Capital Flows Interactions in a Fragile State: Evidence from Nigeria

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Abstract

International transfers and foreign capital inflow remains a significant source of capital to fragile state economies and developing economies in general. These transfers include but not limited to official development assistance (ODA), remittances and foreign direct investment (FDI) among others. The main objective of this study is to empirically investigate the interactions between capital flows (Remittances, FDI and ODA) in a fragile state using the case of Nigeria. The study tests for the complementarity or substitutability among these capital flows with the Autoregressive Distributive Lag (ARDL) estimation technique, using data over the period 1980 to 2015. The study found that remittances complement both FDI and ODA. Also, the study found that FDI and ODA are substitutes. However, after testing whether the level of economic development affects the interactions of capital flows, the study found that the complementarity and substitution vanishes as level of economic development progresses.

Keywords: Capital Flows; Economic Growth; State Fragility;

JEL Codes: C32; F30; O43

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1.0 Introduction

International transfers and foreign capital inflow remains a significant source of capital to fragile state economies and developing economies in general. These transfers include but not limited to official development assistance (ODA), remittances and foreign direct investment (FDI) among others. The result of the coming together of the various components of foreign capital results in an increase in total capital available to an economy. For example, the United Nations Economic Commission for Africa [UNECA] (2014) report states that foreign capital inflow has quadrupled since 2000. More importantly, is that the sources, composition and components of these flows as well as the nature of interactions have progressively evolved over the years, particularly in fragile states. OECD (2010) elucidated how state fragility alters economic interactions and advocated that these economies often require a variation in approach and expectations to how economic variables behave in them. While there appears to be a general consensus on the ability of foreign capital sources to augment for capital shortages of developing economies, their ability to positively drive growth have continued to be debated.[1] Similarly, a significant quantum of capital flows literature have focused more on determinants of these flows aggregate and disaggregate at both country and cross-country levels (Cavoli, 2014;2015). Until recently, there however appears not to be a lot of attention focused on the dynamics of the interactions between the capital flows components in developing economies and perhaps even less attention within the state fragility context.

Although, it is impossible to claim the absolute paucity of literature focusing on the interaction of capital flow components, it appears that the larger chunk of the available few studies have focused on two selected components exclusively. For example Chauvet and Mesle-somp (2007) focused on the substitutability of ODA and FDI. Also, Drabo and Ebeke (2010) investigated the substitutability or complementarity of ODA and remittances within the context of health sector of developing economies. They found that remittances and ODA are complements albeit within the context of the low income developing economies. Similarly, Kpodar, and Le Goff, (2012) of the International Monetary Fund (IMF) focused on whether migrant's remittances reduce ODA dependence or not in a panel of 100 developing countries. They found that remittances increase aid dependency. However, after controlling for transmission channels such as human capital, they found that remittances reduce aid dependence. Recent efforts such as Mallaye and Yogo, (2011) and Cavoli (2014; 2015) have tried to push the envelope in capturing the interaction of more than two capital flow components within the framework of substitutability and complementarity, at cross-country levels. Mallaye and Yogo (2011), in particular, focused on whether FDI, ODA and remittances are complements or substitutes in fragile states using a cross-country panel of 33 fragile states. Their results indicate that, ODA complements both remittances and FDI. However, they argued further that after controlling for the level of economic development, this effect vanishes. In view of the foregoing, this section focuses on exploring the dynamics of interaction that exists between capital flows in a fragile state using the case of Nigeria.

[1] Prasad, E.S., Rajan, R.G. and Subramanian, A., (2007) and Slesman, L., Baharumshah, A.Z. and Wohar, M.E., (2015)

The rest of this study is organized as follows. Section 2 spells out theoretical framework for this study. Section 3 specifies an empirical model. Section 4 reports and discusses the estimated results. Section 5 concludes.

2.0 Theoretical Framework

The main objective of this study is to empirically investigate the interactions between capital flows (Remittances, FDI and ODA) in a fragile state using the case of Nigeria. In the light of this, the study tests for the complementarity or substitutability among these capital flows. An assumption in the literature on the interaction of these flows is such that opines that there is no crowding effect in the relationship (Mallaye and Yogo, 2011). It is assumed that a country can attract any and every form of capital flow without compromising the prospects for another. For example, a plausible argument can be made that an increase in the inflow of remittances and FDI may propel a country's growth thereby reducing the necessity of ODA and signalling economic self-reliance. On the reverse side, and in line with conditionality proponents, an increase in the inflow of remittances[2] and more importantly FDI[3] may be as a result of improved institutional environment which has been argued to be rewarded with more foreign assistance (Neumayer, 2002).

Conditionality proponents have maintained that to ensure effective allocation of scarce resources, developing countries with efforts to ensure improved institutional environment should be encouraged and rewarded with higher ODAs. They argued this will curb the "bottomless rat-hole" arguments of critics of ODA. In a bid to receive more ODA it is expected that countries will make a concerted effort in improving their institutional environment. Nonetheless, a good institutional environment which is a major deficiency of fragile state's remains an attraction for all forms of capital flows. In effect, the dynamics and interaction of capital flows is not necessarily a straightforward one and perhaps more complex in a fragile state.

To effectively investigate this dynamics, this study adopts the framework used by previous studies. Kristjannsdottir, (2006) utilised a simultaneous framework in line with Dalgaard et al., (2004), with focus on an interaction term to estimate the substitutability or complementarity of

[2] Remittances can sometimes be driven by investment and profit motives (Giuliano and RuizArranz, 2009). Such flows are referred to as procyclical. Remittances behaving procyclically are premised on the "optimization of investment" motive of migrants. This is what is referred to as the portfolio approach, in which case remittances respond positively to favourable macroeconomic indicators in the migrant's home country. Laniran and Adeniyi, (2015) found that remittances in Nigeria tend to be procycical.

[3] The interaction between foreign capital and institutional quality remains robust. The ability of a developing country to derive benefits from foreign capital inflows can be significantly affected by the quality of both macroeconomic framework and its institutions (Slesman, et.al, 2015). According to Alfaro et.al, (2008), host country institutional infrastructure may directly influence the volumes and types of capital inflows. Holden and Pagel (2013) highlighted that the major reason why FDI flows to fragile states are resource motives. They highlighted that fragile states, receiving investment purely for extraction may have other consequences as the literature suggests a link to further fragility, institutional weakening and not necessarily growth enhancing. Akinlo (2004) argued that Nigeria is one of the most successful countries in sub-Saharan Africa in attracting FDI with the bulk of it going to the extractive sector despite unstable political and economic environment. Their results support the argument that extractive FDI might not be growth enhancing.

economic variables. This study, therefore, follows similar approach as used in Kristjannsdottir, (2006) and Mitze et al. (2009). The basic equation is therefore presented as:

$$fK_t = mE_t + \varepsilon_t \quad (1)$$
$$E_t = (rem_{t,}\, fdi_t, oda_t, fdi_t * oda_t, fdi_t * rem_t, rem_t * oda_t, f_t)$$

Where: rem_t = amount of workers remittances received in Nigeria at time t, $fdi_{t,}$ = foreign direct investment inflow to Nigeria at time t, , oda_t, = volume of official development aid received by Nigeria at time t, m is a matrix of coefficients to be estimated, f_t is a measure of state fragility in Nigeria at time t, ε_t is a vector of the terms of errors.

In line with previous studies such as Drabo and Ebeke, (2010) and Mallaye and Yogo, (2011), this study tests the interactions of capital flows in terms of complementarity or the substitutability between remittances, FDI and ODA using three interaction variables. The interaction variables or terms used for this study are $fdi_t * oda_t$ for the first equation, $rem_t * oda_t$ for the second equation, and $fdi_t * rem_t$ for the third equation.

3.0 Empirical Model

Equation (2) therefore presents a system of empirically testable equations to be utilized in achieving the objective of this study.

$$\begin{cases} rem_t = \beta_0 + \beta_1 fdi_t + \beta_2 oda_t + \beta_3 fdi_t * oda_t + \beta_4 f_t + \varepsilon_t \\ fdi_t = \beta_0 + \beta_1 rem_t + \beta_2 oda_t + \beta_3 rem_t * oda_t + \beta_4 f_t + \varepsilon_t \\ oda_t = \beta_0 + \beta_1 fdi_t + \beta_2 rem_t + \beta_3 fdi_t * rem_t + \beta_4 f_t + \varepsilon_t \end{cases} \quad (2)$$

The results from this system of equations will provide evidence as to the interaction of capital flows. The coefficient sign of the regressors in the model provides evidence as to the nature of the relationship among the capital flows. The inclusion of interaction terms avails the model to understand the substitutability or complementarity of the capital flows. A positively signed interaction term coefficient will indicate complementarity and a negatively signed interaction term coefficient will indicate substitutability (Dalgaard et al., 2004).

Literature on complementarity or substitutability of economic variables has opined the possibility of heterogeneity in this kind of relationships (Drabo and Ebeke, 2010 and Mallaye and Yogo, 2011). In a similar manner, this study assumes that the level of development can alter the complementarity or substitutability between capital flows. In accounting for this heterogeneity, this study improved the specification, by controlling for the level of economic development using GDP per Capita (y) as proxy.

Equation (3) therefore presents a system of empirically testable equations to be utilized in investigating this heterogeneity. The empirical model will be used for testing the heterogeneity in the complementarity and substitutability of capital flows in the presence of state fragility.

$$\begin{cases} rem_t = \beta_0 + \beta_1 fdi_t + \beta_2 oda_t + \beta_3 fdi_t * oda_t + \beta_4 y_t * fdi_t + \beta_5 y_t * oda_t + \beta_6 y_t * fdi_t * oda_t + \beta_7 f_t + \varepsilon_t \\ fdi_t = \beta_0 + \beta_1 rem_t + \beta_2 oda_t + \beta_3 rem_t * oda_t + \beta_4 y_t * oda_t + \beta_5 y_t * rem_t + \beta_6 y_t * rem_t * oda_t + \beta_7 f_t + \varepsilon_t \\ oda_t = \beta_0 + \beta_1 fdi_t + \beta_2 rem_t + \beta_3 fdi_t * rem_t + \beta_4 y_t * fdi_t + \beta_5 y_t * rem_t + \beta_6 y_t * fdi_t * rem_t + \beta_7 f_t + \varepsilon_t \end{cases} \quad (3)$$

As in equation (ii), the coefficient sign of the regressors in the model will provide evidence as to the heterogeneity in the relationship among the capital flows. The inclusion of heterogeneity interaction terms avails the model to understand the heterogeneity in the substitutability or complementarity of the capital flows.

4.0 Results

4.1 Time series properties of Data

Investigating the time series properties before analysing the relationship among variables is very crucial owing to the challenges that non-stationary series do present in regression analysis (Hamilton, 1994). Stationarity properties are checked by unit root tests, namely Augmented Dickey-Fuller (ADF) (see Dickey and Fuller, 1979), Phillips–Perron (PP) (Phillips and Perron, 1988). Results of unit root tests are reported in Table 1 below.

Table 1: Stationarity test result

	ADF				**PP**			
	At Level		**1st Difference**		**At Level**		**1st Difference**	
	T STAT	PROB	T STAT	PROB	T STAT	PROB	T STAT	PROB
REM	-1.0866	0.7101	-2.9927	0.0460	-1.0399	0.7279	-6.5956	0.0000
FDI	-2.8776	0.0582	-9.9058	0.0000	-2.7688	0.0731	-10.1007	0.0000
ODA	-2.4886	0.1270	-5.5438	0.0001	-2.0149	0.2794	-5.5690	0.0001
Y	0.0386	0.9559	-4.8415	0.0004	-0.3635	0.9047	-4.8389	0.0004
F	-21.6905	0.0001	-5.8355	0.0000	-14.0820	0.0000	-10.3835	0.0001

The ADF test reveals a mixed level of stationarity. Variables F, and FDI were stationary at levels at 5 and 10 percent level of significance respectively while others are stationary at levels. Other variables Y, REM, and ODA were stationary at first difference at 5 percent level of significance. The PP unit root test reveals a similar pattern. Therefore, the unit root results confirm that some variables are stationary at level {i.e., I (0)} and others at first difference {i.e., I (1)}. This indicates that the considered variables may have a long-run relationship (Jawaid, and Saleem, 2017). The mixed form of the order of integration I(0) and I(1) suggests that using the OLS estimation technique may be inept for this study. On that basis, the study, therefore, adopts the ARDL estimation technique.

4.2 Complementarity or Substitutability of Capital Flows in Nigeria

The study proceeds by conducting a formal investigation for co-integration using the ARDL co-integration technique due to the properties of the data as suggested by (Pesaran and Shin, 1999 and Pesaran, Shin, and Smith, 2001). The estimates of the bound co-integration tests are presented in Table 2. The co-integration test revealed that the null hypotheses of no co-integration among the variables should be rejected, implying the presence of co-integration among the variables. This therefore suggests the existence of a long-run relationship among the variables in the model. The co-integrating result as presented in Table 2 reveals that the

calculated F-statistic for the 3 models in the system of equation in equation (2)[4] to be estimated on the interactions of capital flows in fragile state Nigeria is higher than the upper bounds levels at 1 percent for the remittance and ODA models and 2.5 percent for the FDI model.

Table 2: ARDL Bounds Test for Complementarity or Substitutability of Capital Flows

				F-statistics		
REM				6.4359****		
FDI				3.9956***		
ODA				4.2078***		
Critical Values						
	I (0) Bound			I (1) Bound		
Significance (%)	**REM**	**FDI**	**ODA**	**REM**	**FDI**	**ODA**
10	2.2	2.2	2.2	3.09	3.09	3.09
5	2.56	2.56	2.56	3.49	3.49	3.49
2.5	2.88	2.88	2.88	3.87	3.87	3.87
1	3.29	3.29	3.29	4.37	4.37	4.37

****, ***, **,* denote significance at 1%, 2.5%, 5% and 10% respectively.

4.3 Long Run Relationships

Table 3 reports the long-run relationship in a stepwise manner. The first model presents the remittance model. It regresses the remittances received on the FDI; ODA received and their interaction term (FDI*ODA) and a measure of state fragility F. As explained above, the interaction term helps to decide whether FDI and ODA are substitutes or complements. The second model presents the FDI model. It regresses the FDI received on the remittance; ODA received and their interaction term (REM*ODA) and a measure of state fragility F. As explained above, the interaction term helps to decide whether remittance and ODA are substitutes or complements. The third model presents the ODA model. It regresses the ODA received on the FDI; remittances received and their interaction term (FDI*REM) and a measure of state fragility F. As explained above, the interaction term helps to decide whether FDI and remittances are substitutes or complements.

[4] Model 1 is remittance model as represented in equation (2)
Model 2 is FDI model as represented in equation (2)
Model 3 is ODA model as represented in equation (2)

Table 3: Long Run Relationship for Complementarity or Substitutability of Capital Flows

REGRESSOR	REM MODEL	FDI MODEL	ODA MODEL
FDI	2.6865*		0.6545
	(1.4113)		(0.4137)
ODA	5.0876*	0.3664***	
	(2.8785)	(0.1176)	
REM		0.1299*	-0.3143
		(0.0645)	(0.2961)
FDI*ODA	-1.2656*		
	(0.6615)		
FDI*REM			0.0778
			(0.0803)
REM*ODA		0.0200*	
		(0.030160)	
F	0.8077	-0.3877***	0.6288
	(0.4887)	(0.0704)	(0.1701)
C	-11.4686*	4.5994***	-3.7685*
	(5.4546)	(0.3973)	(1.7280)

***, **,* denote significance at 1%, 5% and 10% respectively.

From the result of the remittance model (column 2), there is a positive relationship between the independent variables ODA and FDI and the dependent remittances at the 10 percent level of significance. Also, the independent variable F which is a measure of state fragility which has been introduced into the models to capture the presence of state fragility has a positive relationship with the dependent variable however not very significant. The major independent variable of particular interest in this model is, however, the interaction term (FDI*ODA). As discussed above, the interaction helps to determine whether development aid and FDI are substitutes or complements in Nigeria. The coefficient of the interaction term (FDI*ODA) is negative and significant at 10 percent level. Therefore it can be said that ODA and FDI are substitutes and not complements. This results contrast with the finding of Mallaye and Yogo (2011) which argued that ODA and FDI are complements using a panel of fragile states. They argued that in the context of fragile states, development aid and assistance is required to help create and facilitate the necessary environment (institutional and physical) to attract the needed FDI, thereby complementing each other. Their argument can be premised on the conditionality regime in development aid. However, the result of this study is in line with (Chauvet and Mesplé-Somps, 2007) who found development aid and FDI to be substitutes using a sample of African countries.

The result of this study can, however, be explained within the same context of conditionality premise as well as the nature of the FDI received. In the case of Nigeria, the quantum of development aid received as continued to decrease while the FDI received as continued to increase (OECD, 2013). It is expected that the level of development aid received by a country will continue to decrease if it fails to improve on its institutional and physical environment, within the conditionality premise. This weak environment, remain a common feature of a fragile state.

Taking into consideration the context of the nature of the bulk of FDI received in Nigeria which is largely argued by Akinlo (2004; 2012) Ayanwale (2007) as natural resource-driven, perhaps, the weak institutional environment can be understood. Chauvet and Mesplé-Somps, 2007) explained that this kind of FDI to Africa tends to thrive better where the institutional environment is weak as seen in fragile states. Perhaps this explains the trend witnessed in a continued increase in the flow of FDI to Nigeria and decrease in the flow of development aid to Nigeria, as well as to why there is a negative relationship between FDI and economic growth in Nigeria. The weak institutional environment

The result of the FDI model (column 3), there is a positive relationship between the independent variables ODA and remittances and the dependent variable FDI at the 1 percent and 10 percent levels of significance respectively. The independent variable F which is a measure of state fragility which has been introduced into the models to capture the presence of state fragility has a negative relationship with the dependent variable at 10 percent level of significance. The major independent variable of particular interest in this model is, however, the interaction term (REM*ODA). The interaction helps to determine whether remittances and ODA are substitutes or complements in Nigeria. The coefficient of the interaction term (REM*ODA) is positive and significant at 10 percent level. Therefore it can be said that remittances and ODA are complements and not substitutes.

The result of the ODA model (column 4), there is a positive relationship between the independent variables FDI and the dependent variable ODA and a negative relationship between the independent variable remittances and the dependent variable ODA, however insignificant. The independent variable F which is a measure of state fragility which has been introduced into the models to capture the presence of state fragility has a positive relationship but also insignificant. The major independent variable of particular interest in this model is, however, the interaction term (FDI*REM). The interaction helps to determine whether FDI and remittances are substitutes or complements in Nigeria. The coefficient of the interaction term (FDI*REM) is positive but not significant. Therefore it can be said that FDI and remittances are complements and not substitutes in Nigeria.

4.4 Short run Dynamics

Having estimated the long run co-integration models, an investigation into the short run dynamics within the ARDL framework was carried out. The lagged value of all variables (a linear combination is denoted by the error-correction term ECMt−1) is retained in the ARDL model. The error correction term indicates the speed of adjustment to adjust to equilibrium in the dynamic model. The ECM coefficient shows how quickly variables converge to equilibrium. It is expected to be negatively signed and significant. Bannerjee et. al (1998), noted that an error correction term with high significance levels further confirms the existence of a long-run relationship that is stable. Table 4 below shows the expected negative signs of ECM are highly significant. This therefore further confirms the existence of the co-integration relationship among the variables in the models. The coefficient of ECMt−1 are -0.278***, -1.278*** and -0.729*** for the remittance, FDI and ODA models respectively. This finding suggests a slower adjustment speed in the remittance model, compared to the FDI and ODA model.

Table 4: Short Run Relationship for Complementarity or Substitutability of Capital Flows

REGRESSOR	REM MODEL	FDI MODEL	ODA MODEL
D(FDI)	-1.7292***		0.1494
	(0.3420)		(0.1504)
D(FDI(-1))	-2.1517***		
	(0.3934)		
D(ODA)	-3.2683***	0.4449**	
	(0.5566)	(0.1893)	
D(ODA(-1))	-5.5047***		0.5118***
	(0.7414)		(0.1293)
D(ODA(-2))	-1.9837***		
	(0.3394)		
D(FDIODA)	0.9060***		
	(0.1324)		
D(FDIODA(-1))	1.2389***		
	(0.1736)		
D(FDIODA(-2))	0.5023***		
	(0.0667)		
D(FDIREM)			0.0607
			(0.0447)
D(REM)		0.5272***	0.1998
		(0.1322)	(0.2115)
D(REM(-1))		0.2312*	
		(0.1194)	
D(REMODA)		-0.0799**	
		(0.0376)	
D(REMODA(-1))		-0.0638**	
		(0.0192)	
D(REMODA(-2))		-0.0498**	
		(0.0192)	
D(F)	1.0279***	-0.3958**	0.1545
	(0.1703)	(0.1413)	(0.1654)
D(F(-1))	0.4939***		-0.3525**
	(0.1248)		(0.1656)
D(F(-2))			-0.3472**
			(0.1616)
CointEq(-1)	-0.2785***	-1.2782***	-0.7293***
	(0.0394)	(0.1877)	(0.1286)

****, **,* denote significance at 1%, 5% and 10% respectively.*

4.5 Model Diagnostic Test

To investigate the robustness of the estimated models, some diagnostics tests were conducted such as serial correlation test, heteroscedasticity test as well as stability test. The serial correlation test for all three models suggested the absence of serial correlation in the residuals as the Fstats were not significant in all models as depicted in Table 5. In other words, it can be said that the errors are normally distributed and can be useful for inference making (Nwachukwu and

Egwaikhide, 2007). The stability tests for the models indicated a decent level of stability in the model.

Table 5: Diagnostic Tests for Complementarity or Substitutability of Capital Flows

	REM	FDI	ODA
Serial Correlation	0.5664	2.2678	2.0975
F	(0.6461)	(0.1135)	(0.1363)
LM	3.5717	8.7008	8.5481
	(0.3116)	(0.0335)	(0.0359)
	3.3565	0.4979	2.1430
Normality	(0.1867)	(0.7796)	(0.3425)
Heteroscedasticity	1.0872	1.2200	0.5447
(ARCH)	(0.3720)	(0.3223)	(0.6561)
	3.3438	3.7020	1.7740
	(0.3416)	(0.2955)	(0.6206)

Stability test was conducted for the models. Results, from the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) help in analysing the stability of the long run relationships and short run dynamics. The stability of the regression can be evaluated by stability tests and they can show whether or not the regression equation is stable over time (Pearsan et al, 2001). The null hypothesis here is that the coefficient vector remains same in all periods (Bahmani-Oskooee, and Ng, 2002). CUSUM and CUSUMSQ statistics are plotted against the critical bound of 5% significance. According to Bahmani-Oskooee, and Ng, 2002), if the plot of these statistics remains within the critical bound of the 5% significance level, the null hypothesis (i.e. all coefficients in the error correction model are stable) cannot be rejected. The plot of the cumulative sum of recursive residual is presented in Appendix 5. As shown, the plots of CUSUM and CUSUMSQ residuals for all models were all within the boundaries. That is to say that the stability of the parameters has remained within its critical bounds of parameter stability.

4.6 Does economic development matter for complementarity or substitutability of capital flows

To empirically explore whether the level of economic development affects the interactions of capital flows in Nigeria, in terms of their substitutability and complementarity, the study proceeds by investigating the relationship among the capital flows of interest in a consistent stepwise manner after controlling for economic development level using GDP per capita.

The estimates of the co-integration tests are presented in Table 6. The co-integration test revealed that the null hypotheses of no co-integration among the variables should be rejected, implying the presence of co-integration among the variables. This therefore suggests the existence of a long-run relationship among the variables in the model. The co-integrating result as presented in Table 6 reveals that the calculated F-statistic for the 3 models in the system of equation in equation (3) to be estimated on the interactions of capital flows in fragile state

Nigeria is higher than the upper bounds levels at 1 percent for the remittance and ODA models and FDI model.

Table 6: ARDL Bounds Co-integration Test for Heterogeneity in the Complementarity or Substitutability of Capital Flows

				F-statistics		
REM				10.132****		
FDI				11.887****		
ODA				28.176****		
Critical Values						
	I (0) Bound			I (1) Bound		
Significance (%)	**REM**	**FDI**	**ODA**	**REM**	**FDI**	**ODA**
10	1.92	1.92	1.92	2.89	2.89	2.89
5	2.17	2.17	2.17	3.21	3.21	3.21
2.5	2.43	2.43	2.43	3.51	3.51	3.51
1	2.73	2.73	2.73	3.9	3.9	3.9

*****, ***, **,* denote significance at 1%, 2.5%, 5% and 10% respectively.*

Long Run Relationships

Table 7 reports the long-run relationship of the capital flow interaction when interacted with the level of GDP per capita in a stepwise manner. It presents results of the estimation of the system of models as presented in equation (3).

Table 7: Long Run Heterogeneity in the Complementarity or Substitutability of Capital Flow

REGRESSOR	REM MODEL	FDI MODEL	ODA MODEL
FDI	10.2335*		-1.8471**
	(10.9869)		(0.1039)
ODA	15.9457	9.8009	
	(8.9117)	(2.7285)	
REM		-10.2020*	-1.7509**
		(1.3725)	(0.0744)
FDIODA	-4.3249*		
	(6.8826)		
FDIREM			0.6128**
			(0.0221)
REMODA		1.5697	
		(0.7067)	
YFDI	-12.8548*		0.6657**
	(1.3932)		(0.0172)
YODA	-2.1629	-1.3078	
	(1.1777)	(0.3845)	
YREM		1.4256*	0.4065**
		(0.1861)	(0.0096)
YFDIODA	5.6910*		
	(0.8891)		
YFDIREM			-0.1453**
			(0.0032)
YREMODA		-0.2089	
		(0.0966)	
F	3.8556*	-0.5230*	0.2074**
	(0.5308)	(0.0878)	(0.0072)
C	-39.7003*	5.3917*	-8.8323***
	(3.2651)	(0.4604)	(0.0896)

****, **,* denote significance at 1%, 5% and 10% respectively.*

From the result of the remittance model (column 2), the independent variable of particular interest in this model is Y*FDI*ODA which is the interaction of the interaction term FDI*ODA with the level of economic development. The interaction term helps to determine whether ODA and FDI remain substitutes after controlling for economic development level. The coefficient of the interaction term (Y*FDI*ODA) is positive and significant at 10 percent level. Therefore it can be said that ODA and FDI become complements after controlling for economic development level.

From the result of the FDI model (column 3), the independent variable of particular interest in the case of this FDI model is Y*REM*ODA which is the interaction of the interaction term REM*ODA with the level of economic development. The interaction term helps to determine whether REM and ODA remain complements after controlling for economic development level.

The coefficient of the interaction term (Y*REM*ODA) is negative albeit insignificant. Therefore it can be said that REM and ODA become substitutes after controlling for economic development level.

From the result of the ODA model (column 4), the independent variable of particular interest in the case of this ODA model is Y*FDI*REM which is the interaction of the interaction term FDI*REM with the level of economic development. The interaction term helps to determine whether FDI and remittances remain complements after controlling for economic development level. The coefficient of the interaction term (Y*FDI*REM) is negative and significant at 1 percent level. Therefore it can be said that FDI and remittances become substitutes after controlling for economic development level.

Table 8: Short Run Heterogeneity for Complementarity or Substitutability of Capital Flows

REGRESSOR	REM MODEL	FDI MODEL	ODA MODEL
D(FDI)	-13.6905**		3.8251***
	(0.2462)		(0.0115)
D(FDI(-1))	13.6555**	2.2781**	1.8912***
	(0.3354)	(0.0938)	(0.0097)
D(FDI(-2))	-14.9468***	1.2513**	10.6209***
	(0.2280)	(0.0475)	(0.0113)
D(ODA)	-2.9078***	12.0134**	
	(0.4390)	(0.7656)	
D(ODA(-1))	-4.0999**	-2.8712**	0.3831***
	(0.6847)	(1.5472)	(0.0006)
D(ODA(-2))	-9.1108**	-12.5931*	-0.0713***
	(0.4233)	(1.2195)	(0.0005)
D(YFDI)	1.7891**		
	(0.0331)		
D(YFDI(-1))	-2.3599**		
	(0.0426)		
D(YFDI(-2))	1.9679***		
	(0.0297)		
D(YODA)	3.9313***	-1.8245**	
	(0.0595)	(0.1055)	
D(YODA(-1))	5.5143**	3.7176**	
	(0.0933)	(0.2089)	
D(YODA(-2))	1.1822**	1.6452*	
	(0.0559)	(0.1661)	
D(FDIODA)	15.5679***		
	(0.1290)		
D(FDIODA(-1))	2.7634**		
	(0.0747)		
D(FDIODA(-2))	8.2951***		
	(0.1239)		

D(YFDIODA)	-2.0738***		
	(0.0177)		
D(YFDIODA(-1))	-0.3892**		
	(0.0106)		
D(LYFDIODA(-2))	-1.1099***		
	(0.0164)		
D(REM)		-4.1442*	-14.1191***
		(0.5057)	(0.0214)
D(REM(-1))	-1.5298***	30.1834**	-6.1093***
	(0.0197)	(1.0071)	(0.0196)
D(REM(-2))	-0.6763**	-14.4023**	-10.4677***
	(0.0142)	(0.0689)	(0.0220)
D(YREM)		0.5171*	1.8972***
		(0.0689)	(0.0028)
D(YREM(-1))		-4.3138**	0.9034***
		(0.1424)	(0.0027)
D(YREM(-2))		1.7520**	1.7047***
		(0.0858)	(0.0030)
D(REMODA)		0.6603	
		(0.2426)	
D(REMODA(-1))		-0.4024	
		(0.2686)	
D(REMODA(-2))		5.2349**	
		(0.2546)	
D(YREMODA)		-0.0386	
		(0.0329)	
D(YREMODA(-1))		0.0692	
		(0.0364)	
D(YREMODA(-1))		-0.6786**	
		(0.0343)	
D(FDIREM)			1.4016***
			(0.0048)
D(FDIREM(-1))			-3.6588***
			(0.0053)
D(FDIREM(-2))			-3.5901***
			(0.0055)
D(YFDIREM)			-0.2148***
			(0.0006)
D(YFDIREM(-1))			0.5099***
			(0.0007)
D(YFDIREM(-2))			0.4682***
			(0.0008)
D(F)	-0.9155**	-0.2337*	-0.1711***
	(0.0202)	(0.0291)	(0.0007)
D(F(-1))	0.9457***	0.3947**	0.2525***

	(0.0077)	(0.0301)	(0.0007)
D(F(-2))	0.8488***	0.5939**	0.1220***
	(0.0124)	(0.0203)	(0.0005)
CointEq(-1)	0.5160***	-3.2413**	-1.8306***
	(0.0057)	(0.1045)	(0.0012)

****, **,* denote significance at 1%, 5% and 10% respectively.*

4.5.1 Short run Dynamics

Having estimated the long run heterogeneity, an investigation into the short run dynamics within the ARDL framework was carried out. The coefficient of ECMt−1 are -0.516***, -3.241*** and -1.831*** for the remittance, FDI and ODA models respectively. This finding suggests a slower adjustment speed in the remittance model, compared to the FDI and ODA model, which is similar to the results from table 4.

4.5.2 Model Diagnostic Test

To investigate the robustness of the estimated models, some diagnostics tests were conducted such as serial correlation test, heteroscedasticity test as well as stability test. The serial correlation test for all three models suggested the absence of serial correlation in the residuals as the Fstats were not significant in all models as depicted in Table 5. In other words, it can be said that the errors are normally distributed and can be useful for inference making (Nwachukwu and Egwaikhide, 2007). The stability tests for the models indicated a decent level of stability in the model.

Table 9: Diagnostic Tests for Complementarity or Substitutability of Capital Flows

	REM	FDI	ODA
Serial Correlation	0.6501	2.6287	2.0865
	(0.1361)	(0.1315)	(0.1336)
F			
	3.5628	8.9081	8.8541
LM	(0.0116)	(0.3035)	(0.0395)
	36.4788	19.9730	33.3357
Normality	(0.0001)	(0.0005)	(0.0001)
Heteroscedasticity	1.9498	1.3411	1.5395
(ARCH)	(0.1464)	(0.2826)	(0.2279)
	5.5097	4.0201	4.52511
	(0.1381)	(0.2593)	(0.2101)

Stability test was conducted for the models. Results, from the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) are presented in Appendix 6.

5.0 Conclusion

In conclusion, this study investigates the interactions of components of capital flows namely FDI, ODA and remittances in a fragile state with the specific case of Nigeria, being a leading capital inflow recipient fragile state. This was done by testing for the complementarity or substitutability among these capital flows. The study also tested whether the level of economic development mattered concerning the complementarity and substitutability of capital flows in a fragile state. From the estimates generated, the study found that there is a significant long run relationship in the interactions of capital flow components. The study found that remittances complement both FDI and ODA. Also, the study found that FDI and ODA are substitutes. However, these interactions vanish as level of economic development progresses.

Notes

1. Conceptually state fragility remains an evolving area of study and so is knowledge about it. Perhaps less knowledge is available for accurate quantification of it. It indeed is a phenomenon with very qualitative dimensions; hence a plethora of definitions exists for it.
2. Based on commonalities of the various definitions and symptoms of fragility and dimensional categorization of the manifestations of fragility as proposed by the Fund for Peace (2015), this study identifies relevant variables to explain state fragility. These variables were identified in line with Bertocchi and Guerzoni, (2012), but adapted to suit the context of Nigeria. The selected variables however focused on quantifiable symptoms and manifestations with the most economic relevance and not necessarily causes, symptoms and consequences as proposed by Besley and Pearson (2011).
3. For this study based on its huge economic skewness, variables considered to have some more economic relevance, and bias were selected, bringing into context the larger theme upon which the study is based and in synchronisation with fragility determinant variables as expressed by (Bertocchi and Guerzoni, 2012).
4. This study acknowledges that just like many indices that have been constructed to capture multidimensional issues for econometric analysis are often vulnerable to many other flaws such as uncaptured variables and dimensions of the issue, among others as noted by (Gyimah-Brempong and Traynor, 1999). Similarly this study does not claim to have fully captured all contributory elements of state fragility in computing our measures of fragility. However we have selected most quantifiable elements of the various fragility dimensions with most accurate and uniformly complete available data for the period of the study. However accuracy and precision remains an area that can be further investigated. Also a disaggregation of state fragility into its constituent dimensions to identify their economic implications remains a possible area for extending this study.

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Appendix

Appendix 1: Fragility index Variable Definition and Description

Variable	**Description**
Oil revenue (E)	Oil revenue measured as a percentage of total revenue of Nigeria measured on an annual basis. Source: Central Bank of Nigeria Annual statistical report 2015.
Inflation (E)	The inflation is captured using Consumer price index reflecting the annual percentage change in cost levels of a basket of goods and services. Source: Central Bank of Nigeria Annual statistical report 2015.
School Enrollment (E)	The human capital is captured by proxying with total secondary school enrollment expressed as a percentage of the official national secondary school age population. Source: World Bank Data Bank 2016.
Security (P&M)	The Security variable is captured by the summation of Defence and internal security expenditure made by the government as a percentage of annual government expenditure over the years. Source: Central Bank of Nigeria Annual statistical report 2016.
Terrorism Incidence (P&M)	Terrorism incidence is captured by using data from the Global Terrorism Database. The GTD defines terrorist attack "as the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation". Source: National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2015). Global Terrorism Database [Data file]. Retrieved from http://www.start.umd.edu/gtd
Governance (P&M)	Governance in this study is divided strictly between Military and civil rules. Where governance(Democracy=0 military=1) Source: National Bureau of Statistics 2015.
Youth Bulge (S)	As explained by Gunnar Heinsohn (2003), that continued growth in youth population often leads to social unrest especially where the unemployment level is high, hence the impetus to compete by religion or political ideology. In capturing this youth percentage of the total population was used using the World Bank youth age criteria. Source: World Bank Data Bank 2016.
Ethnicity (S)	The number of major ethno-lingual groups in Nigeria Source: National Bureau of Statistics 2015.
Religion (S)	The number of major religious groups in Nigeria Source: National Bureau of Statistics 2015.

Where E = Economic Indicator, P&M = Political and Military Indicator and S = Social Indicator in line with the Fund for Peace (2015) classification.

Appendix 2: Growth Model Variable Definition and Description

Variable	Representation	Definition
GDP per capita (constant 2000 US$)	Y	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products Data are in constant U.S. dollars. Source: World Bank Data Bank 2016.
FDI (%GDP)	FDI	This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors. Source: World Bank Data Bank 2016.
ODA(%GDP)	ODA	Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC). Source: World Bank Data Bank 2016.
Remittances (%GDP)	REM	Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from non-resident households as a percentage of GDP in current US$. Source: World Bank Data Bank 2016.

Appendix 3: Data Summary

	Y	FDI	REM	ODA	F
Mean	7.367696	3.585877	2.529163	2.133895	5.816660
Median	7.248288	3.620515	3.595232	2.270701	5.639943
Maximum	7.837976	4.921412	5.489350	5.035395	8.469629
Minimum	7.039713	2.228102	-2.275788	0.039007	4.135067
Std. Dev.	0.261392	0.686778	2.567252	1.136802	1.241380
Skewness	0.586506	-0.023263	-0.542831	0.123333	0.737267
Kurtosis	1.787327	2.314691	1.692397	3.375050	2.541226
Jarque-Bera	4.269802	0.707720	4.332731	0.302260	3.577085
Probability	0.118256	0.701973	0.114593	0.859736	0.167204
Sum	265.2370	129.0916	91.04986	76.82021	209.3998
Sum Sq. Dev.	2.391396	16.50824	230.6774	45.23114	53.93583
Observations	36	36	36	36	36

Appendix 4: Lag Length Selection for Co-integration

Complementarity or Substitutability

Endogenous variables: REM FDI ODA FDIODA F

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-204.7702	NA	0.228563	12.71335	12.94009	12.78964
1	-104.8907	163.4392	0.002494	8.175196	9.535658*	8.632950
2	-75.77849	38.81633	0.002174	7.925969	10.42015	8.765185
3	-26.31919	50.95807*	0.000675*	6.443587*	10.07148	7.664264*

Endogenous variables: FDI ODA REM REMODA F

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-247.0707	NA	2.967499	15.27701	15.50376	15.35330
1	-143.5614	169.3788	0.025989	10.51887	11.87933*	10.97663
2	-123.9431	26.15771	0.040278	10.84504	13.33922	11.68425
3	-76.90235	48.46626*	0.014471*	9.509233*	13.13713	10.72991*

Endogenous variables: ODA FDI REM FDIREM F

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-234.0022	NA	1.344052	14.48498	14.71172	14.56127
1	-145.3152	145.1241	0.028904	10.62516	11.98563*	11.08292
2	-115.1230	40.25622*	0.023600	10.31049	12.80467	11.14970
3	-79.39515	36.81056	0.016831*	9.660312*	13.28821	10.88099*

HETEROGENEITY

Endogenous variables: REM FDI ODA YFDI YODA FDIODA YFDIODA F

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-201.5412	NA	4.52e-05	12.69947	13.06226	12.82154
1	-35.94227	240.8712	1.07e-07	6.541956	9.807063	7.640565
2	105.7001	137.3502	2.07e-09	1.836356	8.003781	3.911507
3	352.6024	119.7102*	5.52e-13*	-9.248633*	-0.178890*	-6.196941*

Endogenous variables: FDI ODA REM YODA YREM REMODA YREMODA F

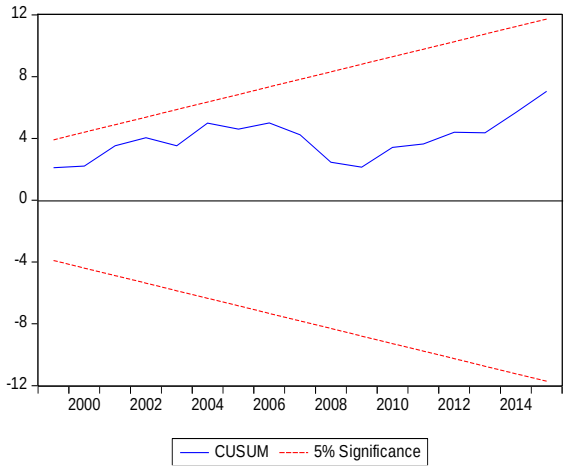
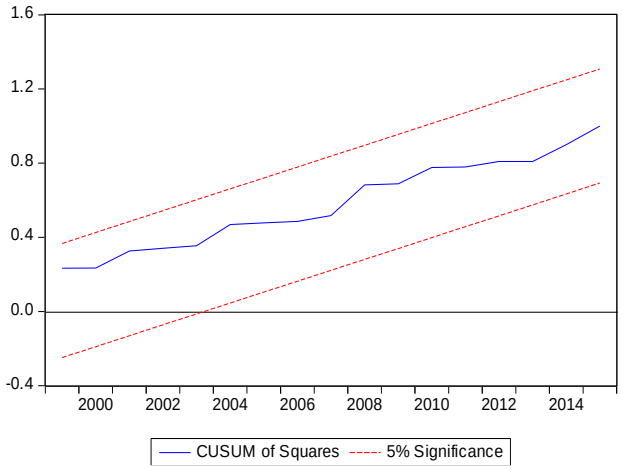
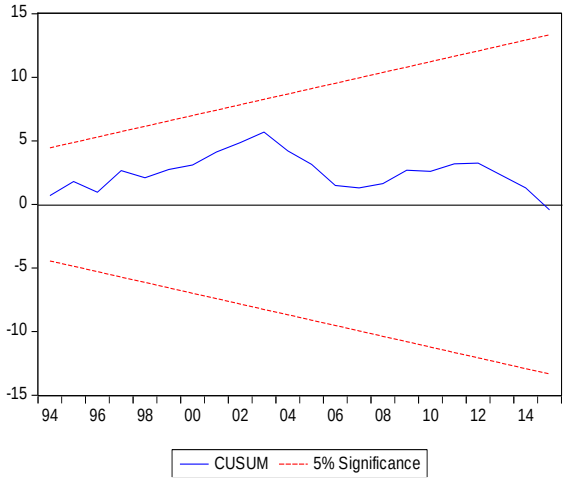
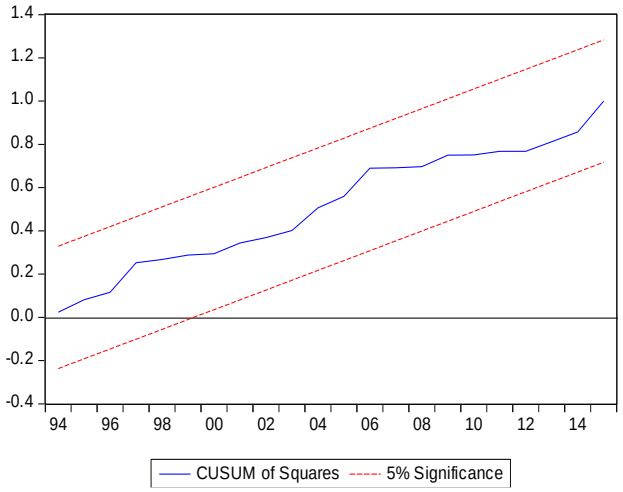
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-234.3109	NA	0.000330	14.68551	15.04830	14.80758
1	-53.39667	263.1480	3.09e-07	7.599798	10.86491	8.698407
2	53.25913	103.4238	4.98e-08	5.014598	11.18202	7.089749
3	270.1390	105.1539*	8.18e-11*	-4.250850*	4.81889*	-1.199158*

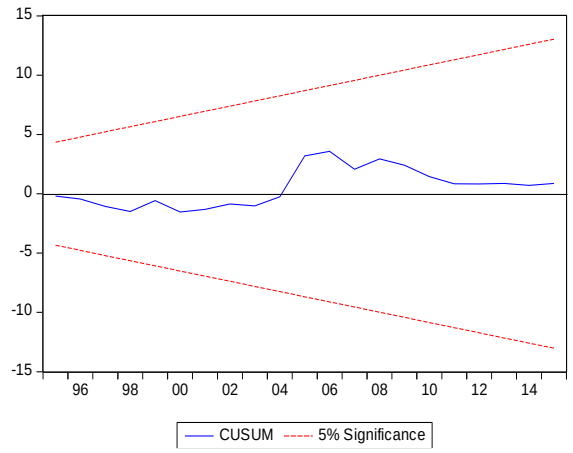
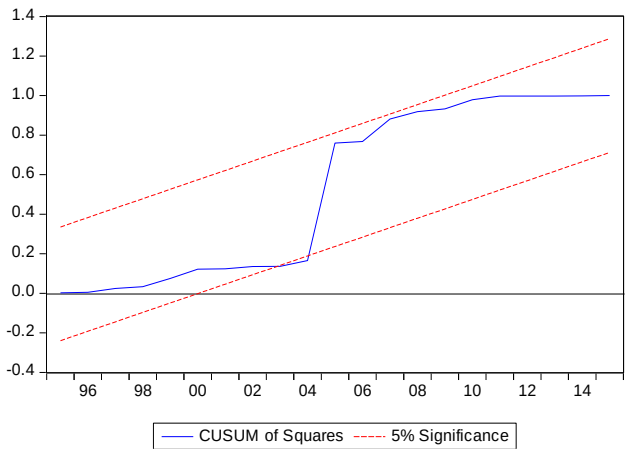
Endogenous variables: ODA FDI REM YFDI YREM FDIREM YFDIREM F

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-265.7805	NA	0.002220	16.59276	16.95555	16.71482
1	-106.3838	231.8498	7.67e-06	10.81114	14.07624	11.90975
2	-5.786387	97.54897	1.78e-06	8.593114	14.76054	10.66827
3	358.0186	176.3903*	3.98e-13*	-9.576885*	-0.50714*	-6.525193*

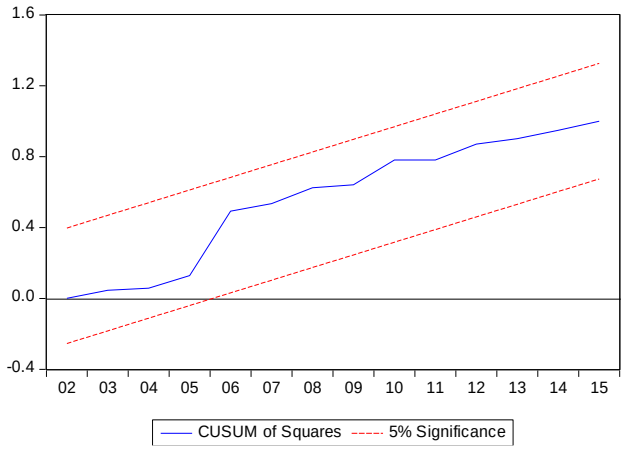
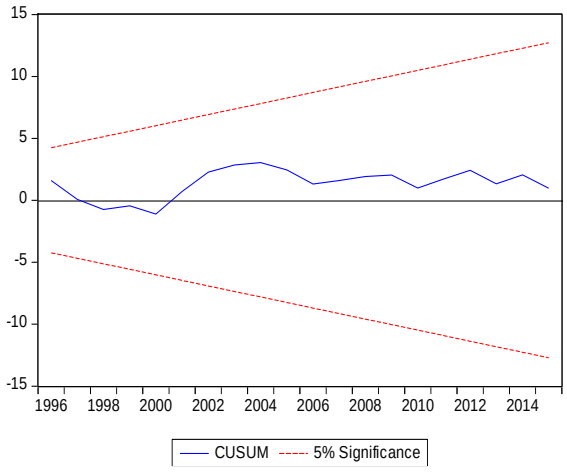
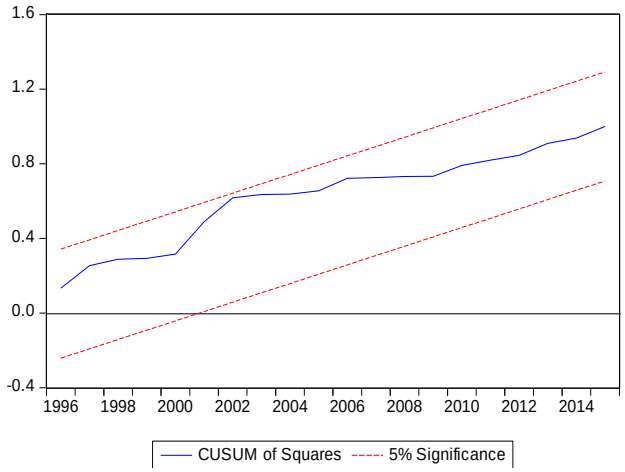
* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

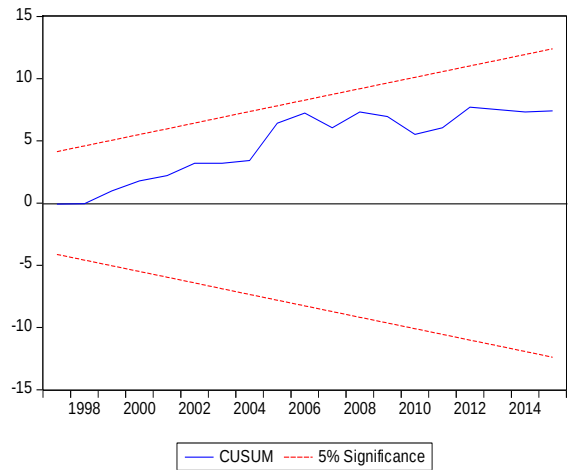
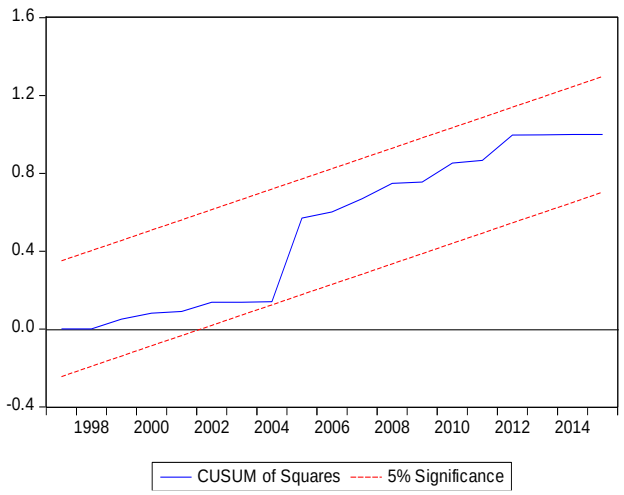
Appendix 5: SUBSTITUTABILITY AND COMPLEMENTARITY

MODEL	CUSUM TEST	CUSUMSQ TEST
REM		
FDI		

ODA	 15 10 5 0 -5 -10 -15 96 98 00 02 04 06 08 10 12 14 CUSUM 5% Significance	 1.4 1.2 1.0 0.8 0.6 0.4 0.2 0.0 -0.2 -0.4 96 98 00 02 04 06 08 10 12 14 CUSUM of Squares 5% Significance

Appendix 6: HETEROGENEITY

MODEL	CUSUM TEST	CUSUMSQ TEST
REM		
FDI		

ODA	 15 10 5 0 -5 -10 -15 1998 2000 2002 2004 2006 2008 2010 2012 2014 CUSUM 5% Significance	 1.6 1.2 0.8 0.4 0.0 -0.4 1998 2000 2002 2004 2006 2008 2010 2012 2014 CUSUM of Squares 5% Significance