is used in place of the traditional Granger test (see Table 8).

The F-statistics of the modified Wald test are calculated. In Table 8, the T-Y causality test results show that there is a unidirectional causality from EU aid inflows to economic growth in Ghana. A similar direction is evident between trade openness and economic growth. EU aid inflows and trade openness supplement domestic incomes and thus lead to economic growth in the short and long run. Nevertheless, the slow pace of Ghana's development is inferred from the insignificance of corruption, as aid and trade alone may not necessarily be sufficient to lead to growth that addresses the needs of all, but institutional inputs such as good governance may play a key facilitating role in achieving sustainable growth. This result is consistent with related studies in the literature (see Gomanee et al., 2002; Hansen & Tarp, 2001; Kilby & Dreher, 2010; Lloyd et al., 2001; Maizels & Nissanke, 1984).

## 5 Policy Implications and Conclusion

This paper examines the causal relationship between EU aid inflows and GDP in Ghana while controlling for corruption (governance) and trade openness. The causal relationship between GDP, corruption, trade openness and EU aid inflows is based on pre-stated hypotheses. The statistical inference deduced from the Johansen model after testing for multivariate cointegration between GDP and the regressors indicates that there is one cointegrating vector relationship. The dynamics of the variables in the short run indicate that the source of causality runs through aid inflows, trade and the dummy variable to GDP. There is a long-run unidirectional causal relationship from EU aid inflows to GDP growth. Conversely, corruption remained insignificant and ineffective to power growth, but it shares a relatively stronger correlation with EU aid inflows. An essential implication of this

result is that aid inflows and trade alone may not necessarily be sufficient to lead to growth that addresses the needs of all, but institutional inputs such as good governance may play a facilitating role in achieving sustainable growth. This analogy confirms the increasing attempts by the government of Ghana to meet the selectivity criteria espoused by most multilateral donors through reforms, which are often used as conditions for aid. However the quality and pace of reform has been below expectations; hence, development has been sluggish.

The long-run unidirectional causality from EU aid inflows to economic growth is confirmed by the negative coefficient and significance of the error correction term. This result supports the growth-led theses on income convergence in the literature (Cypher & Dietz, 2009; Forson et al., 2013; Kargbo, 2012; Mankiw et al., 1992). Therefore, the efforts of the government and policy makers should be directed at meeting selectivity criteria to serve as an inducement for the continued inflow of aid to sustain efforts to meet the MDGs and other developmental priorities. The short-run unidirectional causality from trade to growth is also consistent with the existing literature (see Federici & Montalbano, 2010; Haddad et al., 2012; Stensnes, 2006; Ulaşan, 2012).

The results in this paper also hold significant implications for the conjecture that corruption is endemic in Ghana and is the cause of the slow pace of development. Consequentially, the decision of government to launch the National Anti-Corruption Action Plan (NACAP) in 2011, though long overdue, is rational based on the evidence presented in this paper. However, such an attempt will only work if the various stakeholders (MMDAs, parastatals etc.) show much-needed commitment to eliminate the menace of corruption from its roots. Incidental and systemic corruption is high in Ghana, and due to its nature, it often goes unnoticed or treated with impunity. The scourge of petty corruption on national development is thus underestimated in most cases.

Nevertheless, the activities of NACAP should be directed toward fighting incidental corruption in the MMDAs, customs and police services, as these are the core breeding points of petty corruption. In addition, despite the laudability of the initiative, there are some further concerns that need clarification. For instance,

to what extent will this agency be independent so that it can tackle corruption without fear or favors? How different will its mandate be from existing bodies? Are there mechanisms in place to check conflicts of interest and duplications of functions? We recommend further qualitative research to explore and present an in-depth account to these questions. In addition, relevant draconian measures should be reintroduced and applied where necessary to reduce the level of impunity and at the same time give more meaning to upholding the rule of law and accountability in Ghana.

A central limitation of this paper is the approach used to determine the presence of a single structural break. It is possible that the series may contain two structural breaks at a time. Therefore, considering only one break when there are indeed possibilities for more than one may lead to a loss of power of the test. Future research can extend this analysis by simultaneously considering two breaks in the series.

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