**Abstract**

Using FA-ARDL Approach to co-integration, this paper investigates the effectiveness of foreign capital inflows in the context of Factor Augmented Autoregressive Distributed Lag Approach to co-integration (FA-ARDL). In particular, we examine the short-and long-term dynamic impact of foreign capital inflows (FCIs) on real economic activity. The results show that *foreign aid* is a robust determinant of long-run changes in real economic activity. However, the relationship between *FDI* and real economic activity is negative. This result is consistent with past studies that the mining sector FDI dominance does not generate direct-growth necessary to impact on the broader economy. Using the FA-ARDL model has proven to yield much better results than the standard ARDL since the former contains more information than the latter.

**JEL Classification**: F350; O230; O400

**Keyword**: Economic growth, Foreign Capital Inflows (FCIs), Co-integration, Bound testing, Ghana

**1. Introduction**

The inflows of foreign capital serve as a stimulus and catalyst for economic growth and development in developing countries and also make it possible for host countries to meet the investment level required to achieve a target growth rate. Moreover, FCIs have facilitated the transfer of modern technology and innovations from developed countries to developing countries, thereby speeding up the rate of economic development. Thus, FCIs remain most crucial financial resources for developing countries. The argument has been made that a large infusion of FCIs into developing countries is a recipe for escaping the poverty trap and promoting development (Sachs 2005a, 2005b). Until 2011, 60% of the budget of Ghana was financed by foreign donors.

However, the controversy over whether FCIs lead to growth spurt has not been settled among policy makers and academic researchers. The FCI-growth literature is characterised by mixed results. Some evidence suggests that the impact of FCIs on economic growth vary from one country to another and that for some countries, FCIs may adversely affect the growth process (Borensztein et al. 1998; De Mello 1999; Lipsey 2000).

A clinical diagnosis of the empirical literature by Waheed (2004) reveals that the literature is extremely fraught with econometrics and model estimation challenges. He opined that most of the empirical studies adopt cross-sectional analysis, thus the need for case by case studies in view of each countries unique characteristic. White (1992b) concluded that “further work should be based on country level studies and should employ more detailed macroeconomic models”. This study is unique from other studies because it uses aid and FDI

The purpose of this paper is to examine the impact of foreign capital inflows on economic activities within the context of factor augmented approach. This study adopts a comprehensive approach in a data-driven manner to deal with the estimation conundrum that exists in the foreign capital inflows and growth literature. The paper is unique from other studies in the following ways. Firstly, as far as I know, this is the first attempt to introduce a factor variable into ARDL model. This approach provides the basis for modelling foreign capital inflows and economic activities nexus. Secondly, it compares the traditional methodology with the new factor augmented approach to ascertain the statistical strength of both models in predicting the effect of FCIs on economic activities. Lastly, most of the macroeconomic variables used as proxies are unlikely to reflect the real theoretical meaning of the variable they intend to represent. For example, (Mory, 1993, Lardic and Mignon, 2006) used GDP as a proxy for the “economic activity” whereas Ferderer (1996) used industrial production to proxy economic activity.

In modelling, the paper follows Lian etal (2014) by considering an approach that includes factor variable in standard ARDL model. The paper makes the following findings. Firstly, the results show that *foreign aid* is a robust determinant of long-term changes in real economic activity. However, the relationship between *FDI* and economic growth is negative. This is consistent with most FDI and growth literature in Ghana, especially (Frimpong and Oteng-Abayie, 2006). Lastly, using the FA-ARDL model has proven to yield much better results than the standard ARDL since the former contains more information than the latter.

The rest of the paper is organised as follows: Section 2 presents a historical background on growth, foreign aid and FDI inflows into Ghana. Section 3 briefly discusses related literature. Section 4 presents data and methodology. Section 5 provides empirical results. Section 6 discusses findings and Section 7concludes the paper with policy implications and recommendations.

**2.0 Historical background of growth, foreign Aid and FDI inflows into Ghana**

This section provides a brief background to the historical growth rates, foreign aid and FDI inflows into Ghana.

**2.1 Trend of changes in real GDP per capita**

Ghana experienced a deteriorating and messy economy some few years after it weaned itself from colonial domination. The economy was slowly teetering towards bankruptcy with dried up foreign reserves, plummeting GDP per capita growth and high national debt among others. To restore macroeconomic stability and address the structural weaknesses and imbalances that had characterised the economy at the time, the country signed onto IMF-World Bank program popularly known as Structural Adjustment Program in 1983. The SAP, according to analysts, rather exacerbated the plight of the ordinary Ghanaian. This partly accounts for the sharp decline in GDP per capita growth from 1980 to 1984. After 1984, the growth rate began to pick up at a steady rate given its growing population. This steady growth momentum ushered the country into a lower middle income in 2011.

Fig.1.0 The historical Changes of GDP per capita growth in Ghana, 1980-2016

* 1. **Trend of Foreign Aid and FDI Inflows in Ghana**

According to Tsikata (1999), Ghana’s economy bounced back with sustained economic growth after a decade of economic reform. This was accompanied by a momentous increase in aid inflows from both bilateral and multilateral sources. Figure 2 shows that from 1980 onward, there was an exponential increase in aid flows which reached a volume of US$ 12.38 billion in 1989. This rapid increase between 1983 and 1989 is linked to the implementation of the Structural Adjustment Program. After a significant drop in 1990, there was a steady increase in aid flows from 1991 to 2004 due to the then upcoming multiparty democracy and the fact that Ghana joined HIPC in 2001 led to a cancellation of its accumulated debt and also benefitted from a lot of inflows. When the country assumed a lower middle income status in 2011, many donors ceased pumping funds into the Ghanaian economy that accounts for the sharp drop from 2012 to 2014. As a result of its good governance practices and stable democracy, the country continuously enjoyed the goodwill of many donors and development partners which explains the increase in aid inflows in 2015.

Fig.2 The trend of Foreign Capital inflows into Ghana, 1980 – 2016

In the 1980s, annual FDI inflows were as high as US$ 36.184 million but were much less in most years as shown by figure 2.0. During the early years of the (SAP) spanning from 1983 to 1988, the country had sluggish FDI net inflows, averaging US$ 81.36 million per annum. Between 1989 and 1992, FDI inflows were still insignificant compare to the capital needs of the country. However, the period between 1994 and 2005 witnessed moderate inflows reaching a quantum of US$ 368.17 million owing to the Economic Recovery Program implemented by the government and partly due to the privatization of Ashanti Goldfields. From 2005 onwards, the FDI inflows continue to witness an increase reaching 39.54 billion in 2015.

**3.0 Review of Related Literature**

This section provides a summary of closely related literature on the relationship between foreign capital inflows (ie. aid and FDI) and economic growth. It is unequivocal that foreign capital inflows play a vital role in the development process of developing countries. This assertion has been empirically analysed using different theoretical and econometric tools. This area of study has attracted considerable attention for the past four decades given the importance of development assistance to poor countries. While some studies have predicted a positive impact of development assistance on growth, others have reported contrary results.

**3.1 Foreign aid and economic growth**

The role of foreign aid to economic growth and development cannot be overemphasized. Foreign Capital Inflows continue to remain the most crucial financial resources for developing countries until such time that developing nations are able to stand on their feet and wean themselves off foreign assistance. The argument has been made that a large infusion of aid into developing countries is a recipe for escaping the poverty trap and promoting economic development.

Earlier studies by Chenery and Strout (1966), Papanek (1972) concluded that foreign aid has a positive impact on economic growth. This conclusion emboldened the belief of policy makers and development economists that poverty could be generally alleviated through increased allocation of development assistance and that developing countries could utilize their own economic resources to engender maximum prosperity and welfare through implementation of sound economic policies.

However, it is sad to note that, after decades of this ground breaking research, many countries continue to remain poor and poverty is still an issue in developing countries. In recent years, the urge for aid allocation among donors had declined considerably. This apparent failure has been explained by some academic papers. Most of these papers have argued that aid has historically been ineffective in promoting growth, that it is "growth-neutral" (Boone 1994, 1996; Easterly etal 2004) or even "depresses growth"(Mosley etal 1987, Bobba and Powell, 2007) and large increases in aid are therefore unwanted. This link between foreign aid and economic growth in developing countries has been quiet contentious and presents a conundrum which many academic researchers, development economists and donor agencies in many years are struggling to unravel.

According to Burnside and Dollar (2000), foreign aid is effective only when countries have good economic policies. This result gave new flavour to the debate and also triggered many academic studies on aid-growth nexus. Not only has this policy dimension ramp up the interest of researchers and policy observers, it has also had considerable influence on donors’ decisions and polices (Easterly etal 2003). This finding could have a devastating effect on developing economies given their limited resource capacity and the argument that aid should be channeled to countries with good policy environment because many developing countries with poor policies would be greatly affected. Following Burnside and Dollar (2000), many empirical works emerged to re-examine the aid-growth nexus, taking into consideration the aforementioned policy view, in particular (Collier and Dehn 2001; Dalgaard and Hansen 2001; Hansen and Tarp 2001; Collier and Dollar 2002; Burnside and Dollar 2004; Mosley, Hudson and Verschoor (2004); Dalgaard etal 2004; Easterly etal 2004; and Rajan and Subramanium 2005, inter alia). Although, while several papers disagree with Burnside and Dollar (2000) some share similar view.

Also, Orji etal (2014) employed Seemingly Unrelated Regression Estimation (SURE) technique to examine the implications of four different types of foreign capital inflows, namely; Foreign Direct Investment (FDI), Official Development Assistance (ODA), Foreign Private Investment (FPI) and Remittances (REM) on output growth of the West Africa Monetary Zone (WAMZ) economies over the period 1981-2010. The study reported that there are differences in the growth impact of the various forms of foreign capital inflows in the WAMZ countries. The result also reveals that more than one form of capital inflow contribute significantly to economic growth in Nigeria. Again, ODA contributes positively to economic growth in Sierra Leone and Ghana, whereas, FDI raises economic growth in Nigeria and Gambia. Remittances contributed the highest in Liberia and none of the inflows has positively impacted on Guinea’s economic growth.

Ikechi (2015) examined the impact of foreign capital inflows on economic growth of Sub-Saharan African countries with special emphasis on Nigeria, Ghana and South Africa using a multiple regression technique. The outcome of the study revealed that there is no significant long run relationship between foreign capital inflows and the level of economic growth in Nigeria and South Africa. However, FDI was significantly and positively related to economic growth in Ghana. It was also revealed that, there exist causal relationships between capital inflow indicators and economic growth in the aforementioned countries. The author attributed the inconsistencies of the results to the fact that foreign capital were allocated on the basis of speculations, thus targeted at the non-priority sectors of the economies and are also channeled into businesses with short gestation periods.

Ahmad etal (2016) used panel unit root test and pooled mean group (PMG) estimation to analyse short and long run impact of foreign capital inflow on economic growth in 21 developing countries for the period of 1990 to 2013. The results indicate that inflows including net external debt and net official development assistance have significantly negative impact on economic growth of developing countries, while net foreign direct investment and net remittances have positive and significant impact on economic growth in the long-run.

In recent years, two major papers have emerged in the academic journals one focusing on country specific analysis and the other on cross-sectional analysis. The major findings of both papers point to a positive and significant impact of foreign capital on growth. In particular, Okafor etal (2016) investigated the relationship between foreign capital inflows and economic growth in Nigeria by adopting FDI, FPI and FA as proxies for foreign capital inflow. The study utilized Toda Yamamoto causality test and found that there is bi-directional causality running from GDP to FDI as well as from FDI to GDP. The result also revealed that there is a unidirectional causality between FPI and GDP with causation running from FPI to GDP. Furthermore, the result showed a unidirectional causality between GDP and FA with causation running from FA to GDP. Finally the joint causation between all the components of foreign capital inflow i.e. FDI, FPI, FA and GDP indicates that increase in foreign capital inflow leads to a positive increase in GDP.

Latest studies by Chorn and Siek (2017) on the impact of foreign capital inflows (ie. foreign direct investment (FDI) and official development aid (ODA) on economic growth of developing countries using sample of 77 developing countries from all regions classified by the World Bank from year 1997 to 2012. The study employed Ordinary Last Square (OLS) with time and entity fixed effects and robust function in panel data analysis. The results show that both FDI and ODA have positive and significant impacts on economic growth. However, FDI is seen to be more robust and statistically significant. Furthermore, the marginal impacts of FDI and ODA are not without constraint. The marginal impacts of both FDI and ODA on economic growth decrease given the rising level of initial income per head, treating other factors constant. Moreover, provided that its share of gross domestic saving increases the impact of ODA on growth would keep decreasing. The interaction term between FDI and gross domestic saving also has negative sign as portions of GDP, but the estimated coefficient is not statistically significant.

**3.2 Foreign Direct Investment and Economic growth**

FDI is generally recognized as a catalyst for economic development in developing countries. Many scholarly works have focused on the link between FDI and economic growth given the large volume of FDI inflows into developing countries in the last three decades. To model this link, many empirical analyses began with endogenous growth models. Endogenous growth literature shows that FDI can contribute to economic growth through capital formation and technological transfer (Blomstrom et al.1996; Borensztein et al. 1995). The other studies suggest that FDI can impact growth by increasing the level of knowledge through in-service training and the acquisition of skills (de Mello 1997, 1999).

De Mello (1997) argues that the impact of FDI on economic growth seems to hinge on certain favourable factors such economic and technological conditions which exist in host countries. He further opined that developing countries must achieve a certain level of education and infrastructure development as preconditions for ensuring best use of the potential benefits associated with FDI. In effect, FDI appears to have limited effects on economic growth in technologically challenged countries. The empirical studies on the relationship between FDI and growth in developing countries are varied in nature in terms of methodology and instrumentation.

Blomstrom et al. (1992) conclude that FDI has a positive impact on GDP per capital in the presence of human capital accumulation but considering FDI alone yields negative effect. This is because human capital accumulation is a good proxy for the absorptive capacity of developing countries.

Zhang (2006) employed panel data technique to examine the impact of FDI on economic growth in China. This study shows the transmission mechanism through which FDI causes positive as well as negative impacts on economic growth. The study utilised provincial data from the inland and coastal areas of China covering the period 1992–2004 and concludes that FDI has positive impacts on economic growth, and that these impacts are more robust in China’s coastal areas.

Kim and Bang (2008) utilised the autoregressive distributed lag (ARDL) approach to explore the relationship between FDI and economic growth using annual data for the period 1975–2006 and find a long-term equilibrium relationship between FDI and economic growth. The results show FDI has statistically significant impacts on growth in both short and long terms. The results of the Granger causality test indicate that FDI causes economic growth.

However, a clinical examination of the preceding literature shows that the evidence is not only ambiguous but also these studies are fraught with technical, estimation and generalisation challenges. A study by Hoeffler (2002) and Abdul (2004) for example, has shown that cross-section country studies do not provide specific information on a particular country and it is therefore difficult to come out with policy implications specific to a particular country. Furthermore, the lack of consensus on the impact of foreign aid or foreign direct investment on economic growth suggests the need for country-specific studies with recourse to the unique characteristics of the country under consideration. This study will therefore enrich the existing empirical literature on the impact of foreign capital inflows (notably FDI and Aid) on economic growth.

1. **Empirical Methodology**

This section provides the details of data, analytical framework and econometric methodology. It utilizes new econometric modelling by which factor variable obtained from Principal Component Analysis is incorporated in ARDL Model.

**4.1 Data**

This paper employs annual data covering the period 1980 to 2016. A panel of 73 annual macroeconomic series covering a broad spectrum of the Ghanaian economy is collected, which includes real output, labour market, interest rates and aggregate prices. The data set are obtained from World Bank Development Indicators 2017. To estimate the standard ARDL model, the paper uses *Y* defined as real GDP per capita; *FDI* represented by the ratio of net foreign direct investment (in constant US$) to GDP; *FA* is defined as the ratio of Net official development assistance and official aid received (in constant US$) to GDP; capital investment(K) (in constant US$) is proxied by the share of gross fixed capital formation in GDP, *LF* is measured as the total labour force, *trade openness* is the ratio of the sum of import and export values to GDP whiles financial depth variable is created using principal component analysis from five (5) series of global financial development database including (broad money to GDP ratio, private sector credit to GDP ratio, liquid liabilities to GDP, market capitalization to GDP ratio, domestic credit to GDP ratio). We use GDP deflator to convert the series into real values.

**4.2 Model Specification**

The empirical specification to capture the impact of foreign capital inflows on growth is based on the endogenous growth model;

=  (1)

where real aggregate output growth is a function of total factor productivity (ie. level of technology), real aggregate capital stock (a composite of human and physical capital). According to Lipsey (2001), the impact of FDI on economic growth possibly operates through TFP (A). Again Bhagwati (1985) suggests that any gains from FDI on TFP (A) will depend on the volume of trade of a particular host country. Foreign aid can affect the level of technology by contributing to the acquisition of technical knowledge (see Islam, 2003 and Marvotas, 2002). This occurs through the following channel: (1) importation of capital equipment and (2) technical assistance (see Badri, 2009). He further argued that aid finances imports such as machinery and equipment from developed countries. In the context of Ghana, about 50% of total aid comes in the form of technical assistance. We can therefore assume that foreign aid affects output growth through technological progress. On the basis of the above, we assume that the impact of *FA, FDI, trade openness and financial depth* may operate through (TPF).Therefore, total productivity factor function can be stated as:

=) = (2)

Combining equation (1) and (2) plus an error and a constant term, we obtain the following equation;

= (3)

where *α, β, λ, γ, ω*, and *ϻ* are the constant elasticities of output with respective to *K, LF, FA,FDI, Openness and FD* ; is an error term and is a constant term.

Taking the natural log of equation (3), an explicit estimable function is obtained as specified below;

= + + + (4)

where all the variables are defined as previously. The regression coefficient associated *K, L, FA, FDI, OPEN* and *FD* are expected to be positively related to *Y*.

**4.3 Empirical Methodology**

We implement ARDL approach to address the specific objectives of this study. According to Pesaran and Shin (1995), Pesaran and Smith (1997), and Pesaran et al. (2001), the advantages associated with ARDL modelling approach to co-integration far outweigh the other methodologies. The major importance of this framework is that it can be applied without worrying about the regressors being I (1) or I (0), thus making it possible to avoid unit root tests at the initial stage of the empirical analysis. Also, the ARDL approach usually produces unbiased estimates of the long-run model, and the resulting t-statistics are valid even if some of the regressors are endogenous (Harris and Sollis 2003). According to Pesaran and Shin (1995), the long-term coefficients are highly consistent, and their long-term parameters can be inferred using standard asymptotic theory. The equation form for the ARDL model is given by;

=φi∆λi∆γi∆θi∆Ϙi∆α1∆α2∆α3∆) + α4∆α5∆ α6∆α7 ∆ + *υ ECTt-1* + *εt*

where *β0*is the drift component; *εt* is the white noise error term; *υ* is the coefficient of the error correction term (representing the speed of adjustment); *ln (Yt)*, the natural log of real GDP per capita; *ln* (*FDI*), the natural log of the ratio of net foreign direct investment to GDP*; ln (FA)*, the natural log of ratio of net official development assistance to GDP; *ln* (*K*), the natural log of the share of investment; *ln* (*L*), the natural log of labour force, *ln (OPEN),* the natural log of trade openness, *FD*, financial depth; *n*, the optimal lag length; and ∆ the first difference operator; *φi, λi , γi , θi, Ϙi; ωi* and *ϻi* the short-run dynamic coefficients of the model’s convergence to equilibrium while *α1, α2, α3, α4, α5, α6*and *α7* represent long-run elasticity coefficients.

* 1. **Factor Augmented Approach**

We use the principal component analysis to create a composite index for economic activities from seventy-three (73) macroeconomic series. Many papers in the literature have attempted to proxy economic activity with GDP or industrial production. For example, (Mory, 1993, Lardic and Mignon, 2006) used GDP as a proxy for the “economic activity” while Ferderer (1996) used industrial production to represent economic activity. However, Lian etal (2014) argues that most of the macroeconomic variables used as proxies are unlikely to reflect the real theoretical meaning of the variable they intend to represent and thus, suggested either the use of two-step principle components analysis or Bayesian likelihood approach to extract an “index of economic activity” from several macroeconomic series. Following Lian etal (2014), the paper employs the former as it is computationally simply and easy to implement. The essence of principal component analysis is that it reduces multicollinearity and results in a better estimation and prediction. In modelling, the paper uses (73) macroeconomic series to extract the first principal component as our index for economic activity. In the next step of the principal component analysis, we run a correlation analysis between all the 73 series and first principal component created. We observe from (appendix I) that the first principal component is highly correlated with real GDP. According to Lian etal (2014), since this factor variable is unobservable and highly correlated with real GDP, it is reasonable to term it as “real economic activity because it contains information from all the series used. Incorporating this factor variable (ie. real economic activity) in ARDL model provides the basis for the factor augmented ARDL model. Therefore, the paper substitutes GDP per capita with the real economic activity variable while retain all the independent variables to estimate the factor augmented ARDL model. The results of the principal component analysis are presented in appendix I. From appendix I, the first principal component explains about 73.5% of the total variance in the original data.

1. **Empirical Results**

This section provides empirical evidence of estimation of the two models (ie. the standard ARDL and the FA-ARDL). Particularly, it provides results for the stationarity test, bound testing, short-and long-term equilibrium relationship between the variables.

**5.1 Unit Root Test Results**

As a requirement for estimating ARDL model, it is essential to test for stationarity of all the variables of interest to determine the order of integration for each variable. To avoid misleading and spurious results, this step is necessary to ensure that the variables are not second order stationary i.e I (2). The Peasan etal (2001) F-statistics for the bound test is calculated based on the assumption that the variables are either I (0) or I (1) but not I (2). In this regard, the paper employs Augmented Dickey–Fuller (ADF) and Phillips-Perron (PP) unit root test to determine the stationarity of the variables.

The stationarity results presented in Table 1 and 2 below, show that all the variables considered in the model are either I(0) or I(1)

**Table 1.0**

**Results of Augmented Dickey Fuller Unit Root Test**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Constant  Level | 1st Difference | Trend/Constant  Level | 1st Difference | Conclusion |
| Econ  LY | -5.032379\*\*\*  0.237452 | -5.811422\*\*\*  -4.619596\*\*\* | -4.852514\*\*\*  -2.846022 | -6.197629\*\*\*  -4.456245\*\*\* | I(0), (1)  I(1) |
| LK | -2.286759 | -5.415009\*\*\* | -1.871020 | -6.318631\*\*\* | I(1) |
| LLF | -0.337751 | -1.769538 | -3.275457\* | -1.410922 |  |
| FA  LFDI  LOPEN  FIND | -1.135256  -1.013128  -1.097475  -0.337016 | -4.232331\*\*\*  -4.882741\*\*\*  -4.192442\*\*\*  -4.405529\*\*\* | -2.233780  -3.285714\*  -2.419052  -2.387710 | -4.401079\*\*\*  -4.831117\*\*\*  -4.141226\*\*  -4.292692\*\*\* | I(1)  I(1)  I(1)  I(1) |

Note: \*,\*\* and \*\*\* dente stationarity at 10%, 5% and 1% significance level

According to Perron (1989), the statistical power of standard unit root tests to reject the unit root hypothesis diminishes because of structural changes. This appears to be the case of the ADF results; hence the ADF statistics may be misleading because most of the series employed in this analysis have undergone structural changes. To ascertain this, the paper utilises the Phillips-Peron (PP) test. The results of the PP test are reported in Table 2. The results confirm that the variables are either I (0) or I (1) as in the ADF test except labour force but found to be I(1) in the PP test.

**Table 2.0**

**Result of Philip-Perron (PP) Unit Root Test**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Constant  Level | 1st Difference | Trend /Constant  Level | 1st Difference | Conclusion |
| Econ  LY | -4.108629\*\*\*  1.401345 | -7.249748\*\*\*  -3.189785\*\* | -4.055079\*\*  -3.432331\* | -7.470983\*\*\*  -3.369283\* | I(1),(0)  I(1) |
| LK | -1.718641 | -5.942214\*\*\* | -1.668395 | -6.226264\*\*\* | I(1) |
| LLF | 3.449846\*\* | -1.697750 | -4.026206\*\* | -1.406345 | I(0) |
| LFA  LFDI  LOPEN  FD | -1.837231  -1.002759  -0.604615  -0.138446 | -9.420621\*\*\*  -5.538267\*\*\*  -4.870363\*\*\*  -6.292157\*\*\* | -2.788799  -2.888265  -2.297582  -2.859778 | -9.626951\*\*\*  -5.469713\*\*\*  -4.806548\*\*\*  -6.179122\*\*\* | I(1)  I(1)  I(1)  I(1) |

Note: \*,\*\* and \*\*\* dente stationarity at 10%, 5% and 1% significance level

**5.2** **Results of Factor Augmented ARDL Model**

5.2.1 Co-integration test

After the orders of integration of the variables have be determined to be either I(0) or I(1), ARDL bounds tests can be implemented. The paper then utilizes the cointegration test developed by Pesaran et al. (2001) to determine the existence or otherwise of a long-run equilibrium relationship between the variables using lag 1 for the FA-ARDL model. The F-statistics reported in Table 3.0 test the joint significance of long-run relationship between the variables. The hypothesis that there is no long-term relationship between the variables is rejected at 1% level of significance. This is because the F-statistics (6.956837) is greater than the upper bound of 99% critical value (4.43). Hence, there is evidence that there exist a long-run equilibrium relationship between *FA, FDI, LF, Openness, FIND* and real economic activity. In other words, there exist a linear combination of the 1(1) and I (0) variables that links the variables in a stable long-run relationship.

**Table 3.0**

**Results of bounds test for co-integration**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| F-Statistics | 6.956837\*\*\* | |  | |  | Lower bound | | Upper bound | |
| Critical Values |  |  | | 5% | | | 2.45 | | 3.61 | |
|  |  |  | | 1% | | | 3.15 | | 4.43 | |
|  |  |  | |  | | |  | |  | |

**Note:**  The critical values from Pesaran table (2001) with intercept and no trend with four regressors. \*\*\* denote rejecting the null at 1% level of significance.

The short-run estimates are presented in table 4. The results show that in the short-run, foreign aid *(LFA)* is positively related to real economic activity whereas *FDI* has a significant negative impact on real economic activity. Except labour force *(LLF),* all the other control variables are significant and have a positive effect on real economic activity.

**Table 4.0**

**Results of short-run estimates**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Coefficient | Standard Error | T-Statistic | P-Value |  |
| C | 29.71502 | 3.739091 | 7.947125\*\*\* | 0.0000 |  |
| LK | 8.276898 | 1.488109 | 5.562026\*\*\* | 0.0000 |  |
| LLF | 86.51873 | 73.93503 | 1.170199 | 0.2557 |  |
| LFA | 2.198833 | 1.610799 | 1.365057 | 0.1874 |  |
| LFDI | -3.420771 | 0.477273 | -7.167329\*\*\* | 0.0000 |  |
| LOPEN | 16.88064 | 3.601983 | 4.686485\*\*\* | 0.0001 |  |
| FD | 1.418327 | 0.417080 | 3.400616\*\*\* | 0.0028 |  |

Note: \*\*\* denotes significance at 1% level

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| R2  (0.782142) AIC (4.468739) HQIC (4.591217) |  |  |  | |
| Adjusted R2  (0.723489) SIC (4.827882) DW (2.304195) |  |  | |  | |
| F-statistic (13.33487) Prob(F-statistic) (0.000000) |  |  | |  | |

**Table 5.0**

**Results of long-run estimates**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Coefficient | Standard Error | T-Statistic | P-Value |  |
| LK | 6.467566 | 2.092004 | 3.091566\*\*\* | 0.0058 |  |
| LLF | 45.70957 | 26.95589 | 1.695717 | 0.1055 |  |
| LFA | 5.085000 | 1.344947 | 3.780818\*\*\* | 0.0012 |  |
| LFDI | -3.271582 | 0.704040 | -4.646866\*\*\* | 0.0002 |  |
| LOPEN | 2.511038 | 0.509373 | 4.929666\*\*\* | 0.0001 |  |
| FD | 1.668675 | 0.584974 | 2.852561\*\*\* | 0.0098 |  |

Note: \*\*\* denotes significance at 1% level

The long-run parameter estimates are calculated using the short-term coefficients, and it is given by the equation below;

*LY = 29.71502+ 6.467566 (LK)\*\*\* +45.70957 (LLF) + 5.085000 (LFA)\*\*\* - 3.271582 (LFDI)\*\*\* + 2.511038 (LOPEN)\*\*\* + 1.668675 (FD)\*\*\**

The long-run equation above is constructed from Table 5.0. The equation shows that the coefficient of *LFA, LK, FD* and *LOPEN* are positive and significant at 1% level indicating that, in the long run, *foreign aid, capital investment, financial depth* and *trade openness* have positive impact on real economic activity whereas *FDI* is negatively related to real economic activity. Though, *labour force* is positively associated with real economic activity, however, it is statistically insignificant. In particular, a 1% increase in foreign aid leads to approximately 5.09% increase in real economic activity. This finding reinforces earlier findings made by (Orji etal, 2014, Chorn and Siek, 2017, Okafor etal, 2016) that foreign aid has positive effect on economic growth. Also, a 1% hike in *FDI* reduces real economic activity by approximately 3.27%. This implies that FDI inflows into Ghana since 1980 have been counterproductive. Some earlier papers like (Frimpong and Oteng-Abayie, 2006; Athukorala, 2003) reported similar conclusions.

Considering the impact of *capital investment (K),* the results show that movement in real economic activity has a direct link to changes in *capital investment (K).* A 1% increase in *capital investment (K)* boost growth by approximately 6.47%. Again, the paper finds that *trade openness* and *financial depth* are significant at 1% level and has the expected positive impact on real economic activity. This implies that a 1% increase in *trade openness* and *financial depth* lead to a rise in real economic activity by approximately 2.51% and 1.67% respectively.

**5.2 Results of Standard ARDL Model**

**Table 6.0 Results of bounds test**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| F-Statistics | 7.671871\*\*\* |  |  | Lower bound | Upper bound |
| Critical Values |  |  | 5% | 2.45 | 3.61 |
|  |  |  | 1% | 3.15 | 4.43 |

**Note:**  The critical values from Pesaran table with intercept and no trend with four regressors. \*\*\* denote rejecting the null at 1% level of significance.

Table 6.0 reports ARDL bounds tests results from estimation of the standard ARDL model. The above results show that the F-statistics (7.671871) is greater than the Pesaran upper bound critical value at 1% significance level (4.43). Hence, we reject the null hypothesis at 1% level of significance. By implication, there is existent of long-run equilibrium relationship between real GDP per capital growth and the explanatory variables.

**Table 7.0**

**Results of Short-run estimates**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Coefficient | Standard Error | T-Statistic | P-Value |  |
| C | 0.130510 | 0.016390 | 7.962616\*\*\* | 0.0000 |  |
| LK | 0.038215 | 0.008501 | 4.495208\*\*\* | 0.0002 |  |
| LLF | 0.693193 | 0.470662 | 1.472804 | 0.1556 |  |
| LFA | 0.032828 | 0.009490 | 3.459215\*\*\* | 0.0023 |  |
| LFDI | -0.007025 | 0.003722 | -1.887301\* | 0.0730 |  |
| LOPEN | 0.062167 | 0.019765 | 3.145221\*\*\* | 0.0049 |  |
| FD | 0.002475 | 0.003941 | 0.628138 | 0.5367 |  |

|  |
| --- |
|  |
|  |

Note: \* and \*\*\* denotes significance at 10% and 1% level respectively

R2 (0.853179) AIC (-5.606618) HQIC (-5.483897)

Adjusted R2 (0.815114) SIC (-5.251110) DW-Stat (2.140597)

F-statistic (22.41385) Prob (F-statistic) (0.000000)

The results of the short-run dynamic relationship for the standard ARDL model are reported in table 7.0. The results show that in the short-run, *foreign aid (LFA), capital investment (LK),* and *trade openness (LOPEN)* are positively significant at 1% significance level whereas *LFDI* is negatively significant at 10% significant level. We also observe that *labour force* and *financial depth* have the correct signs; however, they are not significant.

**Table 8.0**

**Results of Long Run Estimates**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Coefficient | Standard Error | T-Statistic | P-Value |  |
| LK | 0.076045 | 0.019890 | 3.823329\*\*\* | 0.0010 |  |
| LLF | 1.174259 | 0.405259 | 2.897554\*\*\* | 0.0086 |  |
| LFA | 0.041635 | 0.013170 | 3.161251\*\*\* | 0.0047 |  |
| LFDI | -0.017928 | 0.006376 | -2.811660\*\* | 0.0105 |  |
| LOPEN | 0.061592 | 0.009467 | 6.505861\*\*\* | 0.0000 |  |
| FD | 0.012204 | 0.004361 | 2.798232\*\* | 0.0108 |  |

Note: \*\* and \*\*\* denote significance at 5% and 1% level respectively

*LY= 4.676347+ 0.076045(LK)\*\*\* + 1.174259 (LLF)\*\*\* + 0.041635 (LFA)\*\*\* -0.017928 (LFDI)\*\* + 0.061592 (LOPENESS)\*\*\* + 0.012204 (FD)\*\**

The long-run equation for the standard ARDL model given above is constructed from Table 8.0. The equation shows that *foreign aid (LFA), capital investment (LK), openness (LOPEN), financial depth (FD)* and *labour force (LLF)* have positive and significant impact on real GDP per capita growth whereas *foreign direct investment* *(FDI)* has a negative impact on economic growth. The results imply that a 1% increase in *capital investment* and *foreign aid* leads to approximately 0.08% and 0.04% rise in economic growth (see table 8). *Trade openness* and *financial depth* have a positive association with economic growth. In particular, a 1% increase in *trade openness* and *financial depth* leads to approximately 0.06% and 0.01% increase in economic growth (see table 8). Also, a 1% increase in labour force boosts growth by approximately 1.17% while a 1% increase in *FDI* slow down growth by approximately 0.02%. This confirms the earlier results that FDI is counterproductive in the context of Ghana between 1980 and 2016.

**5.3 Diagnostic Tests**

**Table 9.0 Factor Augmented ARDL Model Diagnostics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LM Test Statistics |  | χ2 | P-value |  |  |
| Serial Correlation |  | 2.864546 | 0.0906 |  |  |
| Heteroscedasticity |  | 13.74411 | 0.3921 |  |  |

Normality (Jarque-Bera)0.321453 0.851525



Fig 4.0 Plot of cumulative sum and cumulative sum of squares for the ARDL model stability

**Table 10.0 Standard ARDL Model Diagnostics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| LM Test Statistics |  | χ2 | P-value |  |  |
| Serial Correlation |  | 0.480698 | 0.4881 |  |  |
| Heteroscedasticity |  | 12.67489 | 0.4732 |  |  |

Normality (Jarque-Bera)0.108491 0.947200

The diagnostic tests presented in Table 9 and 10 show that both regressions underlying the standard ARDL and the FA-ARDL satisfy the assumptions of the model (i.e. no serial correlation, errors are normally distributed and have constant variance) at 5% significance level. The paper also diagnoses for the stability of the short- and long-term relationships over the entire period of the study. The methodology used is based on the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) tests proposed by Brown et al. (1975). Figure 4 and 5 report results of the CUSUM and CUSUM of squares tests for respective models. In both plots, the lines with the light red colours represent the critical lower and upper bounds of the region indicating 5% significance level. It can be inferred from the graphs that there is no evidence of instability in the regression parameters over the study period, since both the CUMSUM and CUMSUMQ lie within the critical bounds of the 5% level of significance.



Fig 5.0 Plot of cumulative sum and cumulative sum of squares for the ARDL model stability

**6. Discussion**

This paper empirically investigates the relationship between foreign capital inflows (i.e *foreign* *aid and FDI*) and economic growth in the context of Factor Augmented ARDL Model. The preceding analysis shows that foreign aid has a significant long-run impact on the Ghanaian economy. Therefore, both models show that foreign aid is a robust determinant of long-run changes in real economic activity in Ghana. However, *FDI* is observed to be negatively related to real economic activity in both short and long-run. According to Frimpong and Oteng (2006), “the negative FDI effect is consistent with past studies confirming that the mining sector FDI dominance does not generate direct-growth impact on the broader economy”. It has been observed that the agriculture and the industrial sectors are two most growth-driven sectors as far as the Ghanaian economy is concerned. Therefore, for FDI to have positive impact on economic activities there must be a shift of focus to the industrial and agricultural sectors of the economy.

Among the control variables, capital investment, trade openness and financial depth proved to be robust determinants of long-run variations in real economic activity. To some degree, Ghana’s trade liberalization policy which began in the 1980’s has helped to open up the economy and as a consequence enhanced economic growth. Though Ghana’s financial market is a fledgling one; however, it is ranked 7th and its Stock Exchange ranked the best in Africa. Over the years, Ghana’s financial market has facilitated the mobilizations of financial resources for economic development. By implication, Ghana’s financial sector has a growth enhancing effect on the wider economy.

Labour force is not a robust determinant of long-term changes in economic activities. Although it has a positive effect on economic activities in both models; however it is only significant in the standard ARDL model. It has been noted that the active age group forms the largest segment of developing countries demography yet many of these young men and women are unemployed. The few who have jobs have little or no incentive to work hard, hence lower worker productivity. This may probably explain the insignificant coefficient of the labour force variable in the *FA-ARDL* model since the factor model assumes a broader definition of the dependent variable (ie. real economic activity)

The major findings of this paper would be crucial to the literature and in particular, given the fact that over the past three decades, aid-output growth literature is full of conflicting results mainly due to differences in empirical analysis (ie. cross-sectional or country specific), instrumentation problems and different econometrics approaches. By employing this new model which incorporates factor variable into a standard *ARDL* model, we are able to identify a clear methodological approach in which foreign aid contributes to the Ghanaian economy. Both models have shown that whiles foreign aid stimulates long-run changes in economic activity; *FDI* retards long-run changes in economic activity. In particular, the positive relationship between foreign aid and output growth in the standard model could not have occurred without the presence of financial depth and trade openness variables.

7. **Conclusions and Policy Implications**   
The study empirically examines the dynamic relationship between foreign capital inflows *(ie. foreign aid and FDI)* and economic activity within the context of Factor Augmented ARDL. This empirical analysis is based on short and long-term equilibrium relationship. The paper uses Principal Component Analysis to extract a composite index from a large set of annual time series data covering the period 1980-2016. It has been observed that the *FA-ARDL* approach to co-integration works better than the standard ARDL approach because the former has more information than the later. The results of the econometric analysis show that foreign aid is a robust determinant of long-run changes in economic activity whereas *FDI* inflows has not necessary improve economic activities in the whole of the study period but rather detrimental to it. This clearly shows that *FDI* has not been channelled into growth enhancing sectors of the Ghanaian economy. The paper also finds that capital investment, trade openness and financial depth are vital for the economy to experience sustained long-term growth. One important critical resource available in abundance to developing counties is their human resources. However, over the years there has not been a conscious effort by policy makers to exploit this all important resource for economic advancement. This may partly accounts for low labour productivity in Ghana. The results also points to a long-term equilibrium relationship between the variables. In the short-term, trade openness and capital investment have a robust positive association with real economic activity, whiles FDI hinders output growth.

The findings detailed above provide a useful policy implication for the Ghanaian economy. On the basis of the evidence, policies geared towards affordable credit by the private sector, including small and medium enterprises (SMEs), would provide an incentive for innovation and ingenuity, value addition in the agriculture, expansion in plant capacity in manufacturing sector to produce desired levels of employment, incomes and overall growth of the economy. Also, the results indicate that ongoing trade agreement between Ghana and EU would be in the better interest of Ghana if the country diversifies it export and add value to its primary commodities to generate more foreign exchange, thereby increasing the country’s foreign reserve to ensure stable currency. Moreover, transforming the financial market and economic landscape will provide many opportunities for enhanced efficiency and growth in the financial market. The current recapitalization of the commercial banks is a step in the right direction but it must be coupled with a strong corporate stock market and also encourage local participation in government bonds. Going forward, government must direct more inflows into the industrial and agricultural sectors of the economy to create more jobs for the bulge youth in the country. Furthermore, since the Ghanaian economy like any other developing economy is highly dependent on foreign capital resources (ie. aid and FDI), there is the need to adhere to sound financial management practices and also strengthen the existing political, economic and social institutions to tackle the corruption menace. Since 2000, it has been noted that donors are inclined to allocate aid base on good policy track record, strong governance credentials, stable political environment and improved institutional framework inter alia. Therefore, for Ghana to enjoy more development assistance it needs to improve upon the above-mentioned criteria. Government must, as a matter of urgency collaborate with private investors to build project portfolio in growth enhancing areas of the economy such as industry and agriculture sectors and persuade potential investors into those sectors.

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**Appendix I**

**Principal Component Analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Principal Component | Eigenvalues | Proportion (%) | Cumulative (%) |  |
| 1 | 53.62387 | 0.7346 | 0.7346 |  |
| 2 | 7.717990 | 0.1057 | 0.8403 |  |
| 3 | 3.188861 | 0.0437 | 0.8840 |  |
| 4 | 1.981647 | 0.0271 | 0.9111 |  |

This section examines the extent to which Ghana’s macroeconomic series are correlated with the real factor variable. It has noted that the factor do not have a clear economic interpretation becauseit is unobservable. However, the correlation between all macroeconomic series and the factor variable provides an idea of what these common factors represent. Thecorrelation results between 73 macroeconomic series and factor variable are provided in the second column of table below. From the table, it can be observed the factor is highly correlated with real GDP. Following the interpretation of Lian et al. (2014), the then factor represents “real economic activity”. The last column presents the loading matrix.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No. | Series ID | Correlation coefficient | | | Factor loading |  |
|  | AGRICPINDEX | | 0.973978242 | | -8.503576103 |  |
|  | BMONGR | | | -0.478287235 | -10.54191797 |  |
|  | CHINVENT | | | 0.731400351 | -8.720492055 |  |
|  | DEP\_INTR | | | -0.119838078 | 6.841144612 |  |
|  | DTOTFISHPR | | | -0.143635454 | 1.999603552 |  |
|  | EXPVAINDEX | | | 0.878179835 | -0.172237223 |  |
|  | EXPVOINDEX | | | 0.534085755 | 0.574966635 |  |
|  | EXTBALGS | | | -0.902749485 | -0.483746025 |  |
|  | FISCAL\_BAL | | | -0.102603759 | 0.19253332 |  |
|  | FPINDEX G | | | 0.993650909 | -2.814301013 |  |
|  | GCFPRS | | | 0.865347999 | 0.980282473 |  |
|  | IMPVA\_INDEX | | | 0.910004067 | 0.810357199 |  |
|  | IMPVO\_INDEX | | | 0.752959833 | 2.648846116 |  |
|  | LAGRICVAD | | | 0.941429368 | -2.394209996 |  |
|  | LANNINC | | | 0.990339757 | -1.524376387 |  |
|  | LASCONFC | | | 0.974576192 | -0.217178421 |  |
|  | LBMON\_GDP | | | 0.884298589 | 2.18787945 |  |
|  | LBMON\_TOTRE | | | 0.21487716 | -0.311137152 |  |
|  | LCPI | | | 0.939331575 | 1.333577256 |  |
|  | LCPRO | | | 0.917000423 | -0.073698492 |  |
|  | LDISCR | | | -0.205919829 | -0.634006007 |  |
|  | LDOMCREF\_GDP | | | 0.7025911 | -2.025873102 |  |
|  | LDOMCREP\_GDP | | | 0.92748633 | -0.088112862 |  |
|  | LEMP\_TOT | | | 0.874756146 | 2.471802099 |  |
|  | LEMPINAGRIC | | | -0.920513435 | 2.259235777 |  |
|  | LEMPININD | | | 0.84339631 | -1.535088636 |  |
|  | LEMPINSER | | | 0.870461232 | 1.161582567 |  |
|  | LEXP\_G\_S | | | 0.971464433 | 4.86736399 |  |
|  | LEXPORTVOL | | | 0.979264163 | -0.944747719 |  |
|  | LFINCONEXP | | | 0.992296185 | 2.50369978 |  |
|  | LGDPDEFL | | | 0.621605534 | 7.180923989 |  |
|  | LGDPPPPWEO | | | 0.991309438 | 4.011415372 |  |
|  | LGDS | | | 0.86419644 | 3.078021826 |  |
|  | LGFC | | | 0.938053129 | -1.237835867 |  |
|  | LGFCF | | | 0.938233487 | -0.182126794 |  |
|  | LGGOVFINCONEX | | | 0.97439787 | -2.698574191 |  |
|  | LGNEXP | | | 0.994376476 | NA |  |
|  | LGNI | | | 0.995701565 |  |  |
|  | LGNIAT | | | 0.975655772 |  |  |
|  | LGNIPCAT | | | 0.842705743 |  |  |
|  | LGNSAVE | | | 0.42872032 |  |  |
|  | LGRVADFC | | | 0.991714138 |  |  |
|  | LGSAVE | | | 0.94336253 |  |  |
|  | LHFINCONEXP | | | 0.982201958 |  |  |
|  | LIMPGS | | | 0.966096391 |  |  |
|  | LIMPORTVOL | | | 0.981102731 |  |  |
|  | LINVAD | | | 0.94809187 |  |  |
|  | LLFPR | | | 0.597899712 |  |  |
|  | LMANVAD | | | 0.842385201 |  |  |
|  | LMARKCAP | | | 0.790416644 |  |  |
|  | LOEXCR | | | 0.894295649 |  |  |
|  | LRENT | | | 0.868683052 |  |  |
|  | LREXCR | | | 0.945816063 |  |  |
|  | LRGDP | | | 0.996461375 |  |  |
|  | LRGDPAEO | | | 0.576528783 |  |  |
|  | LRGDPPC | | | 0.972888768 |  |  |
|  | LRGDPWEO | | | 0.282004286 |  |  |
|  | LSELFEMPTEMP | | | -0.763553153 |  |  |
|  | LSERVAD | | | 0.95491787 |  |  |
|  | LTLF | | | 0.986208137 |  |  |
|  | LTOT | | | -0.922966643 |  |  |
|  | LTOTEMP | | | 0.988812732 |  |  |
|  | LTOTFISHPR | | | 0.350770995 |  |  |
|  | LTOTRES | | | 0.924142792 |  |  |
|  | LUNEMP | | | 0.630161369 |  |  |
|  | LVULEMP | | | -0.888533947 |  |  |
|  | LWSWORK | | | 0.753669022 |  |  |
|  | NETFINAC | | | -0.828907051 |  |  |
|  | NETINAB | | | -0.772728878 |  |  |
|  | NETPRINC | | | -0.787249352 |  |  |
|  | NETTR\_G\_S | | | -0.904181996 |  |  |
|  | NETTRAB | | | 0.817713079 |  |  |
|  | LIVPINDEX | | | 0.962699671 |  |  |

Note: The last two columns present the correlation coefficients between Ghana’s macroeconomic variables and common factors. The factor loadings are extracted by using the principal component analysis