The Determinants of Economic Growth in Ghana: New Empirical Evidence

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Abstract

This paper deals with an investigation into the determinants of economic growth in Ghana over the period 1975 to 2014. In particular, we investigated the impact of physical capital, human capital, labour, government expenditure, inflation, foreign aid, foreign direct investment, financial development, globalisation and debt servicing on economic performance within an augmented Solow growth model. It was found that, in the long run, both human capital and foreign aid have a positive influence on output, while labour, financial development and debt servicing have a negative impact on output. It was also found that, in the short run, government expenditure and foreign aid have a positive influence on economic growth, while labour, inflation and financial development have a negative impact on economic growth. These findings hold important policy implications for the country.

Keywords: *Determinants; economic growth; Ghana; ARDL bounds testing*

1. Introduction

The purpose of this study is to establish the determinants of growth in Ghana. Establishing the determinants of growth is crucial for a country that aims to achieve sustainable growth, full employment, drastic poverty reduction and an acceptable level of income inequality. After Ghana gained independence in 1957, it struggled to maintain political stability and sustained economic growth until the late 1990s. By the turn of the 2000s, the country had improved on various fronts. In 2010, Ghana was rated the 5th most stable, the 17th best governed and the 13th highest in respect of human capital development. Ghana's economy was also rated the 6th largest based on purchasing power parity and nominal GDP on the African continent in 2010 (see Nesbitt, 2012). The country was also regarded as one of the fastest growing economies in the world, being rated the 10th highest per capita GDP in Africa, with a rate of unemployment at 5.20 per cent, and the highest per capita GDP in West Africa in 2013 [see World Development Indicators (WDI), 2014]. However, from the 2010s onwards, these successes waned. The country's economic growth plummeted from 11.25 per cent in 2011 to 1.52 per cent in 2015 (WDI, 2016).

The economic growth of Ghana has undergone volatile movements over the past four decades, as shown in table 1. The table shows that after the swing from -14.45 per cent in 1975 to 4.98 per cent in 1984, the country's economic growth remained relatively stable at an average of 2 per cent over the period 1985 to 2007. Later on, there was a degree of volatile development after the global financial crisis. Recently, the growth momentum slowed down and reached 1.52 per cent in 2015, the lowest level in two decades. Against this weak growth performance that the country experienced recently, it is of vital importance to investigate the sources of growth over the past few decades to gain some insight into how to sustain the long-term growth of the country.

Table 1: Economic growth in Ghana over the period 1975 to 2015

Source: Prepared by the authors.

Although many studies have been devoted to investigate the determinants of growth in sub-Saharan African countries, they arrived at different conclusions (see, for example, Ghura, 1995; Fosu, 1996; Sachs and Warner, 1997; Ndulu and O'Connell, 1999; Bertocchi and Canova, 2002; Artadi and Sala-i-Martin, 2003; and Masanjala and Papageorgiou, 2008). Moreover, studies that have been conducted so far to investigate the determinants of growth in Ghana established different determinants (see, for example, Lloyd et al., 2001; Anaman, 2006; Adenutsi, 2011; and Klobodu and Adams, 2016). Even in cases where different studies arrived at a common source of economic growth, the impact of the source of growth is not distinct. The difference in conclusions could be due to differences in time spans of data, model specifications and estimation techniques. Because the factors that determine the rate of economic growth are not unanimously settled in the literature, it is empirically valuable to perform this study, which further probes the potential determinants of growth for countries like Ghana that struggle to sustain growth. In addition, this study adds to the existing literature by exploring both the short- and long-run determinants of economic growth in Ghana. Using the autoregressive distributed lag (ARDL) bounds testing procedure, this study explores the impact of physical capital, labour, human capital, government expenditure, inflation, foreign aid, foreign direct investment (FDI), financial development, globalisation and debt servicing on economic growth within an augmented Solow growth model. We find some key results that may be useful in respect of policymaking.

The rest of the paper is organised as follows: The next section reviews the existing literature; section 3 states the objective of the study; section 4 presents the empirical methodology; section 5 presents the results; section 6 concludes the study; and section 7 provides the managerial implications.

2. Review of Literature

The existing literature suggests that a number of factors play an important role in economic growth. These factors include, but are not limited to, physical capital, human capital, labour, government expenditure, inflation, foreign aid, foreign direct investment, financial development, globalisation and debt servicing. Apart from physical capital, human capital, inflation and debt servicing, the existing studies show that the impacts of these factors on growth are far from conclusive. Regarding the impact of labour, for example, some studies argue that population growth affects economic growth negatively (see, for example, Moral-Benito, 2012; and Iyke and Ho, 2017), while others contest that it can accelerate the process of adopting a new technology due to the innovation that is induced by population pressures (see Beaudry and Green, 2002; and Danquah et al., 2014). Similarly, some studies argue that government expenditure has a negative effect on output due to two sources of distortion that lower savings and economic growth. The first one may be reflected in government expenditure programmes, while the second one comes from the adverse effect of the associated public finance through taxation (see Barro, 1991, 2003; and Moral-Benito, 2012). Conversely, other studies show that government expenditure on infrastructure activities, such as electricity provision and road construction, can foster economic growth (see Easterly and Rebelo, 1993; and Bergh and Karlsson, 2010). In addition, Agénor and Moreno-Dodson (2007) demonstrate in an endogenous growth model that public infrastructure is beneficial to growth by reducing investment adjustment costs, improving private capital durability and enhancing the production of education and health services.

The influence of foreign aid on growth is also largely inconclusive. On the one hand, the impact of foreign aid can be beneficial to economic growth by providing higher levels of physical capital and improving education and health services (see Rajan and Subramanian, 2011). On the other hand, foreign aid can also impair economic growth by pushing up the real exchange rate in the recipient country, thereby reducing the competitiveness of the tradable sector (see Corden and Neary, 1982; and Torvik, 2001). On the empirical front, the debate about the impact of foreign aid on growth is also far from settled. Some studies conclude that there is a positive relationship between foreign aid and growth unconditionally or in certain macroeconomic environments (see, for example, Burnside and Dollar, 2000; and Minoiu and Reddy, 2010). In contrast, some studies indicate that aid has no effect on growth (see Boone, 1994, 1996; and Easterly et al., 2004), while others indicate that foreign aid has a negative effect on growth (see Bobba and Powell, 2007; and Rajan and Subramanian, 2011).

The theories on FDI suggest that this kind of investment is important for promoting growth. By introducing new products or production processes to the domestic market, domestic firms can benefit from foreign firms in the transfer of new technology (see Grossman and Helpman, 1991, 1995; and Barro and Sala-i-Martin, 1995, 1997). Additionally, FDI provides direct capital financing to the domestic economy, thereby promoting growth (Alfaro et al., 2004). Yet, these benefits of FDI remain ambiguous on the empirical front. The impact of FDI on growth can be positive, negative or insignificant, depending on the economic, institutional and technological conditions of the domestic country (Li and Liu, 2005). Some empirical studies indicate that FDI promotes growth (see, for example, Blomstrom et al., 1996; and Azman-Saini et al., 2010). Other studies, such as those by Carkovic and Levine (2002) and Durham (2004), found limited support that FDI exerts a positive influence on growth. Furthermore, Herzer and Klasen (2008) found no clear association between FDI and growth. Some studies found FDI to have a negative impact on growth (see, for example, Bende-Nabende et al., 2003; and Klobodu and Adams, 2016).

As far as the impact of financial development is concerned, several transmission mechanisms that affect economic growth either positively or negatively can be identified in the literature. In his pioneering work, Goldsmith (1969) argues that financial development improves the efficient use of investment. McKinnon (1973) and Shaw (1973) extend the argument that financial development also increases the volume of investment by promoting a higher saving rate. Other studies, such as those by Greenwood and Jovanovic (1990) and Bencivenga and Smith (1991), demonstrate how financial markets improve the efficiency of investment under the endogenous growth model. Empirical studies, such as those by King and Levine (1993a) and (1993b) and Raheem (2017), also support this view. On the other hand, financial development can inhibit growth under certain circumstances. De Gregorio and Guidotti (1995), for example, argue that financial development in the form of financial liberalisation in countries with poor regulatory environments will result in fragile financial systems. In this case, financial development is overexposed and fragile, which compromises the efficiency of credit allocation. Similarly, Schneider and Tornell (2004) and Aghion et al. (2004) also argue that financial liberalisation can have a destabilising effect on a country's economy through the practice of overlending in the financial system.

Regarding physical capital, human capital, inflation, globalisation and debt servicing, their impacts on growth are less debatable. In the case of physical capital, for instance, the literature suggests that, in neoclassical and endogenous growth models alike, holding other variables constant, the higher the investment ratio, the higher the rate of growth (see Mankiw et al., 1992; and Barro, 2003). Several theoretical studies have found human capital to exert a positive effect on growth. These studies demonstrate that more educated labour is more productive and innovative, thereby encouraging the creation of new products and improving factors of production (see Romer, 1990; and Bodman and Le, 2013). These empirical studies also show that human capital has a significant and a positive influence on growth (see, for example, Barro, 1991; and Teixeira and Queirós, 2016). Furthermore, the existing literature suggests that a higher inflation rate may inhibit growth

because it increases the cost of borrowing, thereby lowering the rate of physical capital investment (Barro, 1995, 2003; and De Gregorio, 2006).

As far as globalisation is concerned, it is a broad concept from which three important aspects can be identified: it includes economic globalisation, social globalisation and political globalisation (see Obeng et al., 2018). Theories suggest that economic globalisation measured on the basis of international trade can promote economic growth in different channels. It allows economies of scale in production by enlarging the size of the market. Also, it promotes the diffusion of technology through the importation of high-tech products and services. Furthermore, trade that increases competition from the rest of the world may push governments to carry out reforms to strengthen the local economies (see Grossman and Helpman 1991; and Rajan and Zingales 2003). The positive impact of globalisation in respect of trade openness is supported in empirical studies such as those by Romer (1990), Dollar and Kraay (2003) and Bal et al. (2016).

When we consider the relationship between public debt and growth, the bulk of theoretical literature shows a negative relationship in neoclassical and endogenous growth models alike. In the standard overlapping generation models, an increase in public debt will decrease savings and investment through higher interest rates, thereby adversely affecting growth (see Diamond, 1965; and Blanchard, 1985). In the endogenous growth models, a rise in public debt implies a future increase in distortionary tax or a decrease in public spending, thus weakening growth (see Barro, 1990; Saint-Paul, 1992; and Eberhardt and Presbitero, 2015). The empirical findings of authors such as Reinhart and Rogoff (2010), Cecchetti et al. (2011) and Égert (2015) also support this view.

Theories and international empirical studies not only reflect diverse views on the determinants of growth – studies on the determinants of growth in sub-Saharan African (SSA) countries have also arrived at different conclusions. For example, Ghura (1995) confirms that physical and human capital, inflation, government expenditure, exports growth, macroeconomic instability, political and civil instability, and the world real interest rate influence growth in the region. Sachs and Warner (1997) similarly suggest that economic policies such as government saving, openness to international trade, and market-oriented institutions exert substantial impacts on African growth. Apart from these factors, Sachs and Warner (1997) also identify natural factors such as limited access to the sea, a tropical climate, life expectancy and demographic factors as important determinants that may account for the slow growth in the region. Fosu (1996) points out that external debt has a negative impact on growth in the region. Ndulu and O'Connell (1999) hold that governance is a vital factor that explains growth in SSA countries over the past few decades. They argue that the change from authoritarian rule to political pluralism is conducive to growth recovery in the region. Bertocchi and Canova (2002) also investigate the determinants of African growth through a political lens. They find that colonial heritage provides a key explanation for the underdevelopment of the continent over the past few decades. Similar to Ghura (1995) and Sachs

and Warner (1997), Artadi and Sala-i-Martin (2003) also regard geographical factors, closed economies and excessive government expenditure as important factors that affect growth. In addition to these factors, Artadi and Sala-i-Martin (2003) view factors such as low levels of educational attainment, expensive investment goods and frequent military conflicts as crucial factors that affect growth in the region. Masanjala and Papageorgiou (2008) regard initial primary education, primary exports and mining as robust determinants that explain African growth.

Moreover, studies that have been conducted so far to examine the determinants of growth in Ghana established different determinants. Lloyd et al. (2001), for example, states that exports, aid and public investment are important determinants of growth. Anaman (2006) indicates that, in addition to exports, political stability, world oil price shocks and government size are important growth determinants. Similar to Lloyd et al. (2001) and Anaman (2006), Adenutsi (2011) holds that economic openness and investment are important determinants of growth. He also argues that financial development, international migrant remittances and human capital development are important determinants of long-run growth. Klobodu and Adams (2016), in examining the factors that affect growth in Ghana, identified factors that are similar to those indicated in previous findings, for example aid, remittances and trade. Apart from these factors, they also identified FDI, external debt, physical capital, population growth and inflation as factors that influence growth in Ghana.

Even in cases where different studies arrived at a common source of growth, the impact of the source of growth is not distinct (see, for example, Lloyd et al., 2001; Anaman, 2006; Adenutsi, 2011; and Klobodu and Adams, 2016). Hence, the factors that may determine the rate of growth are far from settled in the literature, both theoretically and empirically. This makes it empirically valuable for studies to revisit the determinants of growth for countries like Ghana that struggle to sustain their growth.

3. Objective

The objective of this study is to examine the impact of human capital, physical capital, labour, government expenditure, inflation, foreign aid, foreign direct investment, financial deepening, globalisation and debt servicing on economic performance in Ghana within an augmented Solow growth model.

4. Methodology and Data

4.1 Specification of Empirical Model

According to the neoclassical growth theory, growth in aggregate output may be attributed to capital, labour and exogenous technological progress. The aggregate output of an economy can be written as follows:

$$Y_t = F(K_t, L_t, A_t) \tag{1}$$

where Y_t is the aggregate output, F is the level of the technology that transforms capital (K_t), labour (L_t) and total factor productivity (A_t) into aggregate output, and the subscript t denotes time. Following Solow (1956) and Mankiw et al. (1992), we take the functional form of *Eq.* (1) to be a Cobb-Douglas function and write it as follows:

$$Y_t = A_t K_t^{\alpha} L_t^{\beta} \tag{2}$$

where α and β are the shares of capital and labour in output, respectively. The neoclassical growth theory gives rise to the "sources-of-growth" approach on the empirical front, which is aimed at identifying the determinants in growth (see Agénor and Montiel, 2008). In order to make *Eq.* (2) flexible for empirical purposes, we augment it by allowing technology to advance over time. Most of the literature on empirical growth shows that there are a number of variables that may affect the TFP (A_t) as mentioned above. Therefore, we augment *Eq.* (2) by following empirical studies such as those by Chen and Feng (2000), Li and Liu (2005), Shahbaz (2012) and Takumah and Iyke (2017) as follows: Suppose A_t can be written as a function of human capital, government expenditure, inflation, foreign aid, FDI, financial development, globalisation and debt servicing. Then, imposing a Cobb-Douglas function, we have that:

$$A_t = \theta HC_t^{\delta_1} GOV_t^{\delta_2} INF_t^{\delta_3} AID_t^{\delta_4} FDI_t^{\delta_5} FIN_t^{\delta_6} OPEN_t^{\delta_7} DEBT_t^{\delta_8} \tag{3}$$

where θ is a constant. By replacing A_t in *Eq.* (2) with *Eq.* (3), we arrive at the augmented form of the growth equation, which is as follows:

$$Y_t = \theta K_t^{\alpha} L_t^{\beta} HC_t^{\delta_1} GOV_t^{\delta_2} INF_t^{\delta_3} AID_t^{\delta_4} FDI_t^{\delta_5} FIN_t^{\delta_6} OPEN_t^{\delta_7} DEBT_t^{\delta_8} \tag{4}$$

where HC is human capital, GOV is government expenditure, INF is inflation, AID is foreign aid, FDI is foreign direct investment, *FIN* is financial development, *OPEN* is globalisation, *DEBT* is debt servicing and δ_i is the share of these inputs in the aggregate output. We proceed to log-linearise *Eq.* (4) by taking the natural logarithm of both sides as:

$$lnY_t = ln\theta + \alpha lnK_t + \beta lnL_t + \delta_1 lnHC_t + \delta_2 lnGOV_t + \delta_3 lnINF_t + \delta_4 lnAID_t + \delta_5 lnFDI_t + \delta_6 lnFIN_t + \delta_7 lnOPEN_t + \delta_8 lnDEBT_t + \mu_t \tag{5}$$

Suppose $ln\theta = \gamma$, where γ is a constant term, then *Eq.* (5) becomes:

$$lnY_t = \gamma + \alpha lnK_t + \beta lnL_t + \delta_1 lnHC_t + \delta_2 lnGOV_t + \delta_3 lnINF_t + \delta_4 lnAID_t + \delta_5 lnFDI_t + \delta_6 lnFIN_t + \delta_7 lnOPEN_t + \delta_8 lnDEBT_t + \mu_t \quad (6)$$

where ln is the natural logarithm operator and μ_t denotes the white-noise error term.

4.2 ARDL bounds testing procedure for cointegration

There are various time series approaches that can be used to estimate *Eq.* (6). In this paper, we proceed by using the autoregressive distributed lag (ARDL) bounds testing procedure developed by Pesaran et al. (1996), Pesaran and Shin (1999) and Pesaran et al. (2001). There are various reasons why the ARDL approach is suitable in this study. The main reasons are as follows: First, this approach allows us to explore both the short- and long-run relationships between growth and its determinants. Second, this approach, unlike other approaches, does not impose the restrictive assumption that all the variables under study must be integrated of the same order. It is applicable to variables that are integrated of order zero and one, or a mixture of both. Third, this approach is robust in small samples (see Pesaran et al., 1996; Pesaran and Shin, 1999; and Pesaran et al., 2001). Hence, since the sample in this study is small, the ARDL approach is the appropriate approach for the empirical analysis.

The specification of *Eq.* (6) using the ARDL bounds testing procedure is of the form:

$$\begin{aligned}\Delta lnY_t = \rho_0 &+ \sum_{i=1}^{n} \rho_{1i}\, \Delta lnY_{t-i} + \sum_{i=0}^{n} \rho_{2i}\, \Delta lnK_{t-i} + \sum_{i=0}^{n} \rho_{3i}\, \Delta lnL_{t-i} + \sum_{i=0}^{n} \rho_{4i}\, \Delta lnHC_{t-i} \\ &+ \sum_{i=0}^{n} \rho_{5i}\, \Delta lnGOV_{t-i} + \sum_{i=0}^{n} \rho_{6i}\, \Delta lnINF_{t-i} + \sum_{i=0}^{n} \rho_{7i}\, \Delta lnAID_{t-i} + \sum_{i=0}^{n} \rho_{8i}\, \Delta lnFDI_{t-i} \\ &+ \sum_{i=0}^{n} \rho_{9i}\, \Delta lnFIN_{t-i} + \sum_{i=0}^{n} \rho_{10i}\, \Delta lnOPEN_{t-i} + \sum_{i=0}^{n} \rho_{11i}\, \Delta lnDEBT_{t-i} + \sigma_1 lnY_{t-1} \\ &+ \sigma_2 lnK_{t-1} + \sigma_3 lnL_{t-1} + \sigma_4 lnHC_{t-1} + \sigma_5 lnGOV_{t-1} + \sigma_6 lnINF_{t-1} + \sigma_7 lnAID_{t-1} \\ &+ \sigma_8 lnFDI_{t-1} + \sigma_9 lnFIN_{t-1} + \sigma_{10} lnOPEN_{t-1} + \sigma_{11} lnDEBT_{t-1} + \varepsilon_t \quad (7)\end{aligned}$$

where ε, ρ and σ are the white-noise error term, the short-run coefficients and the long-run coefficients of the model, respectively, and Δ is the first difference operator. t denotes time period and n is the maximum number of lags in the model chosen by the Akaike Information Criterion (AIC). The lnY, lnK, lnL, $lnHC$, $lnGOV$, $lnINF$, $lnAID$, $lnFDI$, $lnFIN$, $lnOPEN$ and $lnDEBT$ are the natural logarithm of economic growth, physical capital, labour, human capital, government

expenditure, foreign aid, FDI, financial development, globalisation and debt servicing, respectively.

The null hypothesis of no cointegration among the variables is specified of the form: $H_0 : \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4 = \sigma_5 = \sigma_6 = \sigma_7 = \sigma_8 = \sigma_9 = \sigma_{10} = \sigma_{11} = 0$. This is tested against the alternative hypothesis of cointegration among the variables of the form: $H_1 : \sigma_1 \neq \sigma_2 \neq \sigma_3 \neq \sigma_4 \neq \sigma_5 \neq \sigma_6 \neq \sigma_7 \neq \sigma_8 \neq \sigma_9 \neq \sigma_{10} \neq \sigma_{11} \neq 0$. The variables are said to be cointegrated if we can reject the null hypothesis. To make a decision, we compare the calculated *F*-statistic to a set of critical values compiled by Pesaran et al. (2001) under this null hypothesis. If the *F*-statistic falls below the lower-bound values, then we fail to reject the null hypothesis of no cointegration. In contrast, we reject the null hypothesis of no cointegration when the calculated *F*-statistic is greater than the upper-bound values. The *F*-statistic may also fall between the lower and upper bounds. In this case, the test is inconclusive (Pesaran et al., 2001).

If the variables are cointegrated, then we estimate *Eq.* (7), the long-run equation, and the following short-run equation (i.e. the error correction model):

$$\begin{aligned}\Delta lnY_t = \rho_0 &+ \sum_{i=1}^{n} \rho_{1i}\, \Delta lnY_{t-i} + \sum_{i=0}^{n} \rho_{2i}\, \Delta lnK_{t-i} + \sum_{i=0}^{n} \rho_{3i}\, \Delta lnL_{t-i} + \sum_{i=0}^{n} \rho_{4i}\, \Delta lnHC_{t-i} \\ &+ \sum_{i=0}^{n} \rho_{5i}\, \Delta lnGOV_{t-i} + \sum_{i=0}^{n} \rho_{6i}\, \Delta lnINF_{t-i} + \sum_{i=0}^{n} \rho_{7i}\, \Delta lnAID_{t-i} + \sum_{i=0}^{n} \rho_{8i}\, \Delta lnFDI_{t-i} \\ &+ \sum_{i=0}^{n} \rho_{9i}\, \Delta lnFIN_{t-i} + \sum_{i=0}^{n} \rho_{10i}\, \Delta lnOPEN_{t-i} + \sum_{i=0}^{n} \rho_{11i}\, \Delta lnDEBT_{t-i} + \sigma ECM_{t-1} \\ &+ \varepsilon_t \end{aligned} \quad (8)$$

where σ is the coefficient of the error correction term and ECM_{t-1}. σ is expected to have a negative sign. This means that economic growth reverts to its steady-state level when it drifts away in the short run. This is also the case for the determinants of growth.

4.3 Data

Annual time series data covering the period 1975 to 2014 are used in this study. The period covered is based on the consideration of data availability. The data were obtained from the World Development Indicators (WDI) database (2016, 2018) compiled by the World Bank. This is the most reliable and easily accessible data source, to the best of our knowledge. We use: GDP per capita (constant local currency) to measure the economic performance (Y); gross capital formation (percentage of GDP) to measure physical capital (K); population growth (annual percentage) to measure labour (L); secondary school enrolment (percentage gross) to measure human capital

(HC), general government final consumption expenditure (percentage of GDP) to measure the government expenditure (GOV); annual percentage change in consumer price index to measure the inflation rate (INF); net official development assistance per capita to measure foreign aid (AID); FDI net inflows (percentage of GDP) to measure FDI; domestic credit to private sector by banks (percentage of GDP) to measure financial development; trade (percentage of GDP) to measure globalisation; and total debt service (percentage of GNI) to measure debt servicing. Table 2 reports the descriptive statistics of the variables.

Table 2: Descriptive statistics of the variables

	lnY	**lnK**	**lnL**	**lnHC**	**lnGOV**	**lnINF**	**lnAID**	**lnFDI**	**lnFIN**	**lnOPEN**	**lnDEBT**
Mean	6.593	2.701	0.929	3.741	2.425	33.228	3.434	0.052	1.871	3.865	2.600
Median	6.536	2.999	0.941	3.668	2.422	24.915	3.639	0.475	1.770	4.089	2.794
Maximum	7.132	3.459	1.248	4.206	3.039	122.875	4.280	2.253	2.936	4.754	4.007
Minimum	6.264	1.217	0.472	3.563	1.768	8.727	1.815	-3.094	0.433	1.844	1.154
Std. Dev.	0.221	0.622	0.164	0.183	0.256	29.251	0.660	1.597	0.740	0.721	0.809
Skewness	0.962	-0.871	-0.711	1.138	0.058	1.899	-0.760	-0.342	-0.260	-0.994	-0.300
Kurtosis	3.252	2.645	4.363	2.909	4.054	6.017	2.546	1.992	1.811	3.246	1.942
Jarque-Bera	6.273	5.268	6.463	8.648	1.875	39.213	4.198	2.352	2.808	6.691	2.466
Probability	0.043	0.072	0.040	0.013	0.392	0.000	0.123	0.309	0.246	0.035	0.291
Sum	263.718	108.030	37.159	149.633	96.994	1329.134	137.377	1.991	74.835	154.614	103.996
Sum Sq. Dev.	1.905	15.085	1.052	1.304	2.548	33368.730	17.001	94.405	21.345	20.266	25.497
Observations	40	40	40	40	40	40	40	38	40	40	40

Source: Prepared by the authors.

5. Empirical Results

5.1 Results of Stationarity Tests

We start the empirical analysis by testing the stationary properties of economic growth and its determinants. As mentioned above, we measure real output as the logarithm of real GDP per capita, so that annual changes in it reflect economic growth. The determinants of growth examined in this paper are physical capital, labour, human capital, government expenditure, inflation, foreign aid, FDI, financial development, globalisation and debt servicing. To examine their stationary properties, we utilise two unit root tests, namely, the Dickey-Fuller generalised least squares (DF-

GLS) test and the Ng-Perron test.[1] Table 3 shows the results of the unit root tests of the variables in levels and at the first differences.

The results reported in table 4 show that *lnINF* is stationary at levels, while lnY, lnK , lnL, $lnHC$, $lnGOV$, $lnAID$, $lnFDI$, $lnFIN$, $lnOPEN$ and $lnDEBT$ are stationary at the first differences. Having established that the variables are integrated of order one at the most, we can then proceed to test the long-run relationships between economic growth and its determinants using the ARDL bounds testing procedure.

Table 3: Results of unit root tests of the variables in levels and at the first differences

Dickey-Fuller generalised least squares (DF-GLS) test

Variable	Stationarity of all variables in levels				Stationarity of all variables at first differences			
	Without trend	Lag	With trend	Lag	Without trend	Lag	With trend	Lag
lnY	-0.007	2	-1.012	1	-2.726***	0	-4.336***	0
lnK	-1.027	0	-2.287	0	-2.900***	1	-6.342***	0
lnL	-1.914*	7	-1.790	7	-4.102***	1	-6.166***	1
lnHC	2.002	0	-0.421	0	-5.027***	0	-5.868***	0
lnGOV	-1.646*	0	-2.310	0	-4.923***	0	-5.203***	0
lnINF	-3.216***	0	-4.270***	1	NA	NA	NA	NA
lnAID	-1.198	0	-2.499	0	-1.623*	1	-6.003***	0
lnFDI	-1.119	0	-1.563	0	-4.156***	0	-5.025***	0
lnFIN	-0.355	0	-2.000	0	-5.429***	0	-5.649***	0
lnOPEN	-1.420	1	-1.818	0	-2.577**	2	-4.175***	0
lnDEBT	-1.238	0	-1.466	0	-6.277***	0	-6.292***	0

Ng-Perron test

Variable	Stationarity of all variables in levels				Stationarity of all variables at first differences			
	Without trend	Lag	With trend	Lag	Without trend	Lag	With trend	Lag
lnY	-0.171	2	-1.110	1	-2.214**	0	-2.849*	0
lnK	-0.996	0	-1.875	0	-2.302**	1	-3.037**	0
lnL	-0.881	7	-1.089	7	-3.929***	1	-5.062***	1
lnHC	2.285	0	-0.289	0	-2.863***	0	-3.005**	0
lnGOV	-1.531	0	-1.901	0	-3.005***	0	-3.018**	0
lnINF	-2.548**	0	-3.387**	1	NA	NA	NA	NA
lnAID	-1.035	0	-2.139	0	-1.856*	0	-1.838	1
lnFDI	-0.944	0	-1.485	0	-2.748***	0	-2.869*	0
lnFIN	-0.346	0	-1.498	0	-3.050***	0	-3.069**	0

[1] These tests are discussed in depth in the literature (see, the for example, Elliott et al., 1996; and Ng and Perron, 2001).

lnOPEN	-1.451	1	-1.550	0	-2.260**	2	-3.871***	1
lnDEBT	-1.160	0	-1.244	0	-3.017***	0	-3.021**	0

Source: Prepared by the authors.

Notes:
(1) *, ** and *** denote significance at 10%, 5% and 1%, respectively.
(2) NA denotes "non-applicable".

5.2 Results of the Cointegration Test Using the ARDL Bounds Testing Procedure

Table 4 reports the results of the ARDL bounds test for cointegration and the lower- and upper-bound critical values, respectively. The results of the ARDL bounds test for cointegration show that the calculated *F*-statistic is 6.595, which is higher than the upper-bound critical values reported by Pesaran et al. (2001) at the conventional levels of significance. Therefore, the results show that the variables are cointegrated. Having found that lnY, lnK, lnL, $lnHC$, $lnGOV$, $lnINF$, $lnAID$, $lnFDI$, $lnFIN$, $lnOPEN$ and $lnDEBT$ are cointegrated, we proceed to estimate the short- and long-run specifications discussed in the methodology section. The first step is to determine the optimal lag length to be used for the model. Here, we use the Akaike Information Criterion (AIC). The preferred specification is ARDL(1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0). The corresponding long- and short-run estimates of this ARDL specification are reported in table 5.

Table 4: Results of the ARDL bounds test for cointegration

Dependent variable	**Function**	***F*-statistic**	**Cointegration status**
lnY	F(*lnY* | *lnK*, *lnL*, *lnHC*, *lnGOV*, *lnINF*, *lnAID*, *lnFDI, lnFIN, lnOPEN, lnDEBT*)	6.595***	Cointegrated

The critical values of the ARDL bounds test

Pesaran et al. (2001) critical values (k = 10)		
Level of significance (%)	**Lower bound**	**Upper bound**
1	2.54	3.86
5	2.06	3.24
10	1.83	2.94

Source: Prepared by the authors.

Notes: *** denote significance at 1%. Critical values are based on Pesaran et al. (2001), table CI (iii), case III.

Table 5: The long- and short-run results of the selected ARDL specification

Panel 1 **Long-run results**

Dependent variable is *lnY*

Regressor	Co-efficient	Standard Error	T-statistics	Probability
lnK	0.048	0.256	0.186	0.854
lnL	-0.851**	0.367	-2.317	0.030
lnHC	1.269***	0.336	3.781	0.001
lnGOV	0.130	0.169	0.772	0.448
lnINF	-0.045	0.040	-1.115	0.277
lnAID	0.113*	0.062	1.830	0.081
lnFDI	-0.040	0.028	-1.455	0.160
lnFIN	-0.211*	0.109	-1.945	0.065
lnOPEN	0.240	0.161	1.496	0.149
lnDEBT	-0.083*	0.045	-1.863	0.076

Panel 2 Short-run results
Dependent variable is Δ*lnY*

Regressor	Co-efficient	Standard Error	T-ratio	Probability
Δ*lnK*	0.001	0.019	0.072	0.944
Δ*lnL*	-0.196**	0.086	-2.270	0.033
Δ*lnHC*	-0.020	0.078	-0.251	0.804
Δ*lnGOV*	0.072***	0.023	3.130	0.005
Δ*lnINF*	-0.009*	0.005	-1.759	0.093
Δ*lnAID*	0.031**	0.013	2.459	0.022
Δ*lnFDI*	-0.005	0.006	-0.857	0.401
Δ*lnFIN*	-0.046**	0.017	-2.666	0.014
Δ*lnOPEN*	0.031	0.030	1.046	0.307
Δ*lnDEBT*	-0.011	0.010	-1.142	0.266
C	0.277***	0.041	6.743	0.000
ECM(-1)	-0.158***	0.025	-6.270	0.000

Source: Prepared by the authors.

Notes:

(1) *, ** and *** denote 10%, 5% and 1% significance levels, respectively.

(2) Δ=first difference operator

First, let us consider the long-run results, which are reported in panel 1 of table 5. In the long run, the key determinants of economic performance in Ghana are labour, human capital, foreign aid, financial development and debt servicing. Regarding the impact of labour, the results show that, in the long run, a percentage increase in labour leads to a 0.85 per cent decrease in real GDP per capita, other factors unchanged. Such a negative impact is due to the fact that higher population growth will lower the capital per capita given the same level of human and physical capital, thus reducing the output per capita. A similar finding is documented in Moral-Benito (2012) and Iyke

and Ho (2017). As far as human capital is concerned, the results shows that human capital has a positive impact on output. A percentage increase in human capital leads to a 1.27 per cent increase in real GDP per capita, other factors unchanged. As workers become more educated, they become more productive and innovative, which encourages the growth of output. This finding is well supported in other studies such as those by Grossman and Helpman (1991), Teixeira and Queirós (2016) and Chirwa and Odhiambo (2017). Regarding the impact of foreign aid, the results show that foreign aid has a positive impact on output. In particular, a percentage increase in foreign aid promotes output by 0.11 per cent, other factors unchanged. The positive relationship between foreign aid and economic performance is also documented in other studies (see, for example, Burnside and Dollar, 2000; and Minoiu and Reddy, 2010). In respect of financial development, contrary to the majority of previous findings, we find that financial development hinders economic growth. A one per cent increase in financial development reduces output by 0.21 per cent. The negative impact of financial development may be due to rapid financial liberalisation in a poor regulatory environment. This makes the financial system more fragile and overexposed, thus weakening economic performance (see De Gregorio and Guidotti, 1995; Schneider and Tornell, 2004; and Aghion et al., 2004). Regarding the impact of debt servicing, the results show that a percentage increase in debt servicing will harm output by 0.08 per cent. This finding is similar to those of Reinhart and Rogoff (2010), Cecchetti et al. (2011) and Égert (2015).

We now turn to the short-run estimates, which are reported in panel 2 of table 5. The results reveal that the key macroeconomic determinants of economic growth (measured as the annual changes in real output, ΔlnY) are labour, government expenditure, inflation, foreign aid and financial development. In general, we find that labour, inflation and financial development have a negative impact on output growth in the short run, while government expenditure and foreign aid have a positive impact.

Finally, the results show that the coefficient of the error correction term, which measures the short-run dynamics and the adjustment towards the long-run equilibrium path, is negative and statistically significant. Specifically, the results show that when the variables drift apart from the equilibrium level by one per cent in the short run, the disequilibrium is corrected in the next period at a rate of 0.16 per cent. Overall, the selected ARDL specification appears to be well fitted since the adjusted R-squared is approximately 76 per cent. The diagnostic tests, reported in table 6, suggest that the selected ARDL specification is free of serial correlation and heteroscedasticity. These results aside, the estimates reported above are structurally stable, as shown by the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) plots in figures A.1 and A.2 in the appendix, respectively.

Table 6: Results of diagnostic tests

Test	**Statistic**	***P*-value**

Serial Correlation: CHSQ (13)	17.861	0.163
Functional Form: F(1,21)	0.990	0.331
Heteroscedasticity: CHSQ (1)	1.036	0.309

Source: Prepared by the authors.

5.3 Sensitivity Analysis

To check for the robustness of the estimates, we perform a sensitivity analysis in this section. Instead of using the AIC, we use the Schwartz Criterion (SC) to choose the optimal lag length in our model. The preferred specification based on the SC is ARDL(1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0). The results of the ARDL bounds test for cointegration show that the calculated *F*-statistic is 4.856, which is higher than the upper-bound critical values reported by Pesaran et al. (2001) at 1 per cent of significance. Therefore, the results show that the variables are cointegrated. The corresponding long- and short-run estimates of this ARDL specification are reported in table 7.

Table 7: The long- and short-run results of the selected ARDL specification

Panel 1
Long-run results
Dependent variable is *lnY*

Regressor	Co-efficient	Standard Error	T-statistics	Probability
lnK	0.010	0.190	0.050	0.960
lnL	-0.642***	0.213	-3.020	0.006
lnHC	1.051***	0.157	6.687	0.000
lnGOV	0.186*	0.102	1.823	0.081
lnINF	-0.039	0.030	-1.327	0.197
lnAID	0.100**	0.047	2.117	0.045
lnFDI	-0.047*	0.024	-1.948	0.063
lnFIN	-0.175**	0.067	-2.635	0.015
lnOPEN	0.256*	0.126	2.022	0.054
lnDEBT	-0.115**	0.042	-2.766	0.011

Panel 2: Short-run results
Dependent variable is Δ*lnY*

Regressor	Co-efficient	Standard Error	T-ratio	Probability
Δ*lnK*	-0.003	0.020	-0.137	0.892
Δ*lnL*	-0.164*	0.092	-1.777	0.088
Δ*lnHC*	-0.026	0.081	-0.322	0.750
Δ*lnGOV*	0.066**	0.024	2.745	0.011
Δ*lnINF*	-0.010*	0.005	-1.844	0.078

Δ*lnAID*	0.029**	0.013	2.193	0.038
Δ*lnFDI*	-0.007	0.006	-1.170	0.253
Δ*lnFIN*	-0.043**	0.018	-2.429	0.023
Δ*lnOPEN*	0.041	0.031	1.305	0.204
Δ*lnDEBT*	-0.018*	0.011	-1.726	0.097
C	0.432***	0.069	6.279	0.000
ECM(-1)	-0.188***	0.031	-5.993	0.000

Source: Prepared by the authors.

Notes:

(1) *, ** and *** denote 10%, 5% and 1% significance levels, respectively.

(2) Δ=first difference operator

The long-run results reported in table 7 show that the key determinants of economic performance in Ghana are labour, human capital, government expenditure, foreign aid, FDI, financial development, globalisation and debt servicing. Similar to our main results, table 7 shows that both human capital and foreign aid have a positive influence on output in the long run, while labour, financial development and debt servicing have a negative impact on output. In addition, the signs of coefficient of physical capital, government expenditure, inflation, FDI and globalisation are the same as those in the main model, even though they are not significant in the main model. As far as the short-run results are concerned, table 8 shows that government expenditure and foreign aid have a positive influence on economic growth, while labour, inflation and financial development have a negative impact on economic growth. This is consistent with our main results. In addition, the second model also passes the relevant diagnostic tests. Based on the above results, we argue that our model specification is robust in relation to the choice of different criteria in selecting the optimal lag length for the model.

6. Conclusion

In this paper, we set out to examine the determinants of economic growth in Ghana over the period 1975 to 2014. Using the ARDL bounds testing procedure, we investigated the impact of physical capital, labour, human capital, government expenditure, inflation, foreign aid, FDI, financial development, globalisation and debt servicing on economic performance in an augmented Solow growth model. We arrived at the following key results: First, both human capital and foreign aid have a positive influence on output, while labour, financial development and debt servicing have a negative influence on output in the long run. Second, we found that, in the short run, government expenditure and foreign aid have a positive and significant influence on economic growth, while labour, inflation and financial development have a negative impact on economic growth. Our sensitivity analysis confirms that our model specification is robust in relation to the choice of the optimal lag length.

7. Managerial Implications

The findings hold important policy implications for Ghana. Based on the findings of the positive impact of human capital and the negative impact of labour on output, it is imperative that policymakers pursue policies that will boost the quality of human capital in order to promote and sustain economic growth in the country. To achieve better human capital development, more resources should be devoted to education in respect of both formal and on-the-job training to enhance the skill set of the population. Regarding the impact of capital flows as measured by aid and debt, the results show differential impacts. Aid promotes growth, whereas debt inhibits growth. In a developing country like Ghana where there is a need for foreign capital flows, the government should implement prudent macroeconomic policies to channel these funds into productive investment projects such as the planning and renovation of state infrastructures to increase the productivity of the country. Such policies are vital for Ghana to ensure it continues to benefit from the positive impact of aid. In respect of debt, Ghana is prone to debt distress – its debt-to-GDP ratio stood at 70 per cent in 2016 (African Development Bank Group, 2018). Therefore, policymakers should, on the one hand, strive to reduce the rate of debt accumulation and, on the other, endeavour to manage debt sustainability through effective revenue mobilisation. Lastly, we found that financial development hinders growth both in the long run and the short run. This is understandable in a developing country where the implementation of financial regulations did not match the pace of financial liberalisation over the past few decades. Therefore, the monetary authorities should establish and implement financial regulations comparable to international standards to prevent overlending by financial institutions and to reduce the fragility of the financial system.

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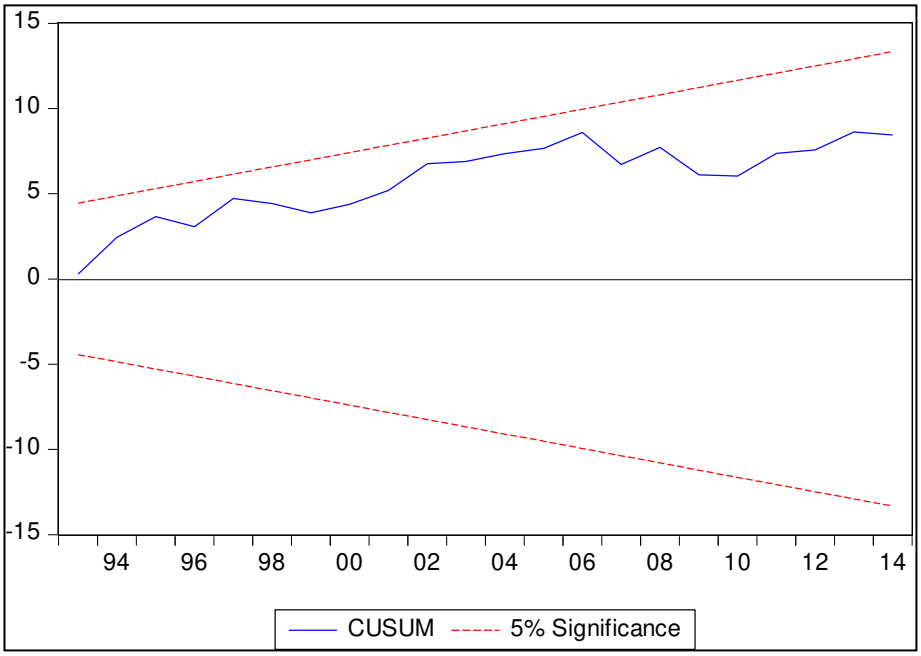
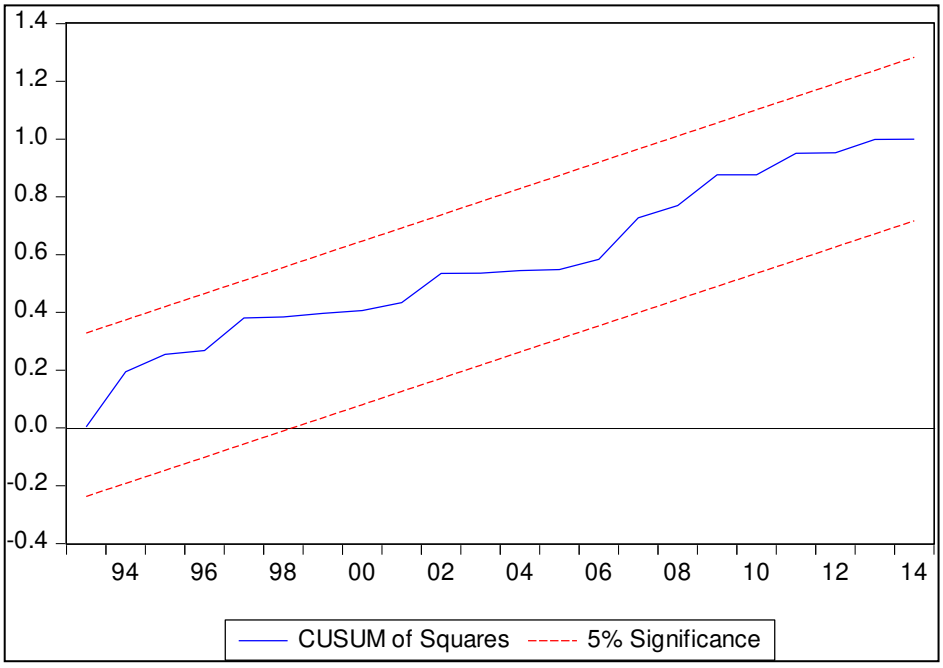
Figure A.1: Plot of the cumulative sum of recursive residuals (CUSUM)



Source: Prepared by the authors.

Figure A.2: Plot of the cumulative sum of squares of recursive residuals (CUSUMSQ)



Source: Prepared by the authors.