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Determinants of Foreign Direct Investment in Tanzania: Co-integration and Error Correction Model Analysis

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Abstract
This study identifies the determinants of foreign direct investment in Tanzania over the period spanning from 1970 to 2012. In order to investigate the determinants, the study utilizes time series analysis employing the multiple regression analysis. The study tests for unit root using Augmented Dickey Fuller (ADF) test and co integration test using Engle-Granger residuals co integration test and Johansen co integration test to affirm if the variables are co integrated. Furthermore, the study estimate long run and short run coefficients using Error Correction Model (ECM). Generally speaking, empirical results suggest that gross domestic product (GDP), openness and inflation rates are main determinants of FDI in Tanzania. Moreover, results further reveal that variables are adjusting to long run equilibrium at the speed of 53 percent per annum. Also structural break in long run suggest stable contributions of these variables in FDI in Tanzania. Thus, in this context, Tanzanian government ought to earmark GDP, openness and inflation rates as crucial variables in attracting FDI in Tanzanian economy. However, it should be clear that not only these variables are essential for determining FDI in Tanzania but these variables have significant contributions as per adjusted R-square since have 70 percent of power in explaining FDI inflow in Tanzania.
Keywords: Determinants of foreign direct investment, Error correction model, Foreign direct investment, Tanzanian foreign direct investment.

1.0 Introduction

Foreign Direct Investment (FDI) is an important component for economic development in any country Tanzania being among. In most cases FDI is used as driver to improve the investment in the respective country. Improving investment is a pre-requisite condition for economic growth and development (Suresh and Ramakrishna, 2013). FDI expected to improve economic growth and development of a country through two main aspects. Firstly, capital accumulation in the host country through introduction of new inputs and modern technology in the production line of the host country's economy. Secondly, FDI expected to transfer new knowledge to the recipient country through imparting new skills to labour under labour training, provision of managerial skills and acquisition of new skills to other sectors. This is mostly known as positive spillover effect of FDI (Toulaboe et.al, 2009). However, the contributions of FDI to economic growth in recipient countries are not uniform across the host countries. Foreign direct investment has shown positive contributions for many countries adopted this strategy (Toulaboe et.al, 2009). It is important to note that, volumes and directions of foreign direct investment is not the same across countries and regions. These differences are caused by country's differences in terms of institutional as well as country's specific factors like human capital, openness to foreign trade, investment in infrastructure, financial structure and country's natural endowments. Other factors include political and social security (stability), export shares, population growth, inflation rates and government expenditures amongst others (Toulaboe et.al, 2009).

Furthermore, literatures hypothesize that foreign direct investment play important role in stimulating economic growth in recipient countries. Thus, FDI's role will depend on favorable business environment as well as capability of absorbing the new technology associated with FDI's inflow in the respective country. In this context, UNCTAD (2006) cited in Toulaboe et.al, (2009) pointed out that only one third of foreign direct investment inflows in 2006 went to developing countries. Further, in 2003 to 2005 developing countries received different percentage of FDI inflows. Hereunder is the statistics of FDI inflows to developing countries in period 2003 to 2005. "Asia and Oceania received 21.4 percent of the world FDI inflows, Latin America and the Caribbean received 11.5 percent, and Africa 3.0 percent" (Toulaboe et.al, 2009, p. 155). Again, in 2009 to 2010 FDI increased tremendously in developing and transition economies countries particularly Asian and Latin American countries. For instance, FDI inflows rose by one percent in 2009 from US$1,114 billion to US$1,122 billion in 2010 (UNCTAD, 2010 cited in Ngowi, 2012, p3). Again, Hornberger et.al (2011) provided the status of FDI in developing countries as follows:

"Indeed, developing and transition economies' share of global FDI inflows rose from roughly 19 percent in 2000 to 52 percent in 2010. And half the top 20 FDI recipients in 2010 were developing or transition economies. This is good news, because FDI accounts for a whopping 11 percent of global GDP and more than 80 million jobs worldwide (UNCTAD 2010)" (Hornberger et.al, 2011, p.1).

From these statistics it is clear that prosperity of FDI on economic growth will depend on the prevailing

factors in host country. Thus, any host country which fails to tape advantages of FDI due to any reasons more likely the economy will be affected negatively with FDI inflows. Tanzania in particular, FDI inflows become important player to economic growth immediately after economic reforms of 1986 in which it liberalize trade, financial sector, service industry, mining sector and agricultural sector just to mention a few. However, should be clear that liberalization process took place gradually depending on nature and sensitivity of the respective sector. For instance, many sectors were liberalized in 1990s including financial and agricultural sectors amongst others. Regarding FDI inflows in Tanzania is alarming well after economic reforms. In recent years after financial economic meltdown of 2008, FDI inflow in Tanzania has improved significantly. BoT, NBS and TIC (2009, p.1) cited in Ngowi (2012) revealed that monetary value of foreign direct investment increased by sixteen fold from US$ 47 million to US$ 768 million in 2009 to 2010 respectively. Indeed, this is spectacular increase of FDI inflow in Tanzania. In this line, this study finds it is imperative to examine the determinants of FDI in Tanzania using co integration and error correction model. This technique helps to identify the long run and short run factors which influence FDI in our country. This is done due to fact that currently there influx of investors in Tanzania as pointed out by Tanzania Investment Centre (TIC). Thus, it is important to examine the pull factors of FDI and from there the government can formulate or re-formulate the existing policy in order to suits the need of the investors and economy at large.

2.0 Review of literature

Determinants of FDI inflows in developing countries differs significantly across countries due to number of factors such as population growth, exchange rates, inflation, availability of good infrastructure, institutional framework, market share (proxies of GDP or RGDP), openness to foreign trade, political and social stability, country's natural resource endowments, sources of energy, government expenditure just to mention a few. Really, these factors are the determinants of FDI inflows in many developing countries. Empirical results obtained so far have produced conflicting results. In some countries some factors seem to be more influential than the others whereas the same factors in other countries are not influential factors in determining FDI inflow. For instance, Asiedu (2002) investigated the factors affecting FDI in developing countries being different or same in Sub Sahara African Countries (SSA). Empirical results revealed that higher return on investment and good infrastructure had positive impacts in non-Sub Sahara African countries whereas the same factors had no significant impacts in Sub Sahara African countries. Results further showed that openness to foreign trade found to be significant both in non-Sub Sahara African countries and Sub Sahara African countries. The study concluded that policies which were successful in one region are not equally the same in Sub Sahara African countries (SSA). Generally, the study proved that differences in institutional framework and infrastructure among developing countries bring disparities in determinants of FDI. Also Demirhan and Masca (2008) analyzed the determinants of FDI in developing countries using panel analysis and they found that availability of telephone lines, growth rate per capita and openness to trade were main determining factors of FDI in developing under study whereas tax and inflation rates affected FDI negatively and significantly. Also the study revealed that cost of labour had positive sign but statistically insignificant while risk had negative sign and statistically insignificant. It is of interest to note that empirical results obtained so far producing mixed results. One factor in other countries found to be significant while in other countries is not significant at all.

Similarly, Moreira (2009) reviewed number of articles regarding the determinants of FDI in African countries. From reviewed articles found that African countries apart from natural resources (minerals) and market size also there were other factors which attracts FDI inflows in Africa like good infrastructure, political stability, inflation rates just to mention a few. The study concluded by asserting that those factors sometime used to be as push factors for FDI inflows in African countries once are not well implemented. Congruent to Moreira (2009) also Mottaleb and Kalirajan (2013) found similar results. Mottaleb and Kalirajan (2013) examined sixty eight low income and lower-middle income developing countries. In order to accomplish that mission, the study employed panel analysis and they found that FDI inflows in those countries were mainly determined with larger GDP of a country, high gross domestic product rate of a country, good business environment and the proportionate of country's international trade. Thus, the study concluded by saying that, countries with factors described above were more successful in attracting FDI inflows than countries with low GDP as well as low GDP growth rate, poor business environment among others.

Abubakar and Abdullahi (2013) examined the determinants of FDI in Nigeria and their findings revealed that all variables in long run were not significant determinants of FDI while in short run inflation and market size were significant determinants of FDI. Included variables were market size, natural resources, inflation and openness. Thus, inflation the proxy of macroeconomic stability of Nigerian economy and market size are important variables in attracting FDI in Nigeria. Again, Akpan et.al (2014) examined determinants of FDI in "Brazil, Russia, India, China, and South Africa (BRICS) and Mexico, Indonesia, Nigeria, and Turkey (MINT)" utilizing panel analysis technique. They found that availability of infrastructure, market size, and trade openness were important determinants of FDI in the respective regions. Furthermore, study reveal that presence

of natural resources and institutional quality were not significant determinants of FDI in BRICS and MINT. Market size remains important determining factor between two studies. A study by Maghori (2014) in Nigeria revealed that GDP, real exchange rate and fiscal deficit ratio were important FDI determining factors in Nigeria. Again results affirmed that openness to trade, inflation rate, and debt were main determining factor in FDI inflow. On the other hand, real interest was not important factor in attracting FDI inflow in Nigeria. However, many variables found to be significant in long run than in short run. Really, these findings motive the study to be taken in Tanzania as well.

3.0 Research Methodology

This study follows time series analysis to measure the research objective. The objective of the present study is to examine the determinants of foreign direct investment in Tanzania. In order to examine the determinants of FDI in Tanzania, economic method is imperative using multiple regression equation. Research study employs secondary data spanning from 1970 to 2012 in accomplishing the mission. Modelling in this study is similar with the previous studies like Abubakar and Abdullahi (2013) and Maghori (2014) but to mention a few. Hereunder is the research study model

FDI = F (GDP, OP, INF) (1)

Where FDI is foreign direct investment, GDP is gross domestic product, OP is openness and INF is inflation rates, and F is function of. It is important to understand that there are many factors which determine the FDI in Tanzania but according to availability of data, this study employs only four variables. To be in position to measure the determinants it is imperative to transform the existing equation into econometric model as shown in equation (2). In order to minimize the problems of outliers and heteroscedasticity, all the variables are in natural logarithms in the study model except openness.

$$LnFDI_t = \alpha_0 + \alpha_1 LnGDP_t + \alpha_2 OP_t + \alpha_3 LnINF_t + \varepsilon_t \quad (2)$$

An expected coefficient from this model is positive signs for GDP and Openness and negative sign for Inflation rates. Variables included in this study are adopted from previous studies like Moreira (2009), Abubakar and Abdullahi (2013) and Maghori (2014) just to mention a few.

In most cases many time series data are severely affected by non-stationarity problem as such many regression outputs are spurious. In this context, this study test for non stationarity and stationarity using Augmented Dickey Fuller test (ADF). Moreover, study also test for co-integration amongst the variables. Having established that variables are integrated in same order and are co integration then error correction model is applied. OLS regression under stationary variables its regression outputs are not spurious. It is of interest to note that if the residuals of the regression at level are stationary then outputs at level also is not spurious rather it representing the long run relationship output (Granger and Engle, 1987, Gujarati, 2004 and Utkulu, 2012).

3.1Testing for unit root

The research utilizes the Augmented Dickey Fuller (ADF) test in testing for unit root because this test is more powerful than Dickey Fuller (DF) test in testing for unit root. We this regard, ADF test is utilized in this study.

3.2 Testing for Co integration

This research utilized two techniques in testing for co integration. Firstly, the Engle-Granger residuals co integration test and Johansen co integration test. This is done purposely because the first technique has the power to estimate only one co integrating equation especially in multiple regression analysis. Therefore, in order to supplement the weakness of that technique the study employ the powerful one that is Johansen co integration test in which has the power of estimating more than one co integrating equations under multiple regression analysis. However, Engle-Granger residuals co integration test has the ability to tell whether the equation at level is spurious or not. Thus combing these two tests are imperative decision so as to eliminate the weakness of each test.

3.2.1 Engle–Granger Residuals (EG) or Augmented Engle–Granger residuals (AEG) co integration Test.

This test for co integration has two step procedures. First step of the test requires fitting the co integrating regression by ordinary least squares (OLS) where the variables are at level and are integrated of order one *I* (1) means are non stationary. Second, to test the residuals obtained from step one using the unit root technique being Dickey-Fuller or Augmented Dickey Fuller (ADF). Decision criteria state that if the residuals are stationary, and then the study should reject the null hypothesis of no co integration. On the other hand, if the residuals are non-stationary the study should not reject null hypothesis then variables are not co integrated. Study employs the residual series technique using Augmented Dickey-Fuller test where in this context is known as Augmented Engle–Granger (AEG) test (Granger, 1986, Granger and Engle, 1987). The study employing the following models

(i) Co integrating regression equation

$$LnFDI_t = \alpha_0 + \alpha_1 LnGDP_t + \alpha_2 OP_t + \alpha_3 LnINF_t + \varepsilon_t \quad (3)$$

Residuals estimation equation

$$\Delta U_t = \alpha_1 U_{t-1} + \varepsilon_t \quad (4)$$

H_0: $\alpha_1 = 0$: no co integration (non stationary). Variables are not co integrated

H_1: $\alpha_1 \neq 0$: co integrated (stationary). Variables are co integrated

Rejection of the null hypothesis means the residual is stationary. If the residuals series are stationary then variables are co integrated (Zivot, 2012). On the other hand, if the computed absolute value of the tau statistic exceeds the AEG critical values, reject the null and vice versa are true (Gujarati, 2004: 824). It is important to note that if the residuals of the equation (4) are stationary, then co integrating regression output in step one is not spurious even though individually variables are non stationary (Engle and Granger, 1987 and Gujarati, 2004). Engle and Granger (1987) asserted that *"the valuable contribution of the concepts of unit root, co integration is to force us to find out if the regression residuals are stationary. A test for co integration can be thought as a pre test to avoid spurious regression situations"* (Gujarati, 2004:822). Equation (3) in step one is known as co integrating regression whereas α's are known as co integrating parameters.

3.2.2 The Johansen co integration test

Having seen that Engle and Granger residuals co-integration test has no power to show more than one co integrating equations in multiple regression analysis. This study employs the maximum likelihood method of Johansen (1988) to back up the weakness of the previous test. The Johansen (1988) mostly has two main strengths: one, to obtain the maximum likelihood estimators of the co integrating matrix and two, to determine the maximum number of co integrating vectors. Furthermore, Johansen (1988) has the ability to estimate long run and short run parameters utilizing the OLS estimator and this are done in some economic soft ware like EViews. Thus, this study employing EViews 7 as such the test will be performed thoroughly.

3.3 Error correction model (ECM)

Error Correction Model is employed after being certain that all variables are co integrated, and then error correction term is incorporated in the short run coefficients and it is treated as the "equilibrium error" (Engle and Granger, 1987, Watson and Teelucksingh, 2002 and Gujararti, 2004). Normally, error term used to tie the short run behaviors to its long run equilibrium. In order to form the short run equation, equation (2) above is transformed into first difference as follows:

$$\Delta \ln FDI_t = \alpha_0 + \alpha_1 \Delta \ln GDP_t + \alpha_2 \Delta OP_t + \alpha_3 \Delta \ln INF_t + \varepsilon_t \quad (5)$$

Equation (5) contain only the short run information as such it is important to incorporate the error term so as to tie the short run behavior into long run value. So the ECM expressed as follows:

$$\Delta \ln FDI_t = \alpha_0 + \alpha_1 \Delta \ln GDP_t + \alpha_2 \Delta OP_t + \alpha_3 \Delta \ln INF_t + \alpha_4 EC_{t-1} + \varepsilon_t \quad (6)$$

According to Engle and Granger (1987) the equation (6) above is known as error correction model (ECM) since has incorporated the error term (EC_{t-1}) in the short run model. Generally speaking, if the residuals of the co integrating regression are stationary then results will be reported as long run coefficients and the results obtained from error correction model (ECM) are reported as short run coefficients.

3.4 Structural break in long run and short run

This research work examined the structural break in order to check the stability of the coefficients under period of study. Testing for stability is important in confirming whether the variables in the study have stable contributions in attracting FDI in Tanzania or not. This study employs the "cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ)" tests as proposed by Brown et.al (1975) in (Dufour, 1982). Decision criteria state that "if the plots of the CUSUM and CUSUMSQ falls within 5% critical bound then H_0 is not rejected and vice versa is true (Dufour, 1982; Hosein, 2007).

4.0 Model estimations and discussion of findings

In this section, the study estimates the unit root, co integration, long run and short run coefficients using the equations expressed in section three above.

4.1 Unit root results

The study performed unit roots tests using the Augmented Dickey –Fuller (ADF) test in all variables. The results shows that all variables at level are non stationary as such variables are integrated of order one *I(1)*. While at first difference all variables are stationary as such variables are integrated of order zero *I(0)*. Implications of the results tell that study modeling is correct as such the empirical results are robust. See table 4.1 in appendix below.

4.2 Engle-Granger residuals co integration test results

Similarly the study estimates Engle-Granger residuals co integration test using the Augmented Dickey-Fuller

tests. Findings reveal that computed value of the tau statistic (-3.684942) in absolute value exceeds the Engle – Granger critical tau values (-2.86154) at 5 percent level (MacKinnon, 2010) then the study rejected the null hypothesis means residuals are stationary and variables are co integrated. Since tau statistic obtained is (-3.684942) and it is significant at 5 percent level of significance. Insert table 4.2 in the appendix below. Thus, research concludes that, the regression outputs obtained in non stationary variables (at level) are no longer spurious as such the empirical results representing the long run relationships amongst the variables.

4.3 Johansen co integration test results

The Johansen co integration test results provide the similar results as obtained in the previous test in Engle-Granger residuals co integration test that variables are co integrated. The powerful test that is trace statistic confirms that there are two co integrating equations whereas max-eigen statistic indicates two co integrating equation. Insert table 4.3 in the appendix below.

5.0 Discussion of findings in long run and short run coefficients

Since this study employs time series data, it discusses both long run and short run coefficients results as shown in section below.

5.1 Long run coefficients results

In the long run coefficients all variables have the expected sign as such results are in line with the theoretical expectations. All variables are significant determinants of FDI in Tanzania since all are statistically significant at 5 percent level of significance. GDP has positive sign as expected (2.2146) and statistically significant at 5 percent level of significance. This result connote that other things remain constant; one percent increase in GDP increases FDI in Tanzania by 2.2146 percent. Positive sign in GDP means influences the FDI significantly in Tanzania. Really, empirical results reflecting the fact because many investors are interested with strong economic growth in order to improve their business. Openness as proxy of liberalization also has positive impact in FDI in Tanzania. Openness has positive sign (6.2656) and statistically significant at 5 percent level of significance. This suggests that one unit increase in openness increases FDI in Tanzania by 6.2656 units. This results telling that after liberalizing the economy, Tanzania attracts more investors in the economy. Furthermore, inflation rates have negative sign (-1.7358) and statistically insignificant at 5 percent level of significance. This empirical result implies that as the inflation rates decreases by one percent FDI increases by 1.7358 percent. It is important to note that negative sign in inflation rates means inflation rates decreasing in Tanzania as such attracts more foreign direct investments. Increasing in inflation rates will affect FDI in negative way. Thus, inflation rates in Tanzania in average are decreasing over time as such influences more FDI in Tanzania. Therefore, FDI is mainly determined by internal factors like GDP, openness and inflation rates. Indeed, these results are similar with the previous observations by Akpan et.al (2014) and Maghori, 2014 just to mention a few. See table 4.4 in the appendix below for more verifications.

5.2 Short run coefficients results

In short run coefficients, GDP has a positive sign (0.9563) but statistically insignificant at 5 percent level of significance. This suggests that other factors remain constant, one percent increase in GDP increases FDI by 0.9563 percent but this impact is negligible. This implies that GDP in short run has no significant impact in attracting foreign investors in Tanzania. Contrary openness has negative sign (-0.7178) and statistically insignificant at 5 percent level of significance. This connotes that openness in short run affect FDI negatively as opposed in long run. This can be true due to fact that the time is too short to realize the impact of liberalization in the economy. On the other hand, inflation rates remains important determinant of FDI even in short run since have expected sign (-1.2845) and statistically significant at 5 percent level of significance. The empirical result indicates that one percent decrease in inflation rates influences FDI by 1.2845 percent. This signifies that low rates of inflation in Tanzania influencing more FDI. Furthermore, error term (EC_{t-1}) found with expected negative sign (-0.5315) and statistically significant at 5 percent level of significance. This result suggests that variables have long run relationship and adjusting to restore the equilibrium at the speed of 53 percent per annum. Thus, error term result obtained in short run confirmed that the co integration results obtained in Engle-Granger residuals and Johansen co integration tests are correct. Therefore, variables are adjusting in short run in order to capture the long run relationships (long run equilibrium). See table 4.5 below in the appendix which showing short run results.

6.0 Structural break results

In long run the structural break results have shown stable contributions of these variables over time even though in CUSUM of square the line touched the bound marginally. Insert figures 6.1 in the appendix below. So this study concludes that variables are stable whereas in short run structural break results have shown unstable contributions over time. Insert figures 6.2 as shown in the appendix below. These results imply that determinants

of FDI in Tanzania are stable only in long run rather than in short run. In fact, short run coefficients are in line with structural break results under study except inflation rates.

7.0 Conclusion, Managerial Implications, Limitations and Future Research

Conclusively, this research study in long run reveals that Gross Domestic Product (GDP), openness and inflations rates are vital determinants of FDI in Tanzania. All these variables are statistically significant at 5 percent level of significance. On the other hand, in short run only inflation rates found to be significant determinant of FDI in Tanzania whereas other variables are statistically insignificant means that are not influencing FDI in short run. However, error correction term confirm that variables have long run relationship since has proper sign and statistically significant at 5 percent level of significance. Thus, the recommendations for this study are straight forward based on the empirical results presented in sections above. The obtained adjusted R-square is 69.8 almost 70 percent. This implies that GDP, openness and inflation rates have significant influence in attracting FDI in Tanzania. Other factors or determinants which are not included in this study have the power to attract the FDI at 30 percent. Therefore, Tanzanian government should not ignore these variables in their efforts to attract FDI in Tanzania. Moreover, other determinants which are not included in this study like infrastructure, labour force, natural resources amongst others should be taken care together with these variables discussed in this study to attract more investors in Tanzania. It is important to acknowledge that the present study is not free from limitations, this study include only few variables among many determinants of FDI due to the problem of availability of data. Again, in secondary data some time may contains some errors in figures or round off but this study has no power to rectify such kind of weakness since it is prepared with independent sources rather than researcher. Further areas of research, other studies may include more variables as mentioned above if they will manage to get more data so as to see if they will provide the similar results or not. Furthermore, other studies may use panel technique to find out if the different sectors have the same determinants of FDI in Tanzania.

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Appendices

Table 4.1 Unit root test results at level and at first difference

AT LEVEL				
Coefficients				
Variables	Without constant and trend	With constant	With constant and trend	Order of integration
LnFDI	0.285736	-1.538948	-2.717956	*I(1)*
Ln GDP	3.280827	-0.771914	-1.366047	*I(1)*
OP	0.976645	-0.967227	-2.499510	*I(1)*
LnINF	-0.053490	-2.392262	-2.695430	*I(1)*
FIRST DIFFERENCE				
Coefficients				
Variables	Without constant and trend	With constant	With constant and trend	Order of integration
LnFDI	-6.801401	-6.824903	-6.847092	*I(0)*
Ln GDP	-3.563883	-4.216814	-4.157481	*I(0)*
OP	-4.620327	-4.617967	-4.810527	*I(0)*
LnINF	-7.105471	-7.058368	-7.055676	*I(0)*

Without constant and trend: Test critical values: 1%, 5% and 10%, with constant: Test critical values: 1%, 5% and 10%, with constant and trend: Test critical values: 1%, 5% and 10%. Notes: If variables are integrated of order one *I(1)* means variables are non stationary. If variables are integrated of order zero *I(0)* means variables are stationary

Table 4.2 Engle-Granger residuals co integration results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0175	0.2288	0.0766	0.9394
RESID (-1)	-0.5037	0.1367	-3.6849	0.0007

Dependent Variable: DRESID

Table4.3 Johansen co integration results

Rank Test (Trace)				Rank Test (Maximum Eigenvalue)			
Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	*P*-values	Hypothesized No. of CE(s)	Max-Eigen Statistic	0.05 Critical Value	*P*-values
None *	49.7807	47.8561	0.0326	None	22.3376	27.5843	0.2036
At most 1	27.4431	29.7971	0.0912	At most 1	16.3681	21.1316	0.2041
At most 2	11.0750	15.4947	0.2069	At most 2	7.0974	14.2646	0.4777
At most 3 *	3.9776	3.8415	0.0461	At most 3 *	3.9776	3.8415	0.0461

Notes: Trace test indicates there are two co integrating equations at the 0.05 critical levels whereas Max-Eigen statistic test indicates two co integrating equations at the 0.05 critical levels.
*denotes rejection of the hypothesis at the 0.05 critical level under MacKinnon-Haug-Michelis (1999) p-values

Table 4.4 Long run coefficients results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.9060	4.0615	-0.2231	0.8246
LnGDP	2.2146	0.4738	4.6743	0.0000
OP	6.2656	2.0553	3.0485	0.0041
LnINF	-1.7358	0.3841	-4.5194	0.0001

Source: Researcher's computation: Adjusted R-squared: 0.697958

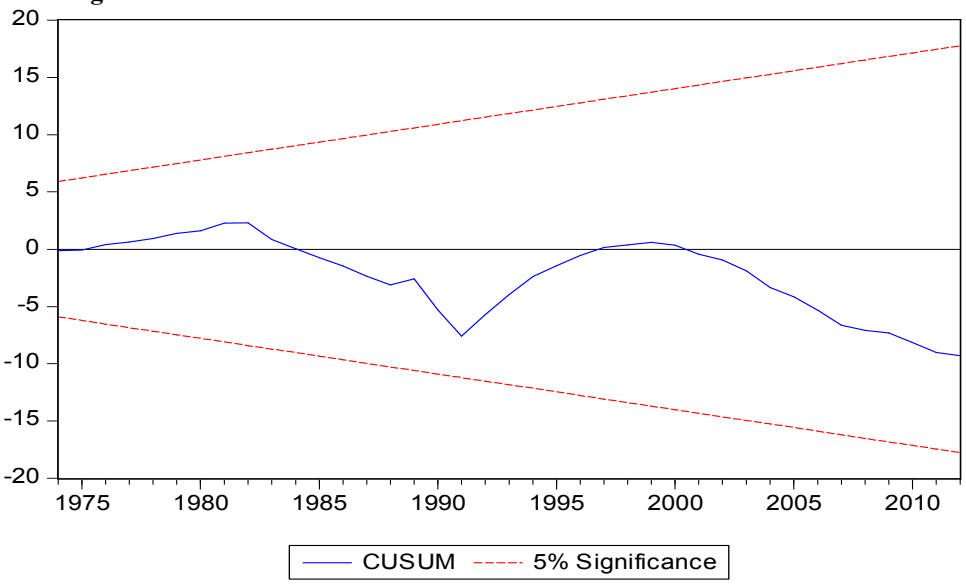
Table 4.5 Short run coefficients results

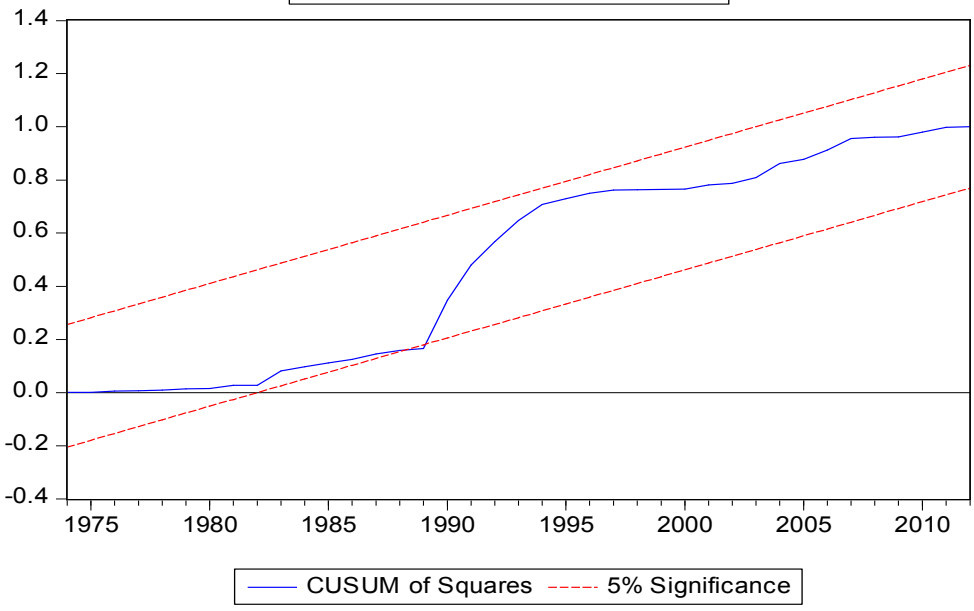
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.1476	0.2898	0.5098	0.6132
DLnGDP	0.9563	2.2910	0.4174	0.6788
DOP	-0.7178	5.1176	-0.1403	0.8892
DLnINF	-1.2845	0.5916	-2.1713	0.0364
EC_{t-1}	-0.5315	0.1443	-3.6833	0.0007

Source: Reseacher's compitation

Figures

6.1 Long run structural break results





6.2 Short run structural break results