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Assessment the Structural Adjustment Policies in Sudan via (VECM) Model Through the Period 1989-2019

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Abstract:- The paper aimed to assessment the structural adjustment policies in Sudan. The paper problem was formulated in following main question: What were the most important objectives of structural adjustment policies and programs? The paper was based on the following main assumption: Structural adjustment policies and programs in Sudan have not achieved the desired goals. The paper used the descriptive and analytical approaches. The study reached that GDP, Per Capita (PC) and External Debt (ED) had inverse impact on Economic Growth (EG), while inflation rate and Real Effective Exchange Rate (REER) they had a direct impact on (GR). The paper recommended that the necessity of evaluating the structural adjustment policies to know the reasons for their failure, and then adopting alternative policies that.

Keywords:- *Assessment, Structural Polices, Economic Growth, External Debt ,Sudan.*

I. INTRODUCTION

Since 1980, many developing countries faced a chronic economic crisis, and they had no choice but to "adapt" to get out of this crisis. By 1992, 78 countries implemented structural adjustment programs with the same policy frameworks without formal agreements with the World Bank [1]. Although the effect of structural adjustment programs on African economies remains performance, Structural adjustment programs certainly have far-reaching implications for the population power in governmental sector in particular [2], African Training and Research Center in Administration for Development. The Sudanese economy is inherently agricultural, and since 1956 the agricultural sector has formed from a traditional and modern sector. Inadequate economic policies that aimed at bringing about economic development led to internal and external imbalances that greatly affected the course of the economy and led to its decline. The first attempt to adjust the defect was to reduce the local currency exchange rate of (43%) in September 1978 as recommended by the International Monetary Fund.Then the Sixty plan (1977/1982) was developed and replaced by renewable development programs developed by World Bank experts that require focusing on cash and mineral crops production at the expense of, eliminating subsidies to reduce government spending, liberalizing trade and privatizing Arab public institutions (2017).The paper seeks to Assessment the Structural Adjustment Policies in Sudan. The main purpose of the paper to assessment the Structural Adjustment Policies. It could be look at the literature of paper variables. The paper is based on a descriptive and analytical approaches by using Eviews Package. Finally, the paper discusses the results and makes recommendations.

➢ *Previous Studies*

El Mak & A. Hag Elamin (1997) make an evaluation effect of agricultural price incentives in main adjustment Programmes implemented by the Sudanese government throw the period 1978-1993. The study examines two main hypotheses : Did these programmes provide any tangible incentives to agriculture? And are improved price incentives an efficient and sufficient condition for increasing aggregate agricultural output? The results indicate that both programmes failed to improve either the level or the stability of real farm prices. Poor macroeconomic policies appear to be the main cause. Non-price factors appear to play a greater role in determining aggregate agricultural output. The analysis implies that without the provision of adequate credit, public investments and improvement in infrastructure, the aggregate response of agriculture to price incentives would be minimal [3].

Bannaga (2005) analyzed the impact of structural adjustment policies in Sudan economy despite the fact that the country is one of the first African countries to adopt them. It then proceeds by using econometric techniques starting by examining the stability of the long-run growth in Sudan for the period (1960–2000) followed by co-integration and ECM model. The study reached that the economic growth rate has changed significantly despite the introduction of the adjustment policies in 1980. Moreover, investment is the most significant variable affecting growth in the long run, and non-policy factors such as weather have a significant impact on the economic growth in the short run only [4].

Ibrahim (2015) examined the impact of the SAPs on the agricultural finance in Sudan and identified the role of the Agricultural Bank in financing the agriculture sector as the sole primary finance for the agricultural projects in Sudan. Many negative results were appeared in terms of GDP declining which had affected the investment programs.

The global environment for the producers of primary agricultural products was not relevant to the Structural Adjustment [6].

Calliope Spanou (2016) addressed the extent to which conditional macroeconomic adjustment programs can be used as a means of strengthening structural and economic and policy reforms. The study is built on conditionality leads to policy change. The study found that the conditionality of the policy defines the areas of reform, while specifying the means and time frame that must be implemented to make the correction.Conditions affect local governance and transform the policymaking system into compliance and implementation mechanism. The police's reform potential depends on its local interaction with the political system and the policy process. Public policy can help to better understand dynamics in highlighting the strengths and limitations of conditionality. The study recommended setting a future research agenda for policy conditionality in order to make the correction in the economy[7].

Oberdabernig (2017) search on impact of Structural Adjustment Programs (SAPs) of the International Monetary Fund (IMF) on poverty and income distribution.This study tries to estimate the impacts of SAPs on a variety of poverty indicators controlling for nonrandom selection. We make use of the matching method to test for differences in poverty indicators and GINI coefficients for countries participating in IMF agreements and countries which do not. Performing Heckman regressions we study the effects in more detail. We control for economic factors and include regional sub models to test for robustness. Propensity score matching does not show significant effects of SAPs on poverty indicators. Using Heckman regressions we find evidence that participation in IMF programs is connected to higher poverty rates and a more unequal income distribution[8].

- *Theoretical Background*

SAPs and their associated stabilization policies are among the most important policy frameworks of the last century that have greatly influenced both strategies and programs for agriculture, food and nutrition security in Africa and therefore overall economic development. As already mentioned, the SAP approach was the response of the WB and the IMF to the African economic crisis of the 1970s. The SAPs were introduced across Africa in the 1980s and continued to operate throughout the 1990s. During this period, the WB and the IMF closely worked together, with the IMF heavily involved in setting the macroeconomic development and policy agenda, while the WB provided structural adjustment lending[9].Structural adjustment programs generally require countries to adopt policies such as: Reductions in government spending, Monetary tightening (high interest rates and/or reduced access to credit), Elimination of government subsidies for food and other items of popular consumption, Privatization of enterprises previously owned or operated by the government and Reductions in barriers to trade, as well as to foreign investment and ownership. These policies and the IMF's role in implementing them have been criticized by developing country governments and development organizations as having worsened the situation of poor and lower-income people, as well as contributing to the degradation of the natural environment Robert & Neil (1999).The main elements of the SAPs were their classical/neoliberal features. They emphasized anti-inflationary macroeconomic stabilization policies and pushed for private sector and free market development, controlling budget deficits, privatizing public sector companies and services, dissolving parastatals, eliminating subsidies and cutting public support for social services [10]. A typical SAP called for devaluation and trade liberalization to improve the country's balance of payments and control its foreign indebtedness; debt rescheduling and stricter debt management were regularly part of the prescribed policy. Given this background, the SAPs and the neo-liberal policies, often called the "Washington Consensus", have continuously generated considerable debate within African countries and development circles. Supporters argued that the reforms were essential and that they should be implemented sooner rather than later. Critics charged that the Washington Consensus paid insufficient attention to the social aspects of development and the institutional weaknesses of developing countries [11].

- *Vector Error Correction Model (VECM)*

If the two variables (X_t, Y_t) are complementary, a common complement in terms of definition , then the relationship between the(X_t, Y_t) by Error Correction Model can be expressed as shown in the following equation:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t - \pi \hat{u}_{t-1} + e_t$$

α_1: is a multiplier effect (short-term effect) that measures the immediate effect of a change in (X_t) change in (Y_t) .

π : it is the effect of reactions or the effect of adaptation and shows how much of the imbalance can be corrected and this is the extent to which any imbalance from the previous period affects the adjustment in As the following equation illustrates:

$$u'_{t-1} = Y_{t-1} - \beta'_1 - \beta'_2 X_{t-1}$$

β'_2 :the long term response.

Features of the Error Correction Model is considered an important and widespread Econometric model for the following reasons:

a) It is the most appropriate model to measure the correction of imbalance in the previous period.
b) If there is a co-integration, formulated using the first differences, which remove the vector from the variables included in the model and solve the pseudo-regression problem.
c) The possibility of building a model using from general to specific in econometric modeling.
d) The limit of the imbalance error is stable, meaning that the long-term adjustment condition prevents the error limit from being large.

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The Error Correction Model has co integration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their co integrating relationships while allowing for short-run adjustment dynamics. The co integration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Consider 2 variable system with one co integrating equation and no lagged difference terms. The co integrating equation is [3]:

$$q_{2,t} = \delta q_{1,t}$$

The corresponding VEC model is:

$$\Delta q_{1,t} = \Phi_1(q_{2,t-1} - \beta q_{i,t-1}) + \mu_{t,1}$$

$$\Delta q_{2,t} = \Phi_2(q_{2,t-1} - \delta y_{i,t-1}) + \mu_{2,1}$$

In the model, the only right-hand side variable is the error term. In long run equilibrium, this term is zero. However, if q_1 and q_2 deviate from long run equilibrium, the error correction term will be nonzero and each variable adjusts to partially restore the equilibrium relation. The coefficient Φ_i measures the speed of adjustment of the i-th endogenous variable towards the equilibrium. As the VEC specification only applies to co integrated series, you should first run the Johansen co integration test as described above and determine the number of co integrating relations. You will need to provide this information as part of the VEC specification. To set up a VEC, click the Estimate button in the VAR toolbar and choose the Vector Error Correction specification from the VAR/VEC Specification tab. In the VAR/VEC Specification tab, you should provide the same information as for an unrestricted VAR, except that: the constant or linear trend term should not be included in the Exogenous Series edit box. Coefficients of (unrestricted) VARs can be accessed by referring to elements of a two dimensional array C. The first dimension of C refers to the equation number of the VAR, while the second dimension refers to the variable number in each equation. For example, C(2,3) is the coefficient of the third regressor in the second equation of the VAR. The C(2,3) coefficient of a VAR named VAR01 can then be accessed by the command $(\text{var } 01.c(2,3))$. To examine the correspondence between each element of C and the estimated coefficients, select View/Representations from the VAR toolbar.For VEC models, the estimated coefficients are stored in 3different ,2 dimensional arrays: A, B, and C. A contains the adjustment parameters α, β contains the co integrating vectors β' , and C holds the short-run parameters (the coefficients on the lagged first difference terms).

a) A is the equation number of the VEC, while the second index is the number of the co integrating equation. For example, A(2,1) is the adjustment coefficient of the first co integrating equation in the second equation of the VEC.
b) B is the number of the co integrating equation, while the second index is the variable number in the co integrating equation. For example, B(2,1) is the coefficient of the first variable in the second co integrating equation. Note that this indexing scheme corresponds to the transpose of β .
c) C is the equation number of the VEC, while the second index is the variable number of the first differenced regressor of the VEC. For example, C(2, d) is the coefficient of the first differenced regressor in the second equation of the VEC [3].

II. METHODOLOGY AND DATA

The model consists of 5 variables; Growth Rate (GR) dependent variable: and four independent variables i.e. Real Exchange Effective Rate (REER), External Debts (ED), Inflation Rate (INF) and Per capita (PC). Data of the first three variables were collected from the Central Bank of Sudan; the other was obtained from the data base of real effective exchange by the World Bank (RRER). Data sample covers the period 1989-2019. The selection of the start period is due to the fact that it represents an important stage in economic adjusted in Sudan. The paper seeks to assess the structural adjustment policies and programs in the Sudan economy using the Vector Error Correction Model (VECM), in order to reach the results of those programs and policies and contribute to helping decision makers to avoid deficiencies in those policies, in addition to working to use a more alternative policy Effectiveness contributes to increasing the rate of economic growth and economic development. The paper used annual data during the period 1989-2019 as important periods in Sudan's economy [3].

Model Specification

Economic growth was studied as a dependent variable by using the following independent variables: Gross Domestic Product (Per Capita (PC)), Inflation (INF), Real Exchange Effective Rate (REER) and External Debt (ED) by Appling VEC Model to estimate the economic growth model. The model was formulated as:

$$GR = \phi_0 - \phi_1 REER - \phi_2 ED - \phi_3 INF + \phi_4 PC + \varepsilon_t$$

Where

GR : Growth Rate
$REER$: Real Effective Exchange Rate
ED : External Debits
INF : Inflation Rate
PC : Gross Domestic Product (Per Capita)
ϕ_0 : Constant
$\phi_1, \phi_2, \phi_3 and \phi_4$: Parameters

VECM Output

$$GR = 1.0321 - 1.032REER - 6.1212ED - 3.100INF + 4.1555PC$$

$$R^2 = 0.69$$
$$\overline{R}^2 = 0.47$$
$$F = 3.06$$
$$F(prob) = (0.00)$$
$$DW = (1.78)$$

Data Description

The model consists of four variables; real GDP growth (GR) the dependent variable: and Four independent variables i.e. inflation (INF), external debts (ED), Real Exchange Effective Rate (REER) and GDP (PC). Data of the first three variables were collected from the Central Bureau of Statistics; the forth was obtained from the database of real effective exchange by the World Bank (RRER). Data sample covers the period 1980-2016. The selection of the start period is due to the fact that it represents the beginning of first development Plan.

Empirical Results

EG are increased in 1989, decreased in 1990, an increased again in 1991-2007, decreased in 2008-2017. INF increased in 1989-1991, decreased in 1992-1995 and increased in 1996, decreased in 1997-2001, an increased in 2002, decreased in 2003, an increased in 2004, 2005, decreased in 2006, 2007, an increased in 2008-2014, decreased in 2015, 2016, an increased finally in 2017-2018. ED value in 1989 (5.1), an increased in 1990-1992, decreased in 1993-2001, an increased in 2002- 2006, decreased in 2007-2018. REER value in 1989 is (-0.1) increased in 1990, decreased in 1991, an increased in 1992,1993, decreased in 1994-1996, an increased in 1997-2000, decreased in 2001, an increased in 2002-2018. PC value in 1989 (610.3), decreased in 1990-1992, an increased in 1993-1995, decreased in 1996, an increased in 1997, decreased in 1998, 1999, an increased in 2000-2016 and decreased in 2017-2018. Appendix (1). It is obvious that model variables tend to move together up and down.

Unit Root Results

Appendix 3. Should that GR doesn't had a unit root at level (stationary) and that INF, ED and PC doesn't had a unit root at first difference (stationary) and that REER doesn't have a unit root at second difference (stationary). Finally all the variables were constant at the level, the first and the second differences respectively.

Johansen Co-Integration Results

Having achieved stationary, accordingly, as Johansen Co integration indicates, there should be a co-integration test. The existence of co integration between the variables is an indication that there is a long run relationship between the variables. The co-integration test is performed using Johansen Co integration two-step residual based test for the entire test statistics used. Except in the case of *GR* and PC, INF,ED, REER it is found that they are 4 co integrated at 5% level of significance. Therefore, when Granger causality is run on these five variables in their levels, the results may be unreliable and misleading. The Johannes Co integration test in appendix 1 result in presented with the variables in their first differences and second one. The result of the Co integration means that there is no long run relationship between adjusted savings and unemployment, inflation and per capita income. In view of the absence of Co integration between the variables, we should use Vector Error Correction Model.

III. RESULTS AND DISCUSSION

The Structural adjustment policies in Sudan had a negative economic impact through increased rates of inflation and unemployment, reduced savings, investment and exports, deterioration of the value of the local currency, increased internal and external deficits, increased imports of consumer goods, a continuous rise in consumer and general prices, decreased production and productivity, and agriculture. The factors and causes of structural imbalances in Sudan were tested through descriptive and econometric tools during the period 1989-2019. The paper concluded that the effect of the real effective exchange rate on the real growth rate is negative compared to the growth in labor productivity. The effect of foreign debts has an adverse effect on economic growth, because these debts were not scheduled to facilitate their repayment, and at the same time the debts were directed to the unproductive sectors.

The effect of the per capita (PC) was positive on economic growth during the study period, while the effect of inflation rate was negative on economic growth, which requires the state must work to optimizing the economic resources and following an effective monetary policy to reduce inflation and unemployment rates and ultimately stimulate economic growth in finally.

The paper recommends alternative policies to be pursued at the national, regional and international levels such as:

a) Expanding the production of goods and services for the purpose of covering domestic consumption and export.
b) Facilitating credit conditions for productive sectors and helping them import all basic production inputs by obtaining foreign exchange.
c) Applying a special exchange rate to the profits of Sudanese expatriates abroad in order to encourage them to transfer their money to Sudan.
d) They need to take advantage of natural resources for the development of the agricultural and industrial sectors.
e) The necessity to reduce spending on defense and on non-productive sectors, and to focus spending on strategic development projects.
f) Enhancing production capacity in order to realize the idea that Sudan is the global food basket and to develop national industries from exporting materials to exporting commodities

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h) Work to establish a new institutions in the countryside for small farmers, facilitate credit for food production, and apply supervision and supervision from voluntary and non-voluntary organizations.

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Appendix (1): Paper Variables Data

Obs	PC	REER	ED	GR	INF
1989	610.3	0.1	5.1	8.9	66.7
1990	481.5	1.2	7.4	-5.5	65.2
1991	428.4	5.2	8.9	7.5	123.6
1992	256.6	1.2	8.7	6.6	117.6
1993	313.7	10	5.6	4.6	101.4
1994	437.7	5.8	3.4	1	115.4
1995	458.8	3.18	1.8	5.1	68.4
1996	290.4	0.68	2.5	5.1	132.8
1997	365.5	6.8	1.2	10.6	46.7
1998	342.3	9.5	1.9	4.3	17.1
1999	316	6.6	2.4	3.1	15.1
2000	352.5	23.6	1.9	6.3	8
2001	368.5	19.2	1.6	6.5	4.9
2002	402.2	21.1	2.2	6.4	8.3
2003	466	20.5	3.8	7.8	7.71
2004	550.7	24.5	5	3.9	8.4
2005	661.6	16.9	7.4	7.5	8.5
2006	868.3	18.5	6.1	10.1	7.2
2007	1081.2	21.5	5	11.5	8.1
2008	1248.4	23.4	5.5	7.8	14.3
2009	1183.2	15.3	4.8	3.2	11.2
2010	1421.5	21	3.4	3.5	13.2
2011	1596.4	21.2	2.7	-1.1	22.1
2012	1806.5	5.8	2.2	0.5	37.4
2013	1871.2	-21.8	3.3	4.4	30
2014	2087.8	5.5	1.2	2.7	36.9
2015	2414.7	5.9	72.9	4.9	16.9
2016	4500	2.4	63.2	3.1	13.5
2017	1183.2	3.3	78.4	3.2	34.2
2018	1421.5	4.1	121.3	5.7	25.2
2019	1643.7	6.3	145.9	4.2	45.3

Appendix (2): Paper Variables Data

Vector Error Correction Estimates
Date: 10/28/20 Time: 03:04
Sample (adjusted): 1989 2019
Included observations: 28 after adjustments
Standard errors & t-statistics
Cointegration Restrictions: B(1,1)= 1, A(2,1)=0
Convergence achieved after 22 iterations.
Restrictions identify all co integrating vectors
LR test for binding restrictions (rank = 1):

				0.122222	Chi-square(1)
				0.111111	Probability
				CointEq1	Co integrating Eq:
				1.000000	GR(-1)
				-0.001111	INF(-1)
				(0.02111)	
				[-0.04321]	
				0.111111	ED(-1)
				(0.10222)	
				[0.22222]	
				0.03211	GS(-1)
				(0.110221)	
				[0.32121]	
				0.012111	PC(-1)
				(0.00000)	
				[2.12221]	
				-20.96675	C
D(PC)	D(GS)	D(ED)	D(INF)	D(GR)	Error Correction:
15.02841	0.357133	0.183346	0.000000	-0.21111	CointEq1
(8.86464)	(0.59147)	(0.68839)	(0.00000)	(0.12222)	
[1.69532]	[0.60380]	[0.26634]	[NA]	[-5.11111]	
-18.02807	0.164522	-0.260044	0.768692	-0.088888	D(GR(-1))
(10.6105)	(0.70582)	(0.83317)	(1.93699)	(0.232222)	
[-1.69908]	[0.23309]	[-0.31211]	[0.39685]	[-0.12121]	
0.682885	0.463375	-0.393834	-1.537453	-0.076543	D(GR(-2))
(7.15222)	(0.47577)	(0.56162)	(1.30566)	(0.000012	
[0.09548]	[0.97394]	[-0.70125]	[-1.17752]	[-0.79131]	
0.825081	-0.055219	0.023196	-0.435213	0.054276	D(INF(-1))
(1.14660)	(0.07627)	(0.09003)	(0.20932)	(0.01871)	
[0.71959]	[-0.72397]	[0.25763]	[-2.07922]	[2.90123]	
0.787682	-0.097070	-0.063223	0.047805	0.012702	D(INF(-2))
(1.34460)	(0.08944)	(0.10558)	(0.24546)	(0.02194)	
[0.58581]	[-1.08526]	[-0.59880]	[0.19475]	[0.57899]	
23.35207	0.156793	0.035766	-0.289204	0.269557	D(ED(-1))
(4.84017)	(0.32197)	(0.38007)	(0.88359)	(0.07897)	
[4.82464]	[0.48698]	[0.09411]	[-0.32731]	[3.41331]	
-50.97486	0.571512	-0.023141	-0.638800	0.172352	D(ED(-2))
(5.25966)	(0.34988)	(0.41301)	(0.96017)	(0.08582)	
[-9.69167]	[1.63347]	[-0.05603]	[-0.66530]	[2.00838]	
-1.229618	-0.568380	0.706618	0.178446	0.029127	D(GS(-1))
(3.48955)	(0.23213)	(0.27401)	(0.63703)	(0.05694)	
[-0.35237]	[-2.44857]	[2.57879]	[0.28012]	[0.51158]	
-5.283116	-0.459294	-0.893208	0.084877	-0.164072	D(GS(-2))
(4.24058)	(0.28209)	(0.33298)	(0.77413)	(0.06919)	
[-1.24585]	[-1.62820]	[-2.68243]	[0.10964]	[-2.37134]	
-0.082621	-0.025178	0.000570	0.039998	0.008769	D(PC(-1))
(0.19242)	(0.01280)	(0.01511)	(0.03513)	(0.00314)	
[-0.42939]	[-1.96711]	[0.03771]	[1.13869]	[2.79313]	

-0.652528	-0.043162	0.015971	0.073145	0.019867	D(PC(-2))
(0.37312)	(0.02482)	(0.02930)	(0.06812)	(0.00609)	
[-1.74882]	[-1.73895]	[0.54510]	[1.07385]	[3.26341]	
190.2568	5.453264	1.732072	-14.09157	-4.132340	C
(73.2705)	(4.87401)	(5.75345)	(13.3758)	(1.19548)	
[2.59663]	[1.11885]	[0.30105]	[-1.05351]	[-3.45663]	
0.982086	0.487270	0.744932	0.416772	0.692068	R-squared
0.968949	0.111268	0.557882	-0.010929	0.466251	Adj. R-squared
284645.4	1259.560	1755.100	9486.054	75.77601	Sum sq. resids
137.7547	9.163550	10.81696	25.14764	2.247606	S.E. equation
74.75849	1.295924	3.982525	0.974448	3.064726	F-statistic
-163.3640	-90.18753	-94.66634	-117.4448	-37.24260	Log likelihood
12.98993	7.569447	7.901210	9.588507	3.121211	Akaike AIC
13.56586	8.145374	8.477138	10.16443	6.12222	Schwarz SC
36.78148	0.344444	4.162963	-3.644444	-0.02232	Mean dependent
781.7567	9.720271	16.26807	25.01134	4.022222	S.D. dependent
			1.58E+11	Determinant resid covariance (dof adj.)	
			8.35E+09	Determinant resid covariance	
			-500.0404	Log likelihood	
			41.85484	Akaike information criterion	
			44.97445	Schwarz criterion	
			65	Number of coefficients	

Appendix (3): Unit Roots Test Results

Null Hypothesis: GR has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on SIC, maxlag=7)			
Prob.*	t-Statistic	Augmented Dickey-Fuller test statistic	
0.0008	3.711110		
	2.279322	1% level	Test critical values:
	1.967767	5% level	
	1.622989	10% level	
Null Hypothesis: D(INF) has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on SIC, maxlag=7)			
Prob.*	t-Statistic	Augmented Dickey-Fuller test statistic	
0.0005	4.401669		
	3.689194	1% level	Test critical values:
	2.971853	5% level	
	2.625121	10% level	
Null Hypothesis: D(ED) has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on SIC, maxlag=7)			
Prob.*	t-Statistic	Augmented Dickey-Fuller test statistic	
0.0009	5.423232		
	3.689194	1% level	Test critical values:
	2.971853	5% level	
	2.625121	10% level	
Null Hypothesis: D(PC) has a unit root Exogenous: Constant Lag Length: 1 (Automatic - based on SIC, maxlag=7)			
Prob.*	t-Statistic	Augmented Dickey-Fuller test statistic	
0.0003	3.933333		
	3.699871	1% level	Test critical values:
	2.976263	5% level	
	2.627420	10% level	
Null Hypothesis: D(REER) has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on SIC, maxlag=7)			

Prob.*	t-Statistic	Augmented Dickey-Fuller test statistic	
0.0007	4.222222		
	3.689194	1% level	Test critical values:
	2.971853	5% level	
	2.625121	10% level	

Appendix (4): Johansen Co-Integration Test

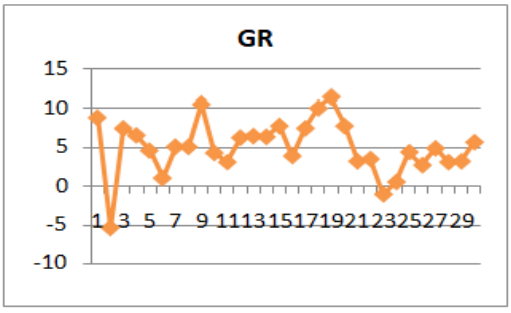
Date: 10/28/20 Time: 03:04
Sample (adjusted): 1989 2019
Included observations: 28 after adjustments
Trend assumption: Linear deterministic trend
Series: GR INF ED REER PC
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

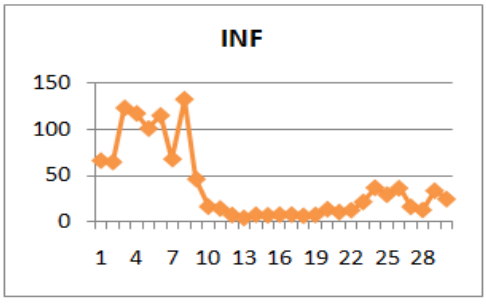
	0.05	Trace		Hypothesized
Prob.**	Critical Value	Statistic	Eigenvalue	No. of CE(s)
0.0010	56.32323	77.44351	0.454545	None *
0.0031	44.44411	64.15678	0.333345	At most 1 *
0.0040	13.13131	33.22234	0.453211	At most 2 *
0.0200	10.12121	12.13121	0.366643	At most 3 *
0.1167	2.545412	7.345122	0.021213	At most 4

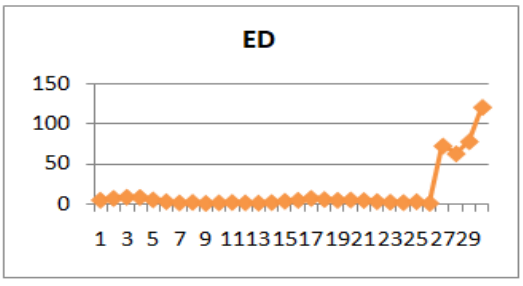
Trace test indicates 4 co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

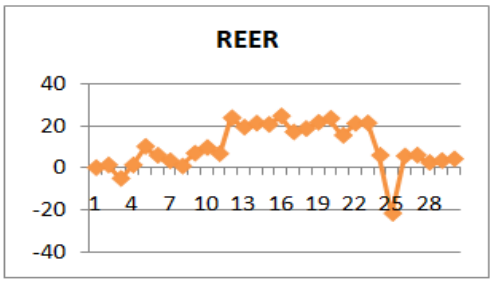
Appendix (4): Descriptive Statistics

	PC	REER	ED	GR	INF
Mean	992.8867	9.718667	14.69333	4.973333	39.53467
Median	580.5000	6.700000	4.300000	5.000000	19.62000
Maximum	4500.000	24.50000	121.3000	11.50000	132.8400
Minimum	256.6000	21.80000	1.200000	-5.500000	4.900000
Std. Dev.	903.4426	10.63749	28.91587	3.519104	40.23260
Skewness	2.158402	0.615435	2.532812	-0.662928	1.203636
Kurtosis	8.582374	3.599913	8.320453	4.208601	3.045245
Jarque-Bera	62.24712	2.343673	67.45971	4.023262	7.246261
Probability	0.212121	0.309797	0.542111	0.133771	0.08669
Sum	29786.60	291.5600	440.8000	149.2000	1186.040
Sum Sq. Dev.	23670048	3281.530	24247.70	359.1387	46941.21
Observations	31	31	31	31	31









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