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Effect of Total Factor Productivity on Economic Growth in Kenya: An Empirical Analysis

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Abstract: *The purpose of the study was to build a model to explain the effect of Total Factor Productivity on economic growth in Kenya for the period 1970-2015 after accounting for labour and capital productivity. ARDL bounds test of co-integration is employed and the Error Correction Model reveals that the Total Factor Productivity Components of Foreign Aid and Financial Development have insignificant effect on economic growth and null hypotheses are accepted, while Foreign Direct Investment has significant effect on Economic Growth and the null hypothesis is rejected. The significant Error Correction Terms reveal multidirectional causality between Foreign Direct Investment, Economic Growth and Foreign Aid while there is unidirectional causality between Economic Growth, Foreign Direct Investment, Foreign Aid and Financial Development. A robustness check is then carried out to determine the consistency of the ARDL findings using the Johansen test of co-integration, vector error correction model (VECM) and post estimation tests. The findings reveal consistency in the Error correction terms with (-.91) for ARDL and (-.87) for VECM. The orthogonalized impulse response functions show the effect of permanent and insignificant shocks for the variables. In conclusion to realise significant effect of the Total Factor Productivity components on Economic Growth, the recommended policy actions are to improve governance through public and private sector reforms and reinforce the powers of agencies such as the Ethics and Anti-corruption Commission (EACC), implement structural and economic reforms, lower transaction costs to businesses, and to improve policies for the adoption of technology.*

Keywords*: Total Factor Productivity (TFP), Economic Growth, ARDL, Kenya*
JEL Classification: *047, 040, C51, C22*

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I. Introduction

The classic works in the academic literature pioneered by Solow (1957) defines Total Factor Productivity (TFP) or Multi Factor Productivity (MFP) or Solow Residual as the rate of growth of real output not accounted for by the growth of factor inputs. Similarly, Comin (2006) describes TFP as the portion of output not explained by the amount of inputs used in production. These definitions describe the importance of TFP for growth, economic fluctuations and development as well as likely future research (Comin, 2006).Adapting the definition of Solow (1957) the current study uses the Solow residual model and growth accounting approach to give a theoretical framework to the residual. Growth accounting approach gives more room for decomposition of factor inputs and technological change to economic growth (Abramovitz, 1956). The study is based on the assumptions of a stable functional relation between inputs and output at the economy–wide level of aggregation; inputs are paid the value of their marginal product; The function exhibits constant returns to scale; and technical change has the Hicks neutral form (Constant (K/L)) and Y = AF (K, L).

Issakson (2007) in his strand of literature states that TFP has been constructed to capture all effects that raise the productivity of physical factors including human capital, vintage capital, development expenditures and

economies of scale, government policies, international trade policies and remittances.It is against the background of the literature of Issaksson (2007) that the current study endeavours to use the components of Total Factor Productivity (Foreign Direct Investment, Foreign Aid and Financial Development), which are the avenues through which Total Factor Productivity policy can be transferred, absorbed and improved to affect economic growth after accounting for labour and capital productivity. It is also in this context that the study gives a brief overview of the trend of Total Factor Productivity, its components and economic growth.

1.1 Trend of Total Factor Productivity (TFP) and Economic Growth (EG) in Kenya

1.1.1 Total Factor Productivity in Kenya

Figure 1.1 belowshows the trend for Total Factor Productivity annual average growth rates. Total Factor Productivity was highest in 2013 while lowest in 1999 in Kenya. One of the challenges in economic growth in Kenya is promoting efficiencyby reversing the declining trend and raising Total Factor Productivity to

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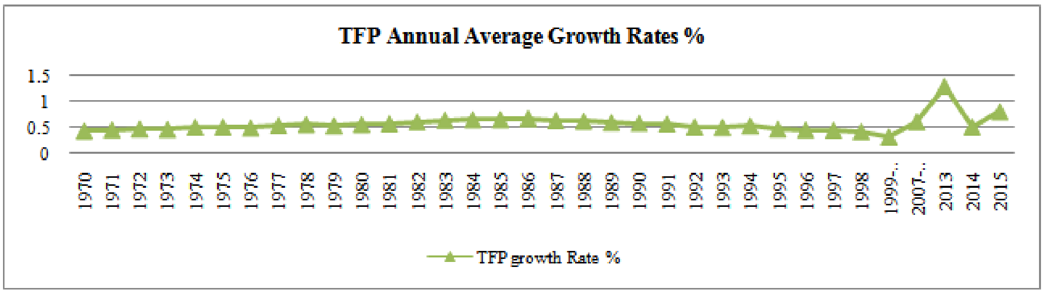
a minimum growth level of 2.5% needed to achieve the vision 2030 targets (see Republic of Kenya, 2003). The declining trends in Total Factor Productivity are evident in the study of Kalio, Mutenyo and Owuor (2012) using

Figure 1.1: Trend of TFP Annual Average Growth Rates: 1970-2015



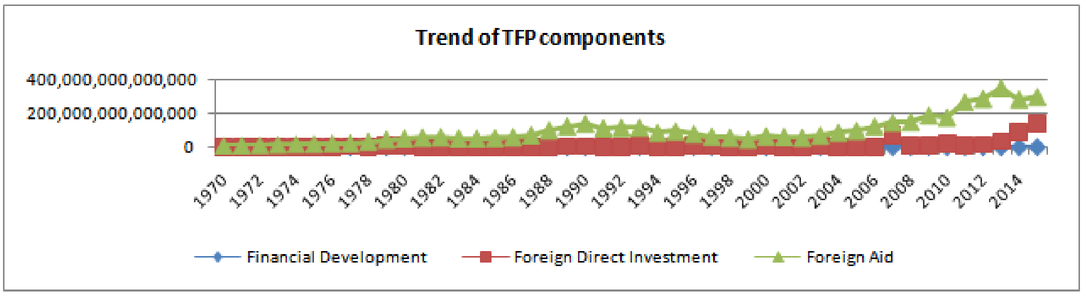
Source of data: Penn world tables 9 data. TFP growth rates at current nominal purchasing power parity for Kenya.

Growth accounting analysis findsaccumulation of classical inputs, capital and labour to be more important than Total Factor Productivity growth with contributions of 71.4%, 25% and 3.6% respectively. In view of this, Total Factor Productivity growth has not been a significant factor in the observed aggregate performance in Kenya. It is therefore important to understand the dynamics of the relationship between the Total Factor Productivity components and Economic Growth in Kenya and the factors contributing to the declining levels of Total Factor Productivity growth.

1.1.2 Total Factor Productivity components and Economic growth in Kenya

Figure 1.2 belowshows the trend of Total Factor Productivity components in the Kenyan economy for the period 1970– 2015. Foreign Direct Investment inflows have significantly increased since 2010 due to the demand stimulating effects of lower oil prices and accommodating monetary policy, and continued investment liberalization and promotion measures (see World Bank, 2016). Financial Development shows low levels due to goods and financial markets which are fragmented, and this prevents the leveraging of cross–border investment opportunities (see African Economic Outlook, 2016). Foreign Aid shows very high levels but despite the high levels there are still regulatory and structural impedimentsthat hinder the growth of Total Factor Productivity

Figure 1.2 Trend of TFP components in the Kenyan Economy: 1970-2015



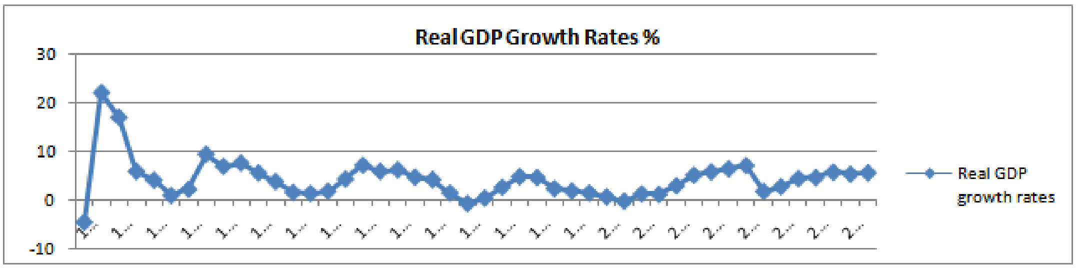
Source of data: Foreign Direct Investment, Foreign Aid: World Bank Database. Financial Development: Kenya National Bureau of Statistics Economic Surveys website.

in the economy (African Economic Outlook, 2016). Nachega and Fontaine (2006) using growth accounting analysis and vector autoregressive (VAR) model found that physical capital formation, foreign aid, openness to trade and financial development have positive and significant effects on economic growth.

1.1.3 Overview of Economic growth in Kenya

A statistical rebasing shifted the base year to 2009 and has reclassified Kenya as a low–middle income country – East Africa's largest economy and Africa's ninth biggest economy (see World Bank, 2015). The vision 2030 economic pillar aims at achieving a growth rate of 10% level andsustaining it for a long time. Figure 1.3 below shows the trend of real GDP growth rates from the period 1970–2015. The rise in GDP can be attributed to high Commodity prices, high external financial flows through stimulated foreign direct investment inflows and improved policies and institutions. The fall in GDP can be attributed to effects of poor infrastructure, low domestic credit, low output and low prices of major agricultural exports (see Republic of Kenya, 2003).

Figure 1.3: Trend of Real GDP Growth Rates: 1970-2015



Source: Real GDP growth rates data from World Bank Database

1.2 Problem Statement

The empirical importance of Total Factor Productivity has motivated economists to develop models of Total Factor Productivity (Easterly and Levine (2001). These focus variously on technological change (Aghion and Howitt 1998; Grossman and Helpman 1991; Romer 1990); Impediments to adopting new technologies (Parente and Prescott 1996); externalities (Romer 1986; Lucas 1988); Sectoral development (Kongsamut, Rebelo, and Xie 1997); or cost reductions (Harberger 1998). Easterly and Levine (2001) positon the importance of Total Factor Productivity as a long run determinant of economic growth, suggesting that growth economists should focus on Total Factor Productivity and its determinants rather than factor accumulation. Parente and Prescott (1996) argue that it would be very useful in designing models and policies to determine empirically the relative importance of Total Factor Productivity in economic growth.

The Economic Recovery Strategy Paper for Wealth and Employment Creation (ERSPWEC) 2003–2007 states that one of the challenges of economic growth in Kenya is promoting efficiency by reversing the declining trend of Total Factor Productivity and raising it to a minimum growth level of 2.5% needed to achieve the vision 2030 targets through adoption of new technology, improvement in governance and reducing transaction costs to businesses (see Republic of Kenya, 2003). There are major challenges in the generation, acquisition and absorption of technological capacity and Total Factor Productivity has suffered on this account. This is accounted for by the limited use of foreign technology licences (see Parente & Prescott, 1996). In addition, to achieve the growth target of 10% according to vision 2030 of Kenya, will require continued implementation of prudent fiscal, monetary and exchange rate policies, enhanced effort to raise the level of investments and savings, and accelerating economic and structural reforms under the Economic Recovery Strategy Paper for Wealth and Employment Creation 2003–2007 in order to increase the efficiency of both physical and human capital and raise Total Factor Productivity(see Republic of Kenya, 2003).

On the- basis of the point of motivation by Parente and Prescott (1996), empirical findings of Kalio, Mutenyo and Owuor (2012) and in view of the challenges stated in the Economic Recovery Strategy Paper for Wealth and Employment Creation 2003-2007, the main objective of this study was to build a model to explain the effect of Total Factor Productivity on economic growth in Kenya. The specific objectives were to determine the effect of Foreign Direct Investment, assess the effect of Foreign Aid and evaluate the effect of Financial Development on economic growth in Kenya. In view of the stated objectives the study sought to answer the following hypotheses: Ho_1: Foreign Direct Investment has no effect on Economic Growth in Kenya; Ho_2: Foreign Aid has no effect on Economic Growth in Kenya; and Ho_3: Financial Development has no effect on Economic Growth in Kenya.The contribution of the study is in two significant ways: (i) by modelling the effect of Total Factor Productivity on economic growth, it forms part of the growing literature on Total Factor Productivity in Kenya, and (ii) argues for a refocus of policy to reverse the declining trend of Total Factor Productivityand to drive competitiveness of the economy and boost economic growth and development.

II. Literature Review

This study reviews the theoretical and empirical literature on the effect of Total Factor Productivity on economic growth. The Total Factor Productivity components of Foreign Direct Investment, Foreign Aid and Financial Development have been reviewed independently to show their effect on economic growth.

2.1 Theoretical Literature

2.1.1 Eclectic Paradigm Theory

The eclectic paradigm theory developed by Professor Dunning (1980, 1988, 1993a, 1993b) is a mix of three different theories of direct foreign investment (O-L-I) advantages. The importance of the theory to the study is to explain the positive effect of the O-L-I advantages of Foreign Direct Investment on economic growth in Kenya. "O" from ownership advantages (according to industrial organization theories of Hymer 1960; Kindleberge 1969; Caves 1974) refer to unique competitive advantages and intangible assets in the form of intellectual properties, technology, copyrights, brand name, and patents. "L" from location advantages according to conventional trade theory (Dunning 1988) refers to the "push" or "pull" factors influencing where to produce and are the key factors determining who will become the host countries for the activities of the transnational corporations (Dunning 1993a, 1993b, 2000). "I" internationalization advantages (in accordance with the internationalization theories of Buckley and Carson 1976;Hennart 1991; Dunning and Rugman 1985;Teece 1981; Buckley 1989) refers to the perceived advantage of hierarchical control of value-added activities to overcome market imperfections.

2.1.2 Two–Gap Theory

Chenery and Strout (1962) in their report to the government of Israel titled "Development Alternative in an open economy the case of Israel" led to the birth of the two- gap model.The major assumption of this model is that most developing countries either face a shortage of domestic savings to augment for investment opportunities (savings gap) and foreign exchange constraints to finance the needed capital and intermediate goods (foreign exchange gap) when this happens external finance either grants or loans supplement domestic resources. Aid, unlike domestic savings, can fill the foreign exchange gap as well as the savings gap. The importance of the theory in the study is that the theoretical assumption of the two-gap model is used to explain either the positive or negative effect of Foreign Aid as a component of Total Factor Productivity on economic growth in Kenya.

2.1.3 McKinnon and Shaw Complementarity Theory

McKinnon and Shaw (1973) developed a theoretical framework that helped explain growth inducing effects of financial liberalization in contrast to financial repression. They explain the relationship between Financial Development and economic growth through a model based on "outside" money and analyse the impact of real interest rate on savings deposits, investment and growth. Mckinnon (1973) emphasizes that the removal or relaxation of the administered interest rates would boost capital formation, since the high deposit rates attract the accumulation of moneyand stimulate investment. The importance of the McKinnon and Shaw (1973) complementarity theory to the study is to explain either the positive or negative effect of Financial Development as a component of Total Factor Productivity on economic growth in Kenya.

2.2 Empirical literature

Much empirical support has been found for the effect of Total Factor Productivity components on Economic Growth. Empirical studies on effect of Foreign Direct Investment on Economic Growth have yielded positive results. For instance, Borensztein et al (1998); Balasubramanyan et al (1996); & Bengoa et al (2003); find that Foreign Direct Investment has a significant positive effect on Economic Growth. Similarly, Li and Liu (2005) find positive effect of Foreign Direct Investment on Economic Growth through its interaction with human capital in developing countries, but a negative effect of Foreign Direct Investment on Economic Growth via its interaction with the technology gap. Bende et al (2001) show that the impact of Foreign Direct Investment on Economic Growthis positively signed and significant for Indonesia, Malaysia and Phillipines, while they identify a negative relationship for Singapore and Thailand. Similarly, Marwah and Tavakoli (2004) find that Foreign Direct Investment has a positive correlation with Economic Growth for all four countries.

Looking at Foreign Aid (FA), studies in relation to Foreign Aid and Economic Growth have been carried out in developing countries. Chenery and Carter (1973) looked at the effect of Foreign Aid on development performance over the period 1960–1970 for a group of developing countries, Kenya included. Findings indicated that unsuccessful development led to a reduction in the aid supplied. Similarly, Griffin and Enos (1969); Weisskopf (1972a, b); Aho (1973) and Bacha (1973) study's findings were similar- to Chenery and Carter's (1973).

Regarding Financial Development (FD), existing studies have shown evidence for an association between Financial Development and Economic Growth. Goldsmith (1969) reports a positive correlation between Financial Development and economic activities. De Gregorio and Guidotti (1995) general finding is that Financial Development is associated with improved growth performance and that the impact of Financial Development increases from high to low income countries. Ram (1999) finds a positive association between financial factors and economic development only for high growth countries. Benhabib and Spiegel (2000) find that specific Financial Development variables are associated with specific components of growthandinterpret these findings as an inclusion that financial factors may proxy for broader country characteristics. Therefore, the study fills the gap in literature by building a model to explain the effect of Total Factor Productivity on economic growth in Kenya using the Total Factor Productivity components of Foreign Direct Investment, Foreign Aid and Financial Development to assess the empirical importance of Total Factor Productivity as a source of economic growth in Kenya and to thus argue for a refocus of policy and reverse the declining trend of Total Factor Productivity.

III. Methodology

3.1 Data and Study Variables

The data is time series and the frequency of the data is yearly. The study uses secondary data obtained from World Bank Database and Kenya National Bureau of Statistics Economic surveys various issues website (see Data Collection Workout in section 7). The study variables were measured and defined as shown in Table 1.1 below.

Table 1.1: Source of data and Operationalization of the Variables

Variables	Definition of variables	Source of data	Measurement
Foreign Direct Investment (FDI)	Expenditure of FDI from abroad including technology, patents, and copyrights in $ US (millions) converted to KSHS (thousands).	World Bank database	Ratio of FDI to GDP
Foreign Aid (FA)	Inflows of FA from abroad that includes technical grants and overseas development assistance in $ US (millions) converted to KSHS (thousands).	World Bank database	Ratio of FA to GDP
Financial Development (FD)	Broad money (M3) that includes currency (notes and coins) + demand deposits + time deposits + foreign currency denominated accounts converted to KSHS (thousands).	KNBS website	Ratio of M3 to GDP
Economic Growth (EG)	Gross Domestic Product (GDP) that includes monetary value of total goods and services in the economy in KSHS.	World Bank database	Real GDP growth rates (RGDP)

3.2 Model Specification

The study is based on the Solow Residual model. Solow (1957) considered a simple model with two factors of production labour and capital. Assuming an aggregate production function to be;

Q = F(K, L, t) ……………………………………………………………………………………..............................(3.1)

Where: Q is output, K is capital, L is labour and t is time. The variable t appears in F to allow for technical change represented by A.

In that case the production function takes the special form

Q = A(t) f (K,L)……………………………………………………………………….. (3.2)

Differentiating equation (3.2) with respect to time and dividing by Q we obtain;

$$\frac{\dot{Q}}{Q} = \frac{\dot{A}}{A} + A\frac{\partial f}{\partial K}\frac{\dot{K}}{Q} + A\frac{\partial f}{\partial L}\frac{\dot{L}}{Q} \quad \ldots\ldots(3.3)$$

Where dots indicate time derivatives.

Now defining w_k as $\frac{\partial Q}{\partial K}\frac{\dot{K}}{Q}$ and w_L as $\frac{\partial Q}{\partial L}\frac{\dot{L}}{Q}$ the relative shares of capital and labour and substituting in the above equation.

Note $\frac{\partial Q}{\partial K} = A\frac{\partial f}{\partial K}$ and $\frac{\partial Q}{\partial L} = A\frac{\partial f}{\partial L}$ the results are therefore,

$$\frac{\dot{Q}}{Q} = \frac{\dot{A}}{A} + w_k\frac{\dot{K}}{K} + w_L\frac{\dot{L}}{L} \quad \ldots\ldots(3.4)$$

Where, $\dot{Q}$/Q is the rate of change in output, $\dot{K}$/K is the rate of change of real gross fixed capital and $\dot{L}$/L is the rate of change of labour. Therefore, TFP is given as:

$$\frac{\dot{A}}{A} = \frac{\dot{Q}}{Q} - \left(w_k\frac{\dot{K}}{K} + w_L\frac{\dot{L}}{L}\right) \quad \ldots\ldots(3.5)$$

Using logarithmic rate of change equation (3.4) is written as:

$$\frac{dlnQ}{dt} = \frac{dlnA}{dt} + w_k\frac{dlnK}{dt} + w_L\frac{dlnL}{dt} \quad \ldots\ldots(3.6)$$

For econometric approach equation (3.6) is linearized into the following form:

Ln (Y) = Ln (TFP) + Ln (K) + Ln (L)………………………………………………………………………(3.7)

Where:Y is output (RGDP), TFP is Total factor productivity, K is capital and L is labour.

TFP is further decomposed into the components FDI, FA and FD to explain the effect of TFP on economic growth, and the equation can be defined as:

$$\mathbf{Ln\ TFP_t = Ln\ FDI_t + Ln\ FA_t + Ln\ FD_t + \varepsilon_t} \quad \ldots\ldots(3.8)$$

Where: FDI is Foreign Direct Investment, FA is Foreign Aid and FD is Financial Development and ε_t is for variables outside the model.
The following model was then adopted to explain the effect of TFP on economic growth. The model investigates the short run and long run relationships between the TFP components and economic growth:

$$\mathbf{RGDP}_t = \mathbf{f}\ (\mathbf{FDI}_t, \mathbf{FA}_t, \mathbf{FD}_t) + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(3.9)}$$

Where: RGDP_t = Real Gross Domestic Product at time t, FDI_t = Foreign Direct Investment at time t, FA_t = Foreign Aid at time t, FD_t = Financial Development at time t, ε_t = Represents variables outside the model.

3.3 Data Analysis Procedure

The first step in the data analysis procedure is the descriptive statistics which is estimated to provide explanations on the characteristics of the variables in the study. The second step is the use of the Autoregressive Distributed lag (ARDL) bounds test of co-integration approach to estimate the short and long run relationships among the variables. This method was developed by Pesaran and Pesaran (1997), Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001). The ARDL bounds test of co-integration approach includes a preliminary unit root test, optimal information criterion selection, co–integration test and error correction model (ECM), and for each equation in the ECM,diagnostic tests that include normality test, serial correlation test, multicollinearity test, heteroscedasticity test, omitted variable bias test and model stability test are carried out. After the diagnostic tests the third step involves testing the model for robustness and consistency using the Johansen co-integration procedure, vector error correction model (VECM) and post estimation tests that include normality test, serial correlation test, impulse response functions and predicted co–integrating equation.

IV. Results

This includes discussion of descriptive statistics, ARDL bounds test of co-integration approach and diagnostic tests, and Robustness check and post estimation tests results.

4.1 Descriptive statistics

The descriptive statistics findings in Table 4.1 below show that the average rate of growth of RGDP was -.063 units per annum, average annual flow of FDI was 30188.59 units, average annual flow of FA was 340609.9 units and average annual FD was .3358 units. The highest Maximum value was FA at 987139.1 units while FD was

Table 4.1: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
RGDP	46	-.0637272	6.190081	-14.11769	24.423
FDI	46	30188.59	38645.99	516.87	159593.3
FA	46	340609.9	291470.3	20413.3	987139.1
FD	46	.3358696	.1055478	.05	.51

Note: RGDP = Real Gross Domestic Product, FDI = Foreign Direct Investment, FA = Foreign Aid, FD = Financial Development

lowest at .51 units and RGDP and FDI was 24.42 units and 159593.3 units respectively. The minimum values ranged between -14.11 units for RGDP, FDI was 516.87 units, FA was 20413.3 units and FD was .05 units. The highest and lowest volatility were experienced by FA at 291470.3 and FD at .1055 while FDI was 38645.99 and RGDP was 6.19.

The findings show that the standard deviation is higher than the mean in RGDP and FDI, and RGDP has a negative minimum value which is an indication of high variability for the variables except for FA and FD. To eliminate the negative values in RGDP a constant (20) is added and RGDP becomes RGDP1, while the variability in FDI and RGDP is corrected by transforming using natural logarithm. FA and FD are also transformed to reduce non-normality of data in the variables. Table 4.2 below shows the new findings after transformation. The variability in the variables has been minimised except for lnFD whichShows a negative minimum value and the

Table 4.2: Descriptive statistics for transformed variables (1)

Variable	Obs.	Mean	Std. Dev.	Min	Max
lnRGDP1	46	2.946034	.3172916	1.771557	3.79369
lnFDI	46	9.543804	1.375616	6.247791	11.98038
lnFA	46	12.23658	1.107968	9.923942	13.80257
lnFD	46	-1.162565	.4348038	-2.995732	-.6733446

Note: lnRGDP1, lnFDI, lnFA and lnFD are the variables after transformation standard deviation is higher than the mean. To correct the variability and eliminate the negative value in lnFD, a constant (10) is added to the values of FD, it is then transformed and lnFD now becomes lnFD1.The results are shown in Table 4.3 below. After the descriptive statistics next is the correlation matrix as presented in Table

Table 4.3: Descriptive statistics for transformed variables (2)

Variable	Obs.	Mean	Std. Dev.	Min	Max
lnRGDP1	46	2.946034	.3172916	1.771557	3.79369
lnFDI	46	9.543804	1.375616	6.247791	11.98038
lnFA	46	12.23658	1.107968	9.923942	13.80257
lnFD1	46	2.335569	.0102469	2.307573	2.352327

Note: lnRGDP1, lnFDI, lnFA and lnFD1 are the variables after transformation

4.4 below to determine the relationship between the variables and there is a positive and significant relationship between lnFDI and lnRGDP1. There is a positive and insignificant relationship between lnFA and lnRGDP1. There is a positive and significant relationship between lnFA and lnFDI, while there is a negative and insignificant relationship between lnFD1 and lnRGDP1, and a negative and significant relationship between lnFD1 and lnFDI, lnFA. This implies a negative impact of lnFD1 on all the variables. Notably, there are no two independent variables which are highly correlated which preclude the problem of multicollinearity. Since there is no problem of multicollinearity, the next step was to administer an ARDL bounds test of co-integration approach to determine the short run and long run relationships between the variables as described in the proceeding subsection 4.3.

Table 4.4: Correlation matrix

Variables	RGDP1	lnFDI	FA	FD
lnRGDP1	1.0000	-	-	-
lnFDI	0.3016* (0.0417)	1.0000	-	-
lnFA	0.1839 (0.2212)	0.7071* (0.0000)	1.0000	-
lnFD1	-0.2680 (0.0717)	-0.2968* (0.0452)	-0.3428* (0.0197)	1.0000

*Note: *indicates significant. lnRGDP1 = Real Gross Domestic Product, lnFDI = Foreign Direct Investment, lnFA = Foreign Aid, lnFD1 = Financial Development.*

4.2 ARDL Bounds test of Co-integration approach

4.2.1 Preliminary unit root test results

The first step is the Preliminary unit root test and theARDL approach is applicable where the regressors' are I (0), I (1) or mutually co–integrated and where sample size is small or finite (sample size for study is 46 observations). Therefore, it does not require pretesting of the variables included in the model for unit roots like the Johansen and Juselius (1990) approach. However, it is still necessary to conduct unit root tests because ARDL bounds test approach Fails for variables which are I (2) which leads to crashing of the ARDL technique. The

Table 4.5: Unit root results

Variables	Phillips-Perron test					
	Test statistic		Test critical values z (t)			
	Level	First difference	1 %	5 %	10 %	Mackinnon p value for z (t)
lnRGDP1	- 5.092	-11.598	-3.621	-2.947	-2.607	0.0000
lnFDI	-3.380	-11.365	-3.621	-2.947	-2.607	0.0000
lnFA	- 0.909	- 9.938	-3.621	-2.947	-2.607	0.0000
lnFD1	- 3.956	-16.045	-3.621	-2.947	-2.607	0.0000

Note: lnRGDP1 = Real Gross Domestic Product, lnFDI = Foreign Direct Investment, lnFA = Foreign Aid, lnFD1 = Financial Development.

unit root analysis in Table 4.5 above using Phillips–Perron test (1988) which incorporates an automatic

Correction to the DF (1979) procedure to allow for auto–correlated residuals shows that the variables lnRGDP1 and lnFD1 are I (0) and lnFDI and lnFA are I(1) and thus are applicable for ARDL bounds test approach.The next step was to run an ARDL regression using AIC as the optimal information criterion for the ARDL model as shown in the next subsection 4.2.2.

4.2.2 Selection of AIC as Optimal Information Criterion

AIC is chosen since it a superior method and gives relatively efficient estimates and- this allows the co-integration relationship to be estimated by OLS once the lag order of the model is identified. The findings in Table 4.6 show the estimates after the ARDL regression.After Determining the Optimal information criterion, the next step

Table 4.6: ARDL Regression using AIC as Optimal Information Criterion

ARDL Regression Sample: 1974 - 2015			
Variable	Coefficient	Std. Error	P > | t |
lnRGDP1 *L1*	-.0843394	.1709556	0.625
lnFDI	.0748407	.0469309	0.119
lnFA	-.0336836	.0554739	0.547
lnFD1	-1.660458	5.212704	0.752
Cons	6.251297	12.35011	0.616

was to determine whether there was co–integration and long–run relationship among the variables. The results are proffered in the following subsection 4.2.3.

4.2.3 ARDL Co-integration test results

To check for long run relationship among the variables the following model was adopted;

$$\Delta \mathbf{LnRGDP}_t = \lambda_0 + \sum_{i=1}^{k} \theta_i \,\Delta \mathbf{LnRGDP}_{t-1} + \sum_{i=0}^{k} \delta_i \,\Delta\, \mathbf{LnFDI}_{t-1} + \sum_{i=0}^{k} \pi_i \,\Delta \mathbf{LnFA}_{t-1} + \sum_{i=0}^{k} \pi_i \,\Delta \mathbf{LnFD}_{t-1} + \beta_4 \,\mathbf{LnRGDP}_{t-1} + \beta_5 \mathbf{LnFDI}_{t-1} + \beta_6\, \mathbf{LnFA}_{t-1} + \beta_7\, \mathbf{LnFD}_{t-1} + u_t \ldots\ldots(4.1)$$

Where Δ is the difference operator; RGDP is the proxy variable for economic growth; FDI represents foreign direct investment; FA represents foreign aid, FD represents financial development, t represents time; Ln stands for natural logarithms; k is the lag length and u is the error term assumed to be serially uncorrelated. The parameter,θ_i , δ_i , π_i *are the short run dynamic coefficients of the ARDL model while* β_4, β_5,β_6, β_7*are the long run parameters (elasticity's).*

Table 4.7 below shows the findings for the co–integration test which show that the F statistic (7.368) is greater than both the Narayan (2005) and Pesaran, Shin and Smith (2001) upper critical values I (1) and lower critical I (0) values at 10%, 5% and 1% significant levels where sample size is 46 and thus the null hypothesis of no co-integration is rejected, and this implies that there is co–integration and thereforea long-run relationship among the variables.

Table 4.7: ARDL Co-integration results

Narayan (2005) critical values	10 %		5 %		1 %	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
	2.93	4.02	3.55	4.80	5.02	6.61
Pesaran, Shin & Smith (2001) critical values	2.72	3.77	3.23	4.35	4.29	5.61
F statistic	7.368					
K (3): no of independent variables – lnFDI, lnFA & lnFD1						

When there are multiple co–integrating vectors ARDL approach to co–integration cannot be applied. Hence, the Johansen and Juselius (1990) approach becomes the alternative. But, since there was one co-integrating vector among the underlying variables an ARDL model of the following form was constructed,

$$\mathbf{LnRGDP}_t = \delta_0 + \sum_{i=1}^{k} \lambda_i\, \mathbf{LnRGDP}_{t-1} + \sum_{i=0}^{k} \delta_{1i}\, \mathbf{LnFDI}_{t-1} + \sum_{i=0}^{k} \delta_{2i}\, \mathbf{LnFA}_{t-1} + \sum_{i=0}^{k} \delta_{3i}\, \mathbf{LnFD}_{t-1} + u_t \ldots(4.2)$$

Next, the ARDL model was re–parameterized into an error correction model (ECM)through a simple linear reparametrization.The reparametrization is possible because the ARDL is a dynamic single model equation and of the same form with the ECM.The re-parameterized result from the ARDL model in equation (4.2) gives the short run dynamics and long run relationship of the variablesrepresented by equations (4.3), (4.4), (4.5) and (4.6) as shown in subsection 4.2.4and for each equation an error correction test and diagnostic tests were carried out.

4.2.4 ARDL Error Correction Model

$$\Delta \mathbf{LnRGDP}_t = \varphi_0 + \sum_{i=1}^{k} \varphi_i\, \Delta \mathbf{LnRGDP}_{t-1} + \sum_{i=0}^{k} \beta_i\, \Delta \mathbf{LnFDI}_{t-1} + \sum_{i=0}^{k} o_i\, \Delta \mathbf{LnFA}_{t-1} + \sum_{i=1}^{k} \phi_i\, \Delta \mathbf{LnFD}_{t-1} + \delta ECT_{it-1} + u_{1t} \ldots\ldots(4.3)$$

$\Delta \mathbf{LnFDI}_t = \boldsymbol{\phi}_0 + \sum_{i=1}^{k} \boldsymbol{\phi}_i\ \Delta \mathbf{LnFDI}_{t-1} + \sum_{i=0}^{k} \boldsymbol{\tau}_i\ \Delta \mathbf{LnRGDP}_{t-1} + \sum_{i=0}^{k} \boldsymbol{\pi}_i\ \Delta \mathbf{LnFA}_{t-1} + \sum_{i=1}^{k} \boldsymbol{\phi}_i\ \Delta \mathbf{LnFD}_{t-1} + \boldsymbol{\alpha}_i \boldsymbol{ECT}_{it-1} + \boldsymbol{u}_{2t}$ ……………………………………**(4.4)**

$\Delta \mathbf{LnFA}_t = \boldsymbol{\phi}_0 + \sum_{i=1}^{k} \boldsymbol{\phi}_i\ \Delta \mathbf{LnFA}_{t-1} + \sum_{i=0}^{k} \boldsymbol{\tau}_i\ \Delta \mathbf{LnRGDP}_{t-1} + \sum_{i=1}^{k} \boldsymbol{\pi}_i\ \Delta \mathbf{LnFDI}_{t-1} + \sum_{i=1}^{k} \boldsymbol{\phi}_i\ \Delta \mathbf{LnFD}_{t-1} + \boldsymbol{\alpha}_i \boldsymbol{ECT}_{it-1} + \boldsymbol{u}_{3t}$ ……………………………………**(4.5)**

$\Delta \mathbf{LnFD}_t = \boldsymbol{\phi}_0 + \sum_{i=1}^{k} \boldsymbol{\phi}_i\ \Delta \mathbf{LnFD}_{t-1} + \sum_{i=0}^{k} \boldsymbol{\tau}_i\ \Delta \mathbf{LnRGDP}_{t-1} + \sum_{i=1}^{k} \boldsymbol{\pi}_i\ \Delta \mathbf{LnFDI}_{t-1} + \sum_{i=1}^{k} \boldsymbol{\phi}_i\ \Delta \mathbf{LnFA}_{t-1} + \boldsymbol{\alpha}_i \boldsymbol{ECT}_{it-1} + \boldsymbol{u}_{4t}$ ……………………………………
(4.6)

Where Δ is the first difference operator while $\Delta LnRGDP_{t-1}$, $\Delta LnFDI_{t-1}$, $\Delta LnFA_{t-1}$ and $\Delta LnFD_{t-1}$captures the short run dynamics of the model; u_t 's are the error terms assumed to be uncorrelated; ECT_{it-1} 's are the error correction terms obtained from the equations.The coefficients of the ECT (δ&α) captures the adjustment towards long run equilibrium.

4.2.4.1 Error correction results for equation 4.3

Table 4.8 below shows the findings for the error correction test for equation 4.3 above. The findings show long run (LR) relationship between lnFDI, lnFA and lnFD1 but the coefficients are insignificant except for lnFDI which is significant. This implies that there is insignificant effect of the TFP components –lnFA and lnFD1 on lnRGDP1 in the long run while lnFDI has a significant effect on lnRGDP1 in the long run. lnFD1 has a negative effect on lnRGDP1Implying a 1% increase in lnFD1 results in a 181% decrease in lnRGDP1. lnFDI has a positive effect on lnRGDP1 which implies an increase in lnFDI by 1 percent results in an increase in lnRGDP1 by 8%, while lnFA has a negative effect on lnRGDP1 which impliesan increase in lnFA by 1% results to a decrease inlnRGDP1 by 3%. Holding other factors constant, the effect of TFP components on lnRGDP1 is 625 %. The variables do not presentany disequilibrium caused by short run shocks of the previous period towards long run value.

Table 4.8: Error correction results for equation 4.3

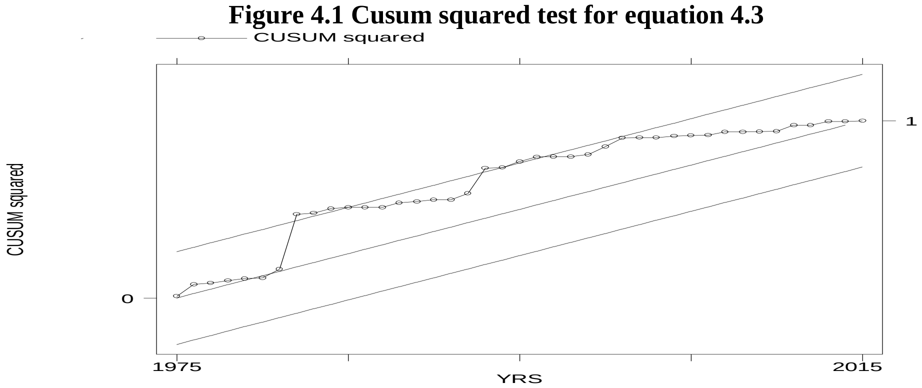
D. lnRGDP1		**LR**	**SR**	**Diagnostic Tests Results**
ADJ lnRGDP1				BG LM = 0.6190 > 0.05
L1	-.91***			BP = 0.1045 > 0.05
	(0.00)			MVIF = 1.66 < 5
lnFDI		.081*		SWILK = lnFA, lnFD1, lnRGDP1 < 0.05,
		(0.09)		lnFDI > 0.05
lnFA		-.036		Ramsey Reset= 0.18 > 0.05
		(0.54)		Cusum squared test = parameter stability
lnFD1		-1.81		
		(0.75)		
Constant	6.25			
	(0.61)			
No. of observations = 42				
R-squared = .44				
Adj R-squared = .38				
Sample = 1974 -2015				

*Note: ***indicates significant at 1%. Numbers in parenthesis indicate p>t. BG LM =Breusch Godfrey langrange Multiplier test, BP = Breusch Pagan test, MVIF =Mean Variance Inflation Factor test, SWILK =Shapiro wilk test. **LR** = long run coefficients, **SR**= short run coefficients. **lnRGDP1** = Real Gross Domestic Product, **lnFDI** = Foreign Direct Investment, **lnFA** = Foreign Aid, **lnFD1** = Financial Development.*

The adjusted lnRGDP1 represents the error correction term which isnegative and significant. This means that the dependent variable lnRGDP1 adjusts back to long run equilibrium following shocks in the short run. The coefficient (-.91) shows that a 1 percent increase in random shocks to equilibrium will lead to 0.91 percent correction in the equilibrium. This shows the speed at 91 percent at which there is adjustment of the model from short run to the long run.

After the error correction test, an ARDL regression is run and diagnostic tests are administered, and the findings are as shown in Table 4.8 above. The model has passed the tests for autocorrelation, heteroscedasticity, and omitted variable bias where p > 0.05, and the null hypothesis is accepted, and no multicollinearity where MVIF < 5 and null hypothesis is accepted. There is normality using SWILK test in lnFDI where p > 0.05, while there is non-normality in lnRGDP1, lnFA and lnFD1 where p < 0.05. Next, Figure 4.1 below shows the findings for the model stability diagnostic test as shown by the Cusum squared test where there is parameter stability if the cumulative sum is within the area of the 5% critical lines (see Brown, Durbin & Evans, 1975).

Figure 4.1 Cusum squared test for equation 4.3



Next, an error correction test is administered for equation 4.4 and results are discussed in the next subsection 4.2.4.2.

4.2.4.2 Error correction results for equation 4.4

Table 4.9 below shows the error correction test for equation 4.4. The findings show long run relationship between lnRGDP1, lnFA and lnFD1 but the coefficients are not significant implying that there is insignificant effect of lnRGDP1, lnFA and lnFD1 on lnFDI in the long run. lnFA has a positive effect on lnFDI implying an increase in lnFA by 1% results in an increase in lnFDI by 26 percent. lnRGDP1 has a positive effect implying a 1% increase in lnRGDP1 results in 387 percent increase in lnFDI. lnFD1 has a negative effect on lnFDI which implies an increase in lnFD1 by 1% results to a decrease in lnFDI by 456 percent. Holding all factors constant, the effect of lnRGDP1, lnFA and lnFD1 on lnFDI is 481 per cent. The short run relationship represents the disequilibrium caused by short run shocks of the previous period towards long run value. 1 % increase in lnFDI results in a decrease in lnFDI by 40% and significant at L2D, a decrease in lnFDI by 28% and insignificant at LD. 1 % increase in lnRGDP1 results in a decrease in lnFDI by 109% and significant at D1 and 1% increase in lnFA results in an increase in lnFDI by 56% and significant at D1. The adjusted lnFDI represents the error correction term which is negative and significant. This means that the dependent variable lnFDI adjusts back to long run equilibrium following shocks in the short run. The coefficient (-.47) represents the speed at which there is adjustment of the model from short run to the long run equilibrium at 47 per cent and shows that a 1 percent increase in random shocks to equilibrium will lead to 0.47 percent correction in the equilibrium. After the error correction test, an ARDL regression is run and diagnostic tests are administered, and the findings are shown in Table 4.9 above. The findings show that themodel has passed the tests for autocorrelation, heteroscedasticity, and omitted variable biaswhere p > 0.05 and null hypothesis is accepted and no multicollinearity where MVIF < 5.

Table 4.9: Error correction results for equation 4.4

D. lnFDI		LR	SR	Diagnostic Tests Results
ADJ lnFDI				BG LM = 0.4045 > 0.05
L1	-.47* (0.10)			BP = 0.9535 > 0.05 MVIF = 3.54 < 5
LD			-.28 (0.20)	SWILK = lnFA, lnFD1, lnRGDP1 < 0.05, lnFDI > 0.05
L2D			-.40** (0.02)	Ramsey Reset= 0.3413 > 0.05
lnRGDP1		3.87 (0.15)		Cusum squared test = parameter stability
D1			-1.09** (0.05)	
lnFA		.26 (0.59)		
D1			.56 (0.13)	
lnFD1		-45.67 (0.36)		
Constant	48.12 (0.35)			

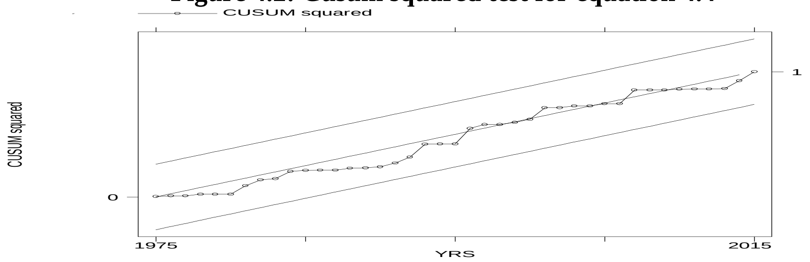
No. of observations = 42
R-squared = .61
Adj R-squared = .52
Sample = 1974 -2015

***** indicates significant at 1%, **indicates significant at 5%, *indicates significant at10%. Numbers in parenthesis indicate p>t. BG LM =Breusch Godfrey langrange Multiplier test, BP = Breusch Pagan test, MVIF =Mean Variance Inflation Factor test, SWILK =Shapiro wilk test.**

**** indicates significant at 1%, **indicates significant at 5%, *indicates significant at10%. Numbers in parenthesis indicate p>t. BG LM =Breusch Godfrey langrange Multiplier test, BP = Breusch Pagan test, MVIF =Mean Variance Inflation Factor test, SWILK =Shapiro wilk test. **LR** =long run coefficients, **SR**= short run coefficients. **lnRGDP1** = Real Gross Domestic Product, **lnFDI** = Foreign Direct Investment, **lnFA** = Foreign Aid, **lnFD1** = Financial Development.*

There is normality using SWILK test in lnFDI where p > 0.05, while there is non-normality in lnRGDP1, lnFA and lnFD1 where p < 0.05. Next the findings for the model stability diagnostic tests in Figure 4.2 below shows that there is parameter stability because the line generated is within the upper bound and lower bound lines of 5 % significance level (see Brown, Durbin & Evans, 1975).

Figure 4.2: Cusum squared test for equation 4.4



Next, an error correction test is administered for equation 4.5 and results are discussed in the next subsection 4.2.4.3.

4.2.4.3 Error correction results for equation 4.5

Table 4.10 below shows the findings for the error correction test for equation 4.5. The findings show long run relationship between lnRGDP1, lnFDI and lnFD1 and the coefficient for lnFDIis positive and significant implying a 1 percent increase in lnFDI results in an increase in lnFA by 81 % in the long run. lnFD1 is negative and significant implying a 1% increase in lnFD1 results in a decrease in lnFA by 429%, also the coefficient for lnRGDP1 is insignificant but there is a positive effect implying a 1% increase in lnRGDP1 results in 20% decrease in lnFA. Holding all factors constant, the effect of lnRGDP1, lnFDI, lnFD1 on lnFA is 314%. The short run relationship represents the disequilibrium caused by short run shocks of the previous period towards long run value. 1% increase in lnFA results in an increase in lnFA at 20% and significant at LD, an increase in lnFA by 16% at L2D and significant. 1% increase in lnRGDP1 results in an increase in lnFA by 6% at D1 and insignificant, increase in lnFA by 28% and significant at LD and increase in lnFA by 35% at L2D and significant. A 1% increase in lnFDI results in a decrease in lnFA by 19% at D1 and is significant, decrease in lnFA by 22% at LD and significant, decrease in lnFA by 16% and significant at L2D and decrease in lnFA by 7% and significant at L3D. 1 unit increase in lnFD1 results in an increase in lnFA by 426% at D1 and is significant. The adjusted lnFA represents the error correction term which is negative and significant. This means that the dependent variable lnFA adjusts back to long run equilibrium following shocks in the short runand shows that a 1 percent increase in random shocks to equilibrium will lead to 0.29 percent correction in the equilibrium. The coefficient (-.29) represents a low speed of 29 percent at which there is adjustment of the model from short run to the long run.

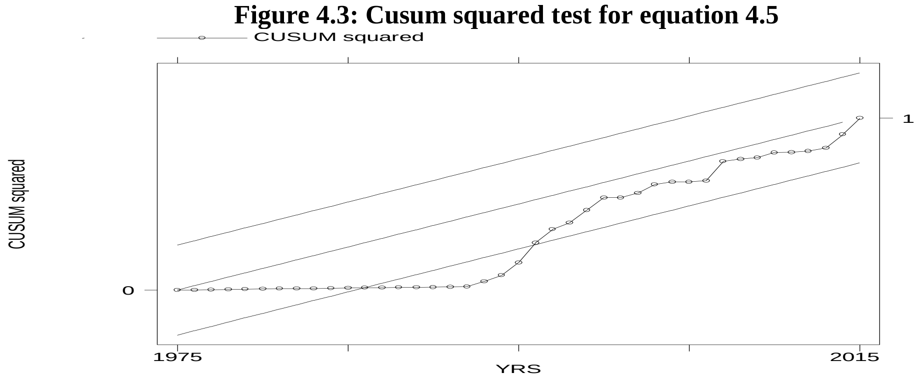
After the error correction test an ARDL regression is run and diagnostic tests are determined. The findings for the diagnostic tests are shown above in Table 4.10 above**.** The model has passed the tests for heteroscedasticity where p > 0.05 and null hypothesis is accepted, and no multicollinearity where MVIF = 5. There is normality using SWILK test in lnFDI where p > 0.05, while there is non-normality in lnRGDP1, lnFA and lnFD1 where p < 0.05 and there is presence of omitted variable bias in the model where p < 0.05 and null hypothesis is rejected, and the model can be made adequate by adding other proxies of foreign aid to the model to make it adequate. There is also presence of autocorrelation in the BG LM test where p < 0.05 and it is transformed using the DW statistic showing 0.79 which indicates positive autocorrelation since the value is closer to 0. Next, the findings for the model stability diagnostic tests are shown in Figure 4.3 below where the model has passed the stability diagnostic test in the cusum squared test albeit some small deviation in the lower bound line, and this implies there is parameter stability if the cumulative sum is within the area between the 5% critical lines (see Brown, Durbin & Evans, 1975).

Table 4.10: Error correction results for equation 4.5

D. lnFA		LR	SR	Diagnostic Tests Results
ADJ lnFA				BG LM = 0.0352 < 0.05
L1	-.29***			DW (transformed) = 0.79
	(0.00)			BP = 0.5892 > 0.05
LD			.20*	MVIF = 5.43 = 5
			(0.06)	SWILK = lnFA, lnFD1, lnRGDP1 < 0.05,
L2D	.		.16*	lnFDI > 0.05
			(0.06)	Ramsey Reset= 0.0065 < 0.05
lnRGDP1		-.206		Cusum squared test = parameter stability
		(0.80)		
D1		.	.68	
			(0.73)	
LD			0.28*	
			(0.06)	
L2D			0.35***	
			(0.00)	
lnFDI		.814***		
		(0.00)		
D1			-.19**	
			(0.02)	
LD			-.22***	
			(0.00)	
L2D			-.16**	
			(0.02)	
L3D			-.077*	
			(0.08)	
lnFD1		-42.96**		
		(0.04)		
D1			42.69***	
			(0.00)	
Constant	31.44**			
	(0.03)			
No. of observations = 42				
R-squared = .90				
Adj R-squared = .85				
Sample = 1974 -2015				

***** indicates significant at 1%, **indicates significant at 5%, *indicates significant at 10%. Numbers in parenthesis indicate p>t. BG LM =Breusch Godfrey langrange Multiplier test, DW = Durbin Watson test, BP = Breusch Pagan test, MVIF =Mean Variance Inflation Factor test, SWILK =Shapiro wilk test. LR =long run coefficients, SR =short run coefficients. RGDP1 = Real Gross Domestic Product, lnFDI = Foreign Direct Investment, lnFA = Foreign Aid, lnFD1 = Financial Development.**

Figure 4.3: Cusum squared test for equation 4.5



Next, an error correction test is administered for equation 4.6 and results are discussed in the next subsection 4.2.4.4.

4.2.4.4 Error correction results for equation 4.6

Table 4.11 below shows the findings for the error correction test for equation 4.6. The findings show long run relationship between lnRGDP1, lnFDI and lnFA and none of the coefficients is significant implying there is insignificant effect of lnRGDP1, lnFDI and lnFA on lnFD1 in the long run. lnFA has a positive effect implying a 1% increase in lnFA results in an increase in lnFD1 by 1%. lnFDI has negative effect implying a 1 percent increase inlnFDI results in a decrease in lnFD1 by 1%, lnRGDP1 has a negative effect implying a 1% increasein lnRGDP1

Table 4.11: Error correction results for equation 4.6

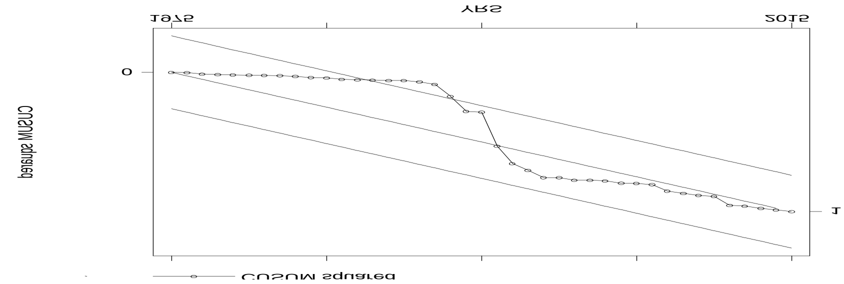
D. lnFD1		**LR**	**SR**	**Diagnostic Tests Results**
ADJ lnFD1	-.14 (0.27)			BG LM = 0.8126 > 0.05
				BP = 0.8133 > 0.05
lnRGDP1				
D1		-.005 (0.78)		MVIF = 3.08 < 5
				SWILK = lnFA, lnFD1, lnRGDP1 < 0.05,lnFDI > 0.05
lnFDI		-.018 (0.33)		Ramsey Reset= 0.0021 < 0.05
D1			.001 (0.20)	Cusum squared test = parameter stability
LD			.002*** (0.00)	
lnFA		.015 (0.45)		
D1			.014*** (0.00)	
LD			-.003* (0.10)	
constant	.33 (0.28)			
No. of observations = 42 R-squared = .84 Adj R-squared = .80 Sample = 1974 -2015				

*Note: *** indicates significant at 1%, ** indicates significant at 5% and * indicates significant at 10%. Numbers in parenthesis indicate p>t. BG LM =Breusch Godfrey langrange Multiplier test, BP = Breusch Pagan test, MVIF =Mean Variance Inflation Factor test, SWILK=Shapiro wilk test.* ***LR****=long run coefficients,* ***SR****=short run coefficients.* ***lnRGDP1*** *= Real Gross Domestic Product,* ***lnFDI*** *= Foreign Direct Investment,* ***lnFA*** *= Foreign Aid,* ***lnFD1*** *= Financial Development.*

results in 0.5% decrease in lnFD1. Holding all factors constant, the effect of lnRGDP1, lnFDI, lnFA on lnFD1 is 33%. The short run relationship represents the disequilibrium caused by short run shocks of the previous period towards long run value. 1% increase in lnFDI results in an increase in lnFD1 by 0.1% at D1 and insignificant, an increase in lnFD1 by 0.2% and significant at LD. 1% increase in lnFA results in an increase in lnFD1 by 1% and significant at D1, a decrease in lnFD1 by 0.3% and significant at LD. The adjusted lnFD1 represents the error correction termwhich is negative and insignificant. This means that the dependent variable lnFD1 adjusts back to long run equilibrium following shocks inthe short runand shows that a 1 percent increase in random shocks to equilibrium will lead to 14 percent correction in the equilibrium. The coefficient (-.14) represents a speed of 14 percent at which there is adjustment of the model from short run to the long run.

After the error correction test, an ARDL regression is run and diagnostic tests are determined. Table 4.11 above shows the findings for the diagnostic tests. The model has passed the tests for autocorrelation, heteroscedasticity, and no multicollinearity where MVIF < 5. There is normality of residuals using SWILK test in lnFDI where p > 0.05 and null hypothesis is accepted while there is non-normality in residuals in lnFD1, lnRGDP1 and lnFA where p < 0.05. There is also presence of omitted variable bias where p < 0.05 and null hypothesis is rejected. The presence of the omitted variable bias is due to the limitation that while M3 the proxy for FD measures financial breadth, there are other proxies of Financial Development such as credit and monetary aggregates which account for broader country characteristics and were not taken into account. Next, the findings for the model stability diagnostic test are shown in Figure 4.4 below where the model has passed the model stability diagnostic test albeit some deviation in the lower bound line and this implies there is parameter stability if the cumulative sum is within the area between the 5% critical lines (see Brown, Durbin & Evans, 1975).

Figure 4.4: Cusum squared test for equation 4.6



The next step was to determine a robustness check and the results are discussed in the next subsection 4.3.

4.3 Robustness check

The findings of the ARDL bounds test approach in subsection 4.2.1 were tested for robustness and consistency using the Johansen co-integration test, VECM approach and post estimation tests. The first step was to determine the unit root results and ensure the variables are I (1) at first difference using the Phillips Perron (1988) test as discussed in subsection4.2. The results are similar in both models since the same procedure is used to determine the unit root test.

Table 4.12: Unit root results

Variables	Phillips-Perron test					
	Test statistic		Test critical values z (t)			
	Level	First difference	1 %	5 %	10 %	Mackinnon p value for z (t)
lnRGDP1	- 5.092	- 11.598	-3.621	-2.947	-2.607	0.0000
lnFDI	-3.380	- 11.365	-3.621	-2.947	-2.607	0.0000
lnFA	- 0.909	- 9.938	-3.621	-2.947	-2.607	0.0000
lnFD1	-3.958	-16.045	-3.621	-2.947	-2.607	0.0000

Next step is the optimal lag length selection as shown in the next subsection 4.3.1

4.3.1 Optimal Lag length Selection results

The second step is the optimal lag length selection and the findings show that the optimallag length was lag 1 – using the AIC criterion since it has the smallest value and is significant. Thus, lag 1 was chosen as an optimal lag for the analysis of the proceeding findings.

Table 4.13: Optimal lag length selection

Sample 1974 - 2015		No. of observations= 42		
lag	p	AIC	HQIC	SBIC
1	0.000	-3.53819*	-3.23489*	-2.71073*

*Note: *indicates significant*

Next, the third step determines co-integration and long run relationship using the Johansen co-integration techniquewhich gives the number of co-integrating equations and their significant lag length as shown in Table 4.14 below.

4.3.2 Johansen Co-integration test

Table 4.14 below presents the findings of the Johansen co- integration test which shows 3 co-integrating equations at lag 1. The findings show some consistency with the ARDL bounds test approach because the ARDL model would only be inappropriate if there were multiple co-integrating vectors.

Table 4.14: Johansen test for co-integration results

Johansen tests for co- integration					
Trend: constant				Number of obs = 45	
Sample: 1971 – 2015				Lags = 1	
Maximum Rank	Parms	LL	Eigenvalue	Trace Statistic	5% Critical Value
0	4	52.848008		88.5908	47.21
1	11	73.241505	0.59602	47.8038	29.68
2	16	86.646694	0.44887	20.9934	15.41
3	19	97.073165	0.37086	0.1405*	3.76
4	20	97.143412	0.00312		

Maximum Rank	Parms	LL	Eigenvalue	SBIC	HQIC	AIC
0	4	52.848008		-2.01043	-2.111155	-2.171023
1	11	73.241505	0.59602	-2.32466	-2.601654	-2.766289
2	16	86.646694	0.44887	-2.497484	-2.900384	-3.139853
3	19	97.073165	0.37086	-2.707105*	-3.185549*	-3.469918
4	20	97.143412	0.00312	-2.625635	-3.12926	-3.428596

*Note: *indicates significant*

After the Johansen co-integration test, the next step is to determine the short run coefficients and the error correction terms using the Vector error Correction Model shown in Table 4.15 below.

4.3.4 Vector error correction model

The findings of the VECM in Table 4.15 below shows there is consistency in the results for Both the ARDL model and VECM for lnRGDP1 where the co-integrating equation one has an error correction term with the value (-.91) for the ARDL model and (-.87) for the VECM. After determining the short run coefficients and error correction term, the next step was to carry out the post estimation tests as shown in subsection 4.4 below. This includes theNormality test, serial correlation test, impulse response functions and predicted co-integrating equation.

Table 4.15: Vector error correction model results

Vector Error-Correction Model

Sample:1971 – 2015 No. of obs = 45 AIC = -3.469918
HQIC = -3.185549
SBIC = -2.707105

Equation	Parms	RMSE	R-sq	Chi2	p > chi2
D_lnRGDP1	4	.299525	0.4519	33.80322	0.0000
D_ lnFDI	4	1.00257	0.4166	29.27304	0.0000
D_lnFA	4	.378495	0.4799	37.82477	0.0000
D_ lnFD1	4	.008119	0.4214	29.85771	0.0000

Equation	Term	Coef.	Equation	Term	Coef.
D_ lnRGDP1	Ce1 *L1*	-.87***	D_ lnFDI	Ce1 *L1*	.0410
	Ce2 *L1*	.060		Ce2 *L1*	.144
D_ lnFA	Ce1 *L1*	.093	D_ lnFD1	Ce1 *L1*	-.004
	Ce2 *L1*	.079		Ce2 *L1*	.030*

***, ** and * indicates significant at 1%, 5% and 10% respectively

4.4. Post estimation tests

4.4.1 Normality of residuals

The normality of residuals is tested using the Jarque-bera test, skewness test and kurtosis test. The findings on Table 4.16 below show normality of the residuals for the other variables except for lnRGDP1 which shows non-normality in the Jarque-bera test, skewness test and kurtosis test where $p < 0.05$. The Langrange multiplier test is used to test for serial auto correlation. The findings in Table 4.17 show that the $p > 0.05$ therefore the null hypothesis of no autocorrelation at lag order is accepted.

Table 4.16: Normality test results and serial correlation results

Variable	Jarque-Bera test Prob > chi2	Skewness test Prob > chi2	Kurtosis test Prob > chi2	Langrange-Multiplier test Lag	Prob > chi2
D_lnRGDP1	0.00000	0.00004	0.000000	1	0.75352
D_ lnFDI	0.52610	0.55806	0.33191	2	0.52467
D_lnFA	0.38901	0.21064	0.57084		
D_lnFD1	0.36352	0.44876	0.22852		
ALL	0.00000	0.00071	0.00000		

The next step in the post estimations test is to estimate the impulse response functions as shown in Table 4.17 below.

4.4.2 Estimating Impulse response functions

Table 4.17 below shows the findings of the impulse response functions which were estimated by setting 13 as the forecast horizon. The values represent the effect of the variables and the shocks on themselves and on other variables from period zero to 13 as shown below.

Table 4.17: Impulse Response functions results

step	(1) oirf	(2) oirf	(3) oirf	(4) oirf	(5) oirf	(6) oirf	(7) oirf	(8) oirf	(9) oirf	(10) oirf
0	.299522	.102803	-.06406	-.001566	0	.997289	.159391	.001812	0	0
1	.061407	.334746	.038979	-.000943	.037232	.236995	.139332	.001384	-.070579	-.136256
2	.035073	.189621	.091189	-.000192	.000494	.08287	.08103	.00006	-.024286	-.102431
3	.013781	.114966	.091692	-.000329	.001039	.043716	.064446	-.000253	-.008776	-.04347
4	.007758	.082008	.088468	-.000433	.0023	.041148	.059118	-.000344	-.002288	-.014783
5	.006078	.07113	.086218	-.000488	.003364	.043522	.057999	-.000358	-.000413	-.003859
6	.005796	.068227	.085263	-.000508	.003816	.045277	.057896	-.000357	.000021	-.000556
7	.005807	.067708	.084938	-.000514	.003973	.046056	.057961	-.000354	.000068	.00021
8	.005846	.067719	.084851	-.000515	.004016	.046328	.058012	-.000353	.000048	.0003
9	.005868	.067783	.084835	-.000515	.004025	.046403	.058034	-.000353	.000031	.000269
10	.005877	.06782	.084835	-.000515	.004025	.046418	.058042	-.000352	.000023	.00024
11	.005879	.067835	.084836	-.000515	.004024	.046419	.058045	-.000352	.00002	.000227
12	.00588	.06784	.084838	-.000515	.004023	.046418	.058045	-.000352	.000019	.000222
13	.00588	.067842	.084838	-.000515	.004023	.046417	.058045	-.000352	.000019	.00022

step	(11) oirf	(12) oirf	(13) oirf	(14) oirf	(15) oirf	(16) oirf
0	.337268	.006141	0	0	0	.004741
1	.053173	.000517	-.043179	-.182366	-.150761	.001685
2	.005226	-.000085	-.025384	-.195397	-.183248	.001188
3	-.00391	-.000143	-.017977	-.173458	-.190747	.001101
4	-.002625	-.000073	-.01458	-.160021	-.191052	.001119
5	-.001011	-.000029	-.013484	-.154296	-.190468	.001138
6	-.000169	-.00001	-.013193	-.152382	-.190078	.001147
7	.000152	-3.6e-06	-.013143	-.151873	-.18991	.001151
8	.000251	-1.9e-06	-.013145	-.151781	-.189854	.001152
9	.000274	-1.6e-06	-.013152	-.151783	-.189838	.001152
10	.000277	-1.6e-06	-.013155	-.151794	-.189835	.001152
11	.000276	-1.6e-06	-.013157	-.1518	-.189835	.001152
12	.000276	-1.7e-06	-.013157	-.151803	-.189836	.001152
13	.000275	-1.7e-06	-.013158	-.151804	-.189836	.001152

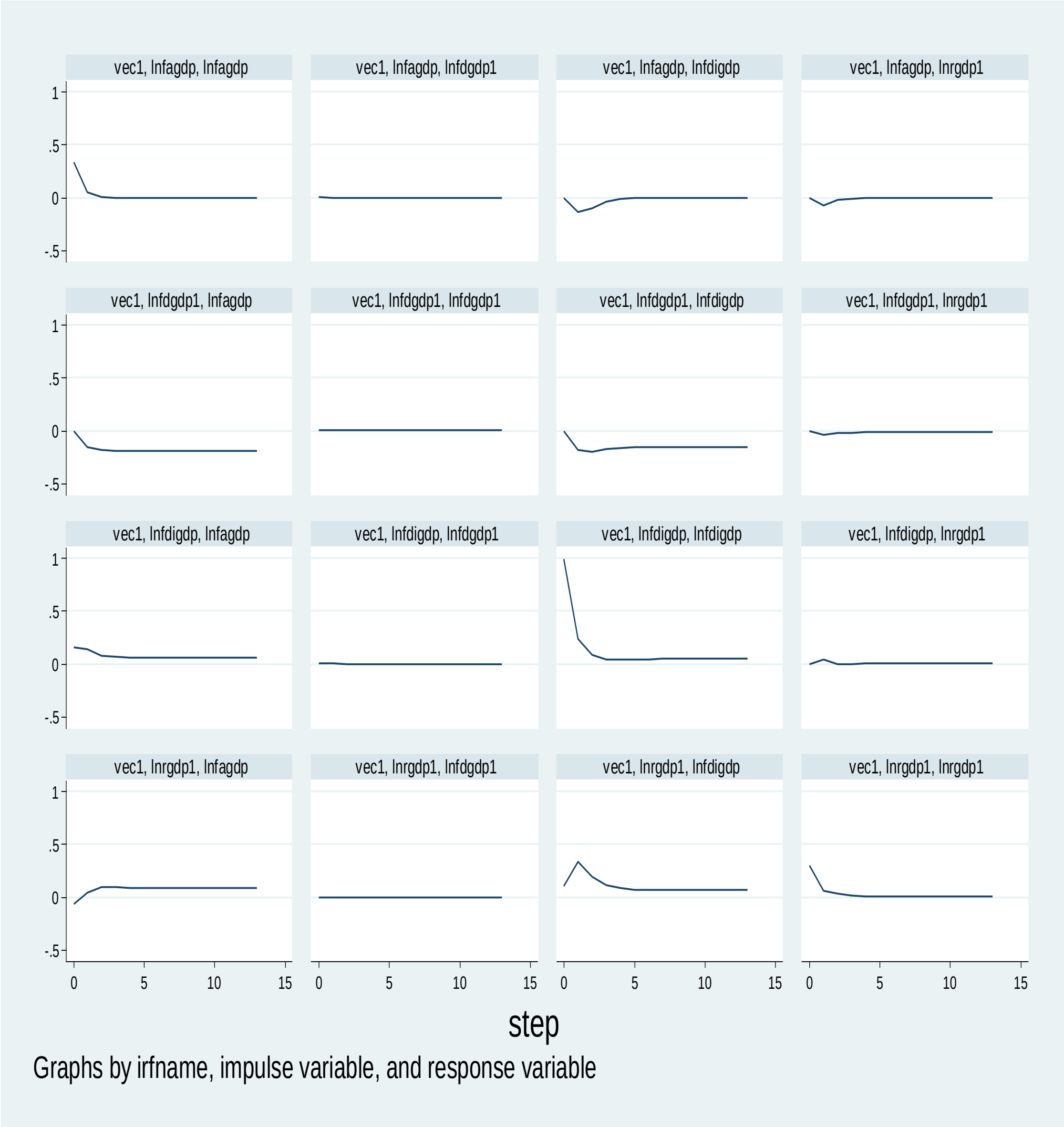
```
(1) irfname = vec1, impulse = lnrgdp1, and response = lnrgdp1
(2) irfname = vec1, impulse = lnrgdp1, and response = lnfdigdp
(3) irfname = vec1, impulse = lnrgdp1, and response = lnfagdp
(4) irfname = vec1, impulse = lnrgdp1, and response = lnfdgdp1
(5) irfname = vec1, impulse = lnfdigdp, and response = lnrgdp1
(6) irfname = vec1, impulse = lnfdigdp, and response = lnfdigdp
(7) irfname = vec1, impulse = lnfdigdp, and response = lnfagdp
(8) irfname = vec1, impulse = lnfdigdp, and response = lnfdgdp1
(9) irfname = vec1, impulse = lnfagdp, and response = lnrgdp1
(10) irfname = vec1, impulse = lnfagdp, and response = lnfdigdp
(11) irfname = vec1, impulse = lnfagdp, and response = lnfagdp
(12) irfname = vec1, impulse = lnfagdp, and response = lnfdgdp1
(13) irfname = vec1, impulse = lnfdgdp1, and response = lnrgdp1
(14) irfname = vec1, impulse = lnfdgdp1, and response = lnfdigdp
(15) irfname = vec1, impulse = lnfdgdp1, and response = lnfagdp
(16) irfname = vec1, impulse = lnfdgdp1, and response = lnfdgdp1
```

The next step in the post estimations test is to graph the orthogonalized impulse response functions as shown in Figure 4.5 below.

4.4.3 Orthogonalized impulse response functions

Figure 4.5 below shows the findings for the orthogonalized impulse response functions. The effect of lnRGDP1 on lnFDI shows presence of significant and transitory shocks from period 0 to 3 beyond which at period 4 the shocks become permanent and insignificant, while the effect of lnRGDP1 on lnFA, lnFD1 is permanent and insignificant from period 0 to 13. However, the effect of lnFD1 shocks on itself, lnFA, lnFDI, and lnRGDP1 is insignificant and permanent from period 0 to 13 and therefore exhibits permanent shocks for all periods.

Figure 4.5: Orthogonalized impulse response functions results

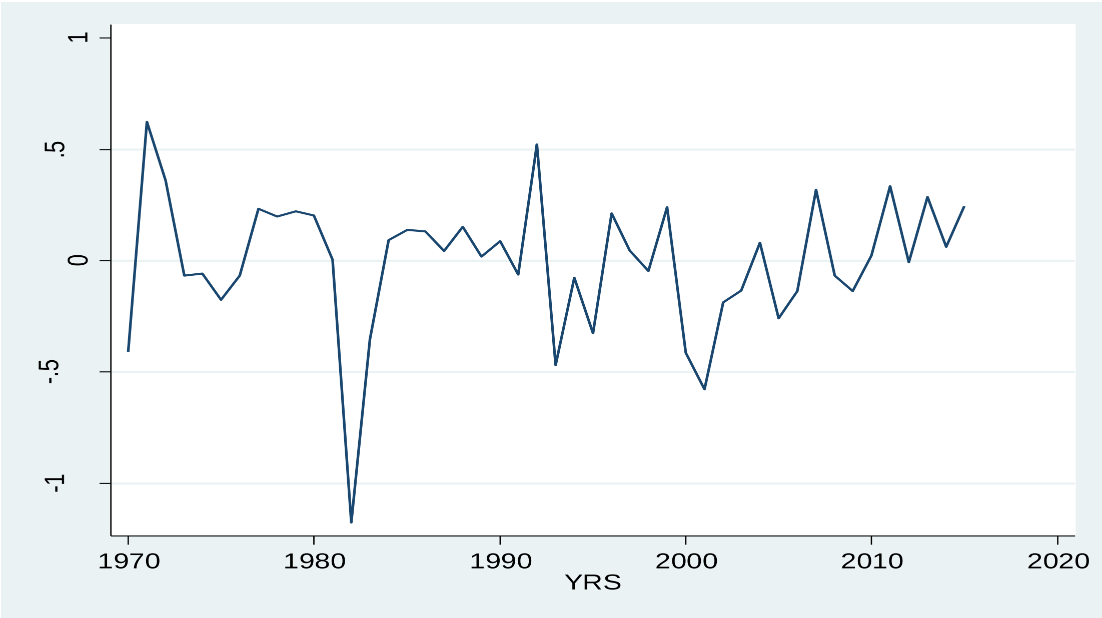


Likewise, the effect of lnFA shocks on itself, lnFD1, lnFDI and lnRGDP1 is insignificant and permanent from period 0 to 13 and therefore exhibits permanent shocks for all periods. The effect of lnFDI shocks on itself, lnFD1, lnFA is insignificant and permanent from period 0 to 13 and therefore exhibits permanent shocks for all periods, while the effect of lnFDI on lnRGDP1 shows presence of transitory shocks from period 0 to 2 beyond which the shocks become permanent. After the impulse response functions the next step in the post estimations test is to graph the predicted values of the co-integrating equations as shown in Figure 4.6 below.

4.4.4 Graph of the predicted values of co-integrating equation

The graph for the predicted values as shown on Figure 4.6 below shows that the model is stableand has the characteristics of a stationary series.

Figure 4.6: Graph of predicted values of co-integrating equations



Next, the findings of the ARDL model are fitted as shown in subsection 4.5 next.

4.5 Model fitting

The ARDL Error Correction Model was represented by equations which are fitted as follows;
The fitted equation (4.3) is as follows for the short run and long run coefficients and ECT;

$$\mathbf{lnRGDP1_t = 6.25 + 0.08_{lnFDI} - 0.03_{lnFA} - 1.81_{lnFD1} - 0.91_{lnRGDP1}} \ldots\ldots \textbf{(4.3)}$$

The fitted equation (4.4) is as follows for the short run and long run coefficients and ECT;

$$\mathbf{lnFDI_t = 48.12 - 0.40_{lnFDI} - 0.28_{lnFDI} - 1.09_{lnRGDP1} + 0.56_{lnFA} + 3.87_{lnRGDP1} + 0.26_{lnFA} - 45.67_{lnFD1} - 0.47_{lnFDI}} \ldots\ldots \textbf{(4.4)}$$

The fitted equation (4.5) is as follows for the short run and long run coefficients and ECT;

$$\mathbf{lnFA_t = 31.44 + 0.20_{lnFA} + 0.16_{lnFA} + 0.06_{lnRGDP1} + 0.28_{lnRGDP1} + 0.35_{lnRGDP1} - 0.19_{lnFDI} - 0.22_{lnFDI} - 0.16_{lnFDI} - 0.07_{lnFDI} + 42.69_{lnFD1} - 0.29_{lnFA}} \ldots\ldots \textbf{(4.5)}$$

The fitted equation (4.6) is as follows for the short run and long run coefficients and ECT;

$$\mathbf{lnFD1_t = 0.33 - 0.01_{lnFA} - 0.003_{lnFA} + 0.002_{lnFDI} + 0.001_{lnFDI} - 0.005_{lnRGDP1} - 0.01_{lnFDI} + 0.01_{lnFA} - 0.14_{lnFD1}} \ldots\ldots \textbf{(4.6)}$$

V. Conclusionsand recommendations

5.1 Conclusions

In line with the declining trend of Total Factor Productivityas stated by the Economic Recovery Strategy Paper for Wealth and Employment Creation 2003-2007, the trend of annual average growth rates of Total Factor Productivity in Figure 1.1 also shows the low levels and the findings revealed that the Total Factor Productivity components -foreign Aid and Financial Development have insignificant effect on economic growth and the null hypotheses were accepted. However, Foreign Direct Investment has a significant effect on Economic Growth and the null hypothesis is rejected. The study concurs with the findings of Kalio, Mutenyo and Owuor (2012) and supports the earlier view that Total Factor Productivity growth has not been a significant factor in the observed aggregate performance in Kenya.The Error Correction Terms for Economic Growth, Foreign Direct Investment and Foreign Aid had negative and statistically significant coefficients, representing long run causal relationship between the variables implying that the variables have multidirectional causality while the Error Correction Term for financial development was insignificant implying unidirectional causality between the variables and Financial Development.

The first objective was to determine the effect of Foreign Direct Investment on Economic Growth in Kenya. The findings show that Foreign Direct Investmenthas a positive effect on Economic Growthand significant and this implies an increase in Foreign Direct Investmentby 1% results in an increase in Economic Growthby 8% in the long run. This finding rejects the null hypothesis that Foreign Direct Investment has no effect on Economic Growth. The findings are similar to Borensztein et al (1998); Balasubramanyan et al (1996); Bende et al (2001) & Bengoa et al (2003) who find that Foreign Direct Investment has a significant positive effect on Economic Growth for the host countries- Indonesia, Malaysia and Phillipines, while they identify a negative relationship for Singapore and Thailand.The findings are also similar -to Marwah and Tavakoli (2004) who find that Foreign Direct Investment has a positive correlation with Economic Growthfor the countries – Indonesia, Malaysia, Phillipines and Thailand. The short run relationship when Foreign Direct Investment is the dependent variable shows significant effects of Foreign Direct Investment on itself, and there are significant effects from Economic Growth.In view of the findings the Eclectic paradigm theory of Professor Dunning (1988) partially only explains the effect of the Ownership-Localisation-Internalisationadvantages of Foreign Direct Investmentas a component of Total Factor Productivity on Economic Growthin Kenya.From the findingsForeign Direct Investmentseems to have significant effect of shocks on Economic Growth, but insignicant effect of shocks on itself, Foreign Aid and Financial Development and this can be concluded to be the stimulating effects of lower oil prices and accomodating monetary policy, and continued investment liberalization and promotion measures (see World Bank, 2016). However, there are high transaction costs to businesses which seem to trade off the positive effects. The effect of the Ownership-Localisation-Internalisationadvantages of Foreign Direct Investmenton Economic Growthin Kenya have not yet reached their full potential, and internationalisation advantages are affected by weak absorptive capacity in terms of physical and human capital whereby competition from new advanced methods stifle the domestic industries thus protectionist policy measures are enacted to protect domestic industries. In terms of ownership advantages, according to Parente and Prescott (1996) there is limited use of foreign technology licenses and this limits the realisation of competitive advantages and intangible assets in the form of intellectual properties, technology, copyrights, brand name, and patents. In terms of localisation advantages the challenge arises from common and specific political and government policies that affect Foreign Direct Investment inflows.

The second objective was to assess the effect of Foreign Aid on Economic Growthin Kenya.The findings show that Foreign Aidhas a negative effect on Economic Growthbut insignificant and implies an increase in Foreign Aidby 1%, results to a decrease in Economic Growthby 3% in the long run. This finding accepts the null hypothesis that Foreign Aidhas no effect on Economic Growth. The findings are not similar- to Nachega and Fontaine (2006) who finds that Foreign Aid has a positive and significant effect on Economic Growth in Niger. However, the short run relationship when Foreign Aid is the dependent variable shows that Foreign Aidhas a significant effect on itself and there are significant effects from Economic Growth, Foreign Direct Investment and Financial Development.Also, the findings though not similar can be explained by the findings of Chenery andCarter (1973) who looked at the effect of Foreign Aid on development performance over the period 1960-1970 for a group of developing countries Kenya included for the period 1962-1975 by determining aid requirements as a function of growth objectives and domestic performance. Findingsindicated that unsuccessful development led to a reduction in the aid supplied. Therefore, although the total supply of public funds for external assistance can be given, its distribution depends both on donor policy and performance of recipients. It is worth noting that Kenya has been ranking highly in the corruption index, and this has hampered its development efforts and its ties with development partners (see ERSPWEC, 2003-2007). In view of the findings the two-gap model explains the negative effect of Foreign Aid as a component of Total Factor Productivity on Economic Growth in Kenya. The effect of Foreign Aidshocks on itself, Economic Growth, Foreign Direct Investment and Financial Developmentis insignificant and that there is presence of permanent shocks and this can be concluded to be from regulatory and structural impediments that hinder the growth of Total Factor Productivity in the economy. It is also evident that earlier structural adjustment programmes under the Bretton Woods Institutions and other donors in the 1990s that were meant to aid economic recovery failed (see African Economic Outlook, 2016).

The third objective was to evaluate the effect of Financial Development on Economic Growthin Kenya. The findings show that Financial Developmenthas a negative effect on Economic Growthbutinsignificant and implies a 1 % increase in Financial Development results in 3% decrease in Economic Growthin the long run. This finding accepts the null hypothesis that Financial Developmenthas no effect on Economic Growth. The findings are not similar to Nachega and Fontaine (2006) who finds that Financial Development has a positive and significant effect on Economic Growth. However, the short run relationship when Financial Development is the dependent variable shows that Financial Developmenthas significant effects on itself, and there are significant effects from Economic Growth.From the findings the proxy for Financial DevelopmentM3 has a negative effect on Economic Growth and according to Benhabib and Spiegel (2000) there are other proxies which are credit and monetary aggregates which if included can proxy for broader country characteristics and thus eliminate the negative effects of Financial Development on Economic Growth.In view of the findings the Mckinnon and Shaw complementarity theory can be taken to explain the negative effect of Financial Developmentas a component of Total Factor Productivity on Economic Growthin Kenya since it found mixed empirical support. It can also be noted that Financial Developmentshowed the effect of insignificant and permanent shocks for all periods on itself, Economic Growth, Foreign Direct Investment and Foreign Aid and this can be concluded to be the effects of fragmented goods and capital markets which prevents the leveraging of cross-border investment opportunities (see African economic Outlook, 2016) and also weak financial systems which can cause negative effect on growth of the economy due to the microeconomic rationale that weak financial systems cause the existence of frictions in the trading system (see Issaksson, 2007).The negative effects of financial liberalization are argued by neostructuralists who criticized the McKinnon-Shaw school and predicted that financial liberalization would slow down growth.

5.2 Recommendations for policy action

To mitigate the declining levels of Total Factor Productivity and to realise significant effect of Total Factor Productivity components on Economic Growth, the following policy actions are recommended in addition to the ones proposed by the Economic Recovery Strategy Paper for Wealth and Employment Creation2003-2007. Multidirectional causality implies that the variables are interdependent on each other as Total Factor Productivity components and any policy action to mitigate the shocks in one variable must also accompany policy actions in the other variables.The first policy action by the Economic Recovery Strategy Paper for Wealth and Employment Creation 2003-2007 states that reducing transaction costs to businesses will enable to attract Foreign Direct Investment, also in the same line simplifying of business rules and regulations and harmonizing competition law and sectoral regulatory law will enable to reverse the declining trend in Total Factor Productivity growth and mitigate the shocks to Foreign Direct Investment.The second proposed policy action is the improvement of policies for the adoption of technology such as the adoption of Information Communication Technologyin government and education institutionsto promote physical, human and Total Factor Productivity growth and alleviate the weak absorptive capacity in the business environment and limited adoption of foreign technology licences. Total Factor Productivity growth is unlikely to be achieved without investments in physical and human capital, which in turn facilitates the adoption of new technology and thus reverse the declining trend of Total Factor Productivity growth.The third proposed policy action is the accelerating of economic and structural reforms as outlined under the Economic Recovery and Strategy Paper for Wealth and Employment Creation 2003-2007 in order to increase the efficiency of both physical and human capital and raise Total Factor Productivity (see Republic of Kenya, 2003) and to mitigate the transitory shocks in Foreign Aid due to structural and regulatory impediments that hampered the success of the structural adjustment programmes in the 1990s.The conclusion also stated hampered ties with development partners due to Kenya ranking highly in the Corruption Index, thus the fourth proposed policy action is improving governance through institutional reforms in both public and private sector and reinforcing the powers of agencies such as the Ethics and Anti- Corruption Commission (EACC) to oversee corruption and economic crimes as this will in turn reinforce the stability of institutions.The fifth proposed policy action is to strengthen financial systems to world class levels through financial sector reforms to mitigate the shocks to Financial Development and this will raise the level of savings and investments. This is because financial systems play a role in the growth and development process because they provide funding for capital accumulation and diffusion of new technologies, and also in a world where writing, issuing and enforcing contracts consumes resources and also where information is asymmetric and its acquisition is costly, properly functioning financial systems can reduce the information and transaction costs and in the process savers and investors are brought together more efficiently, and ultimately economic growth and development is affected(see Issakson, 2007).A future area for research isthe effect or relationship of TFP components on economic growth in emerging economies and incorporating components such as trade and stability of institutions since the study was limited to the Total Factor Productivity components of Foreign Direct Investment, Foreign Aid and Financial Development.

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Data collection Workout

Table 1: Data collection workout

YRS	FDI	FA	FD	GDP	FDI/GDP	FA/GDP	FD/GDP	FD/GDP1	RGDP1	RGDP
1970	1380000000000	8432000000000	3880160	24368661.91	56630	346020	0.16	10.16	15.47	-4.531
1971	740000000000	9887000000000	4172452	29772169	24860	332090	0.14	10.14	44.42	24.423
1972	630000000000	11289000000000	4754342	34857851.08	18070	323860	0.14	10.14	34.14	14.1445
1973	1726000000000	13989000000000	5928665	36913418.56	46760	378970	0.16	10.16	21.80	1.8022
1974	2342000000000	16546000000000	6037278	38414318.15	60970	430720	0.16	10.16	21.98	1.9816
1975	1715874700000	17986000000000	7257895	38753132.44	44280	464120	0.19	10.19	18.91	-1.093
1976	4637185000000	21694000000000	9069248	39587874.91	117140	548000	0.23	10.23	20.15	0.147
1977	5654522500000	22565000000000	13504110	43330512.60	130500	520760	0.31	10.31	24.89	4.886
1978	3441412900000	32498000000000	15670034	46325517.63	74290	701510	0.34	10.34	23.26	3.2608
1979	8400990300000	44900000000000	17724219	49853205.80	159590	852960	0.34	10.34	23.82	3.81575
1980	7897374500000	51963000000000	17863000	52640000	150030	987140	0.34	10.34	23.36	3.36352
1981	1414755700000	57320000000000	19678000	60460000	23400	948060	0.33	10.33	19.36	-0.6364
1982	1300089400000	59820000000000	23028000	67540000	19250	885700	0.34	10.34	5.88	-14.118
1983	2373884200000	51520000000000	24840000	76840000	30890	670480	0.32	10.32	13.70	-6.2996
1984	1075352700000	51452000000000	28180000	85880000	12520	599120	0.33	10.33	21.12	1.12054
1985	2884594900000	54046000000000	26920000	99860000	28890	541220	0.27	10.27	23.65	3.65165
1986	3272577600000	59727000000000	35680000	116860000	28000	511100	0.31	10.31	22.50	2.49956
1987	3938134400000	70870000000000	39660000	131220000	30010	540090	0.30	10.30	20.81	0.80524
1988	3944300000000	100644000000000	42820000	152680000	25830	659180	0.28	10.28	23.75	3.7479
1989	6218991700000	123028000000000	48360000	172860000	35980	711720	0.28	10.28	20.76	0.75869
1990	5708109600000	138332000000000	58040000	198780000	28720	695910	0.29	10.29	22.02	2.0165
1991	1883097600000	113438000000000	71740000	227240000	8290	499200	0.32	10.32	18.30	-1.7038
1992	636313300000	116106000000000	96540000	255760000	2490	453960	0.38	10.38	30.75	10.7478
1993	14565551700000	116977000000000	124820000	321240000	45340	364140	0.39	10.39	11.28	-8.7163
1994	743241200000	86576000000000	205820000	400680000	1850	216070	0.51	10.51	14.67	-5.334
1995	4228924800000	94979000000000	231080000	4652800009	910	20410	0.05	10.05	19.05	-0.9508
1996	10867293100000	78531000000000	267820000	526620000	20640	149120	0.51	10.51	19.59	-0.4051
1997	6209680900000	62866000000000	294052000	623235000	9960	100870	0.47	10.47	17.33	-2.668
199	26548245000	5665400000	3037500	69091000	3840	82000	0.44	10.44	16.30	-

8	00	0000	00	0						3.7013
1999	5195345500000	44996000000000	312116000	742135000	7000	60630	0.42	10.42	22.22	2.22268
2000	11090455000000	64830000000000	314686000	967838000	11460	66980	0.33	10.33	12.73	-7.2739
2001	530262200000	60679000000000	322923000	1025918000	520	59150	0.31	10.31	11.05	-8.9501
2002	2761844700000	55877000000000	350733000	1038764000	2660	53790	0.34	10.34	15.81	-4.1909
2003	8173824000000	69649000000000	395116000	1141780000	7160	61000	0.35	10.35	16.50	-3.5004
2004	4606393100000	87170000000000	511425000	1274328000	3610	68400	0.40	10.40	19.34	-0.6595
2005	2121168500000	97685000000000	557750000	1415724000	1500	69000	0.39	10.39	13.92	-6.082
2006	5067472500000	122744000000000	653035000	1622434000	3120	75650	0.40	10.40	15.57	-4.4334
2007	72904414600000	146663000000000	777596000	1833510000	39760	79990	0.42	10.42	24.01	4.0114
2008	9558568000000	149152000000000	901055000	2107589000	4540	70770	0.43	10.43	16.13	-3.874
2009	11625760800000	189725000000000	1045657000	2366984000	4910	80150	0.44	10.44	14.91	-5.0851
2010	17806460600000	177474000000000	1271638000	3169301000	5620	56000	0.40	10.40	18.25	-1.7543
2011	13986209100000	268579000000000	1514152000	3024782000	4620	88790	0.50	10.50	22.38	2.37815
2012	16341021000000	288254000000000	1727686000	4261150000	3830	67650	0.41	10.41	17.51	-2.4917
2013	37184669600000	352638000000000	1996242000	4730800000	7860	74540	0.42	10.42	23.27	3.2704
2014	94432730500000	285132000000000	2329978000	5398020000	17490	52820	0.43	10.43	18.40	-1.6044
2015	143700000000000	300150000000000	2658165000	6224369000	23090	48220	0.43	10.43	22.07	2.0701

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