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Trade openness and growth in agricultural sector output in Nigeria

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Abstract
The study examined trade openness and growth in the output of the agricultural sector in Nigeria. The objectives were to investigate the impact of degree of openness and exchange rate on agricultural sector growth in Nigeria. The study employed quasi-experimental research design. Time series data were used. Data were generated from central bank of Nigeria statistical bulletin and National bureau of statistics statistical bulletin. The study adopted the analytical method of ordinary least squares (OLS) of multiple regression. Other methods of analysis employed in this study includes; unit root test, co-integration test and parsimonious error correlation model. The estimated parsimonious error correction result showed that the overall model is satisfactory with an R-squared of 0.596, thus 60 percent of the systematic variation in growth of agricultural output is explained by the ECM. The ECM coefficient appeared with a negative sign and is statistically significant at the 5% level. Meanwhile, the current and lag one forms of all the independent variables (DOP, EXR and UEP) were rightly signed, meaning that both degree of openness and exchange rate are positively signed. All these conform to apriori expectation. But for the three periods, the independent variables were not statistically significant at 5 percent level. We could infer from these results that trade openness is not the only determinant of growth in agricultural output in Nigeria during the period under review. Therefore, the study recommends that the government should reassess its reforms programmes and policy on trade so that the end product should be significant impact on the growth of agricultural sector.

Keywords: Growth, globalization, output, needs, liberalization.

1. Introduction

1.1 Statement of the problem

With the emergence of globalization and liberalization, scholars have long been interested in factors which cause different countries to grow at different rates and achieve different levels of wealth. One of such factors is trade openness. Trade openness is the process of reducing or removing restrictions on international trade. This may include the reduction or removal of tariffs, abolition or enlargement of import quotas, abolition of multiple exchange rates, and removal of requirements for administrative permits for imports or allocations of foreign exchange. One of the basic interests in development and international economics is to check if trade openness promotes economic growth especially in the agricultural sector. Giving that the world is a "global village" regional integration becomes a way of improving the levels of participation of countries in the sub region in global trade as well as the world economy, and also their integration into the borderless and interlinked global economy (NEEDS 2005).

The widely-held policy consensus on the beneficial impact of trade openness on growth provided an easy roadmap for developing countries: integration into the globalization process through trade reforms was viewed as one of the major pillars of any sound development strategy and most of the time as an ultimate goal (Rodrik 2001). Trade openness means allowing market forces to determine international transactions with little or no government interference. Trade-related changes in the developing countries especially Nigeria are usually associated with one-time reforms in trade policy; most of the trade developments in advanced countries reflects long run tendencies in transport and communication costs, technology and factor endowments (Turin, 2002).

In 1986, Nigeria adopted the structural adjustment programme (SAP) of IMF/World Bank. With the adoption of (SAP) in 1986, there was a radical shift from inward – oriented trade policies to outward-oriented trade policies in Nigeria. These are policy measures that emphasize production and trade along the lines dictated by a countries comparative advantage such as export promotion and export diversification, reduction or elimination of imports tariffs and adoption of market determined exchanged rates. The primary aim of the programme was to restructure and diversify the productive base of the economy which includes the agricultural sector. In addition SAP was also designed to establish a realistic and sustainable exchange rate for the naira through trade and payment liberalization, tariff reforms, commercialization and privatization of public enterprises etc. (oyejide, 1990) [12]. Today, as part of moving with the trend of globalization and trade liberalization in global economic system, Nigeria is a member of and signatory to many international and regional trade agreements such as international monetary fund (IMF). World trade organization (WTO), economic community of West African States (ECOWAS), and so many others. The policy response of such economic partnership on trade has been to remove trade barriers, reduce tariffs and embark on outward – oriented trade policies. The economy has struggled vigorously to stimulate growth through openness to trade. In fact, it seems that as the country put greater effort to boast her economic growth by opening up to trade with the global economy the more she becomes worse-off relative to her

trading partners in terms of country output growth especially in the agricultural sector of the economy.

1.2 Objectives of the Study

The objective of this research work is to determine the impact of the trade openness, exchange rate on the growth of agricultural sector output in Nigeria

2.1 Literature Review

2.1.1 Theoretical underpinning

From Mercantilism to classicism and modern trade theories as found in the history of economic thought have argued in favour of global trade. These scholars believed that trade is a sine-qua-non to the improvement of welfare through the efficient allocation of resource factors across various sectors and countries. The theoretical framework of this study is the Heckscher Ohlin theory of international trade. This theory as argued by many international economists is an improvement of David Ricardo's theory of comparative advantage because trade occurs as a result of differences in comparative cost which is also due to inter-country differences in relative factor endowment. Heckscher Ohlin theory is relevant because it began with the comparative advantage and link the pattern of global trade to the economic structure of trading nations. This provides the model to explaining a change in global trade on the growth of all sector of economies. Many econometric studies as argued by Nnadozie, 2003, have confirmed that positive relationship exist between global trade and economic growth. The Heckscher – Ohlin theory postulates that international trade – of which exports are expected to constitute the major component – will significantly reduce the gap between the rich and poor countries. The theory contends that inter-country differences in factor endowments are the basis for foreign trade.

The Heckscher-Ohlin theory also implies that free trade specialization in production based on relative factor endowments will tend to bring about factor price equalization and thus will increase the returns to labour in poor countries to the levels in rich countries; this suggests that international trade in general and exports in particular have the ability to mitigate inequality in income and wealth distribution between and within nations as well as the ability to bring about a convergence in absolute poverty incidence between the rich and poor countries (Ozughalu and Ajayi, 2004). The relationship between exports and economic growth has always been a hot issue and has often generated heated debate among economists and policy makers. Furthermore, the African Development Report (2012) identified trade as a powerful tool through which gains from globalisation are distributed within and between nations. However the relationship between trade and growth does not however establish a cause and effect, because as economies grow, they trade more and become more open (Chatterji, Mohan & Dastidar, 2013). Relaxing foreign exchange controls may increase investment opportunities. These increases in investment bring about new technologies that could increase a country's economic growth. Such investment opportunities can be facilitated through creating trading opportunities and an environment that can attract multinational companies. However benefits from trade depend on the production, nature and characteristics of the goods that a country produces and trades; the domestic economic policies pursued and the trading regime adopted. The static and dynamic gains from trade arise from comparative advantage theory and the effects of trade on the level of investment, and on the state of technical knowledge (Marrewijk, 2012).

2.2 Empirical Literature

Adebiyi (2006) investigated the relationship between policies of trade openness and economic growth performance in Nigeria. This study applied Vector Auto regression Techniques and used annual time series data set. Major findings suggest that sustained economic growth in Nigeria can be achieved by implementing a comprehensive trade openness programme. In a recent study, Vanikkaya (2003) used a large number of openness measure for a cross-section of countries over the last three decades. His analysis found a significant positive correlation between trade shares and growth. However, this study observed that different measures of trade barriers are positively associated with growth in the less developed countries. Loayza, Fajnzylber, and Calderon (2005) run growth regressions on panel data of large samples of countries. Both papers use openness indicators based on trade volumes and control for their joint endogeneity and correlation with country-specific factors through GMM methods that involve taking differences of data and instruments. Both papers conclude that opening the economy to international trade brings about significant growth improvements. Empirical study by Bolaky and Freund (2004) using cross-country regressions in levels and changes of per capita GDP and controlling for simultaneity via external instruments, they find that trade opening promotes economic growth only in country's that are not excessively regulated. They argue that in highly regulated countries, growth does not accompany trade openness because resources are prevented from flowing to the most productive sectors and firms, and trade is likely to occur in goods where comparative advantage is actually missing.

Calderon, Loayza, and Schmidt –Hebbel (2004) interact in their panel growth regressions a measure of openness (volume of trade /GDP) with linear and quadratic terms of GDP per capita, which they regard as proxy for overall development. They find that the growth effect of trade openness is nearly zero for low levels of per capita GDP, increases at a decreasing rate as income rises, and reaches a maximum at high levels of income.

Chang, Kaltani and Loayza (2005) [6] study how the effect of trade openness on economic growth depends on complementary reforms that help a country take advantage of international competition. They presented some panel evidence on how the growth effect of openness depends on a variety of structural characteristics. They use non-linear growth regression specification that interacts a proxy of trade openness with proxies of educational investment, financial depth, inflation, stabilization, public infrastructure, governance, labour-market flexibility, ease of firm entry, and ease of firm exit. They find that the growth effects of openness are positive and economically significant if certain complementary reforms are undertaken. Baliamoune-Lutz and Ndikumana (2007) [5] explore the argument that one of the causes of the limited growth effects of trade openness in Africa maybe the weakness of institutions. They also control for several major factors and, in particular, for export diversification, using a newly developed data set on Africa. Results from Arellano-Bond GMM estimations on panel data from African countries show that institutions play an important role in enhancing the growth

effects of trade. They find that the joint effect of institutions and trade has U-shape, suggesting that as openness to trade reaches high levels, institution play a critical role in harnessing the trade-led engine of growth. The results from this paper are informative about the missing link between trade liberalization and growth in the case of African countries. Ogujiuba, Oji and Adenuga (2004) test the validity of trade openness for Nigeria's long-run growth using a co-integration approach. They preferred the VAR approach for some reasons and their econometric results show that there is no significant relationship between openness and economic growth, and that unbridled openness could have deleterious implications for growth of local industries, the real sector and government revenue.

Wacziarg and Welch (2003) arrive to a similar, though more nuanced, conclusion from a methodological different stand point. Using an event-study methodology –where the event is defined as the year of substantial trade policy liberalization--, they find that liberalizing countries tend to experience significantly higher volume of trade, investment rates, and most importantly, growth rates. However, in an examination of 13 country-case studies Wacziarg and Welch find noticeable heterogeneity in the growth response to trade liberalization.

Moreover, Addison and Wodon (2007) study the macroeconomic volatility, private investment growth, and poverty in Nigeria. Using cross-sectional data for 87 countries, they show that real per-capita growth over the period 1980 - 1994 was a function of productivity growth and investment rates, both of which were negatively affected by volatility (in terms of trade, real exchange rate, and public investments). Akanni, *et al*. (2008) [3]. examining the effect of trade liberalization on agricultural exports in Nigeria, observed that the policy had tremendous effects on the level and value of exports in agricultural sub-sector A regression analysis relating the total value of agricultural produce and the aggregated domestic prices, and other relevant parameters of four commodities accounted for between 65 and 87 percent of the variability in income from the foreign sector of Nigeria Agricultural commodity trade between 1990 and 1998. High value of co-efficient of elasticity further confirmed that export trade in these four commodities would dominate the Nigeria Agricultural export trade for years to come. Kingsley *et al*. (2004) examined the impact of openness on Nigeria's long-run growth using the cointegration approach. They reported that there is no significant relationship between openness and growth, and that unbridled openness could have deleterious implications for growth of local industries, the real sector and government revenue. Meanwhile, Chimobi (2010) investigated the causal relationship among financial development, trade openness and economic growth in Nigeria from 1970 to 2005. The results suggest that trade openness and financial developments have causal impact on economic growth with feedback effect during the period studied.

Anyanwu (2009) applying Ordinary Least Squares technique, studied the determinants of aggregate agricultural productivity among smallholder farmers in Rivers State, Nigeria. Cross-sectional data generated from 288 food crop farmers randomly selected from 5 out of the 23 Local Government Areas were used. Results of the analysis showed that farm land, labour input, planting materials, age of the farmers, farming experience, and level of education are the main significant determinants of aggregate agricultural productivity in the State.

3.1 Methods Of Study

3.1.1 Method of Data Analysis

The research employ time series data in its analysis. Data were generated from central bank of Nigeria statistical bulletin and National bureau of statistical bulletin. The study adopted the analytical method of ordinary least squares (OLS) of multiple regression. Other methods of analysis employed in this study includes; unit root test, co-integration test and parsimonious error correlation model. The choice of co-integration test for our analysis was informed by the pitfalls that sometimes characterize time series data.

3.1.2 Unit Root Test

In order to avoid a spurious regression, the researcher first tests the stationarity of the variables. Unit root tests are usually performed on variables to determine if they are stationary (i.e. zero mean and constant variance) and if otherwise, to determine the order of integration (i.e. number of times they are to be differenced to achieve stationarity). The times series characteristics of the variables using the augmented Dickey – Fuller (ADF) (Dickey and Fuller, 1981) [7] and Philips-Perron (PP) (Philips and perron, 1988) tests were examined. Basically, the idea is to ascertain the order of integration of the variables as to whether they are stationary 1 (0) or non-stationary; and therefore, the number of times each variable has to be differenced to arrive at stationarity.

3.1.3 Co-integration Analysis

Co-integration is the idea that the linear combinations of non-stationarity series can be stationary, implying a long-run relationship, thus they can be modeled. In testing for co-integration, the Johansen efficient maximum likelihood test was used to examine the existence of a long-term relationship among the variables.

3.1.4 Error Correction Model

This is the final specification that includes a short run dynamic process, consistent with data and converging to the long run equilibrium. The error correction model (ECM) attempts to integrate economic theory useful in characterizing long run equilibrium with observed disequilibrium by building a model that explicitly incorporates behavior that would restore equilibrium. Error correction mechanism has the co-integed relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their co-integrating relationship while allowing for short-run adjustment dynamics. The error correction term (ECM) is the one-period lagged value of the residual from the static model.

3.2 Model Specification

The model is specified thus:

AGDP = F (DOP, EXR, UEP)……3.1

Thus we can express the econometric form of the model as:

$AGDP = B_0 + B_1 DOP, + B_2 EXR + B_3 UEP, + Ui$……..3.2

Where

AGDP = Growth in agricultural sector output

DOP = The degree of openness measured as trade – GDP ratio is (import + export)/GDP

ER= Exchange rate

UEP = Unemployment rate

Ui = Stochastic or Error term

4.1 Results
4.2 Short-Run Regression Analysis

Table 4.2: Analysis of Regression Result for Agricultural Output Model

Dependent Variable: LOG(AGP)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	10.38124	1.058160	9.810655	0.0000
LOG(DOP)	0.059661	0.184378	0.323580	0.7485
LOG(UEP)	0.230313	0.466102	0.494127	0.6248
LOG(EXR)	0.275463	0.188857	1.458579	0.1551
R-squared	0.639355	Mean dependent var		11.73852
Adjusted R-squared	0.603291	S.D. dependent var		0.922703
S.E. of regression	0.581163	Akaike info criterion		1.862561
Sum squared resid	10.13252	Schwarz criterion		2.042133
Log likelihood	-27.66353	F-statistic		17.72813
Durbin-Watson stat	1.721250	Prob(F-statistic)		0.000001

Source: Author's *Computation*

The estimated short run result of the agricultural output model as reported in table 4.2 in chapter four, shows that the R^2 is 0.639, meaning that the deviation in agricultural output brought about by degree of openness, exchange rate and unemployment rate is 64 percent. The remaining 36% is captured by the error term. The variable, Degree of Openness (DOP) appeared with positive sign but statistically not significant. Also, the regression coefficient of exchange rate (EXR) is positively signed but statistically not significant at 5 percent level. But the regression coefficient of unemployment rate is positively signed and statistically not significant at 5 percent level. This does not conform to the apriori expectation. Meanwhile, the overall model is significant at 5 percent level given the f-value of 17.728 with the probability of 0.0000. The Durbin Watson value of 1.72 shows the presence of serial autocorrelation. The summarized results show that the regression result is spurious. This is because none of the independent variables is statistically significant. Also, the Durbin Watson shows the presence of serial autocorrelation. These findings are supported by the non-stationarity of time series data that are used for the study. Thus, there is need to conduct stationarity test to stabilize the time series.

4.3 Long Run Regression Analysis
4.3.1 Unit Root Test (Augmented Dickey Fuller)
One of the characteristics of short run analyses spurious result. Thus, a stationarity test is essential to stabilize the data and determine whether a long run relationship exists between the variables under consideration. Table 4.3 below presents the result of the Augmented Dicky-Fuller unit root diagnostic test conducted on the time series.

Table 4.3: Result of Unit Root Test on Variables

Variables	**ADF Test**		**Critical Value**				**Order of integration**
			1% critical value	**5% Critical value**	**10% critical value**		
AGP	-6.517440		-3.6576	-2.9591	-2.6181		I(1)= 1st Diff.
DOP	-6.076494		-3.6576	-2.9591	-2.6181		I(1)= 1st Diff.
UEP	-7.170254		-3.6576	-2.9591	-2.6181		I(1)= 1st Diff.
EXR	-3.739007		-3.6576	-2.9591	-2.6181		I(1) = 1st Diff..

Source: *Author's computation*

The unit root test results presented in table 4.3 in chapter four shows that the variables were stationary. Although, all the variables were not stationary at their levels, all non-stationary variables became stationary when differenced once. Meaning that agricultural output, degree of openness, exchange rate and unemployment rate were integrated of order one 1(1).

4.3.2Johansen Test for Co-integration
The analysis of and testing for unit roots naturally lead to the theory of cointegration, thus, according to Iyoha and Ekanem, (2004), cointegration deals with the methodology of modeling non-stationary time series variables. For detail result of the Johansen co integration, see table 4.4 below

Table 4.4: Johansen Integration Test Result for AGP Model

Eigen value	**LikelihoodRatio**	**5% critical value**	**1% critical value**	**Hypothesized N0 of CE(s)**
0.981199	196.4037	47.21	54.46	None **
0.856740	81.16151	29.68	35.65	At most 1 **
0.387478	24.81179	15.41	20.04	At most 2 **
0.306087	10.59686	3.76	6.65	At most 3 **

Source: *Author's Computation*
Note: * denote rejection of the hypothesis at the 0.05 level. **Mackinnon-Haug-Michelis (1999) p-values. Likelihood ratio test indicate 4 co-integrating eqn(s) at 0.05 level

4.3.3 Error Correction Model (ECM)

According to Iyoha and Ekanem (2004), error correction model (ECM) involves using lagged residual to correct for deviations of actual values from the long-run equilibrium values. In order to capture the short-run deviations that might have occurred within the period of the study. The estimated result of the parsimonious ECM obtained is showed below:

Table 4.5: Parsimonious Error Correction Model

Dependent Variable: D(AGP)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	55650.76	76359.05	0.728804	0.4742
D(AGP(-1))	-0.109421	0.283243	-0.386315	0.7031
D(AGP(-2))	-0.017812	0.200788	-0.088709	0.9302
D(DOP)	1.922646	26.98150	-0.071258	0.9439
D(DOP(-2))	1.971837	21.52374	0.091612	0. 9279
D(EXR)	4.35.5555	44.43113	-0.098029	0.9228
D(EXR(-2))	6.183443	46.51807	-1.329256	0.1980
D(UEP)	-9.243438	40.69022	-0.227166	0.8225
D(UEP(-2))	-41.89028	39.97948	1.047795	0.3066
ECM(-1)	-5.843659	19.48978	-2.998320	0.0068
R-squared	0.596935	Mean dependent var		9327.406
Adjusted R-squared	0.424193	S.D. dependent var		448968.1
S.E. of regression	340685.8	Akaike info criterion		28.57101
Sum squared resid	2.44E+12	Schwarz criterion		29.03358
Log likelihood	-432.8506	F-statistic		3.455642
Durbin-Watson stat	1.751506	Prob(F-statistic)		0.009188

Source: *Author's Computation*

The estimated parsimonious error correction result as shown in table 4.5 shows that the overall model is satisfactory with an R-squared of 0.596, thus 60 percent of the systematic variation in agricultural production output is explained by the ECM. The ECM coefficient appeared with a negative sign and is statistically significant at the 5% level. Meaning that, the ECM will correct any deviation from the short run to long-run equilibrium. Also, the Durbin Watson value of 1.75 which is not too far from 2.0, suggests a lesser level of autocorrelation. The F-statistic of 3.455 is significant at the 5% level, meaning that the overall model is satisfactory.

Meanwhile, the current and lag one forms of all the independent variables (DOP, EXR and UEP) were rightly signed, meaning that both degree of openness and exchange rate are positively signed while unemployment is negatively signed. All these conform to apriori expectation. But for the three periods, the independent variables were not statistically significant at 5 percent level With these results, we accept the respective null hypotheses of the analysis which state that; (i) There is no significant relationship between agricultural output and degree of openness (ii) There is no significant relationship between agricultural output and exchange rate (iii) There is no significant relationship between agricultural output and unemployment rate. We could infer from these results that trade openness is not the only determinant of agricultural output in Nigeria during the period under review.

4.3.4 Pairwise Granger Causality Test Result

In order to find out the direction of the effect of trade openness on agricultural output, we conducted the Granger causality test. This helps us to detect the direction of effect between the dependent and the independent variables. Before the causality test, the variables were subjected to the level at which they were stationary. The results of our tests are as follows:

Table 4.6: Granger Causality Test

Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
DOP does not Granger Cause AGP	32	1.50264	0.24057
AGP does not Granger Cause DOP		2.98061	0.06767
EXR does not Granger Cause AGP	32	3.50454	0.04435
AGP does not Granger Cause EXR		0.20132	0.81887
UEP does not Granger Cause AGP	32	4.02758	0.02946
AGP does not Granger Cause UEP		0.91837	0.41128
EXR does not Granger Cause DOP	32	3.49270	0.04477
DOP does not Granger Cause EXR		0.72009	0.49582
UEP does not Granger Cause DOP	32	0.63621	0.53705
DOP does not Granger Cause UEP		4.11617	0.02752
UEP does not Granger Cause EXR	32	0.95067	0.39904
EXR does not Granger Cause UEP		6.42645	0.00521

Source: *Author's Computation*

The results presented on table 4.6 above showed that there was a unidirectional causality among the variables AGP & DOP, EXR & AGP, UEP & AGP, EXR & DOP, DOP & UEP as well as EXR & UEP. This reveals that the variables are necessary condition for achieving growth in agricultural output

5.1 Conclusion and Recommendation

Trade openness is a major determinant of growth in the economy according economic theory hence countries thrive to create the enabling environments for free movement of investments capital and international trade that creates growth and development. The results of the study showed that the coefficient of trade openness is positive but not significant in impacting on growth in agricultural output hence the study recommends for more and sustainable economic reforms that will remove all impediments to trade openness in Nigeria.

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Appendix I

Research Data

YEAR	AGP(N'M)	UEP(N'M)	EXR(N /$)	DOP(N'M)
1980	6501.800	6.400000	0.540000	0.033500
1981	57909.70	7.100000	0.610000	0.116300
1982	59450.80	4.700000	0.670000	0.095000
1983	59009.60	10.20000	0.720000	0.088400
1984	55918.20	7.300000	0.760000	0.088600
1985	65748.40	6.100000	0.890000	0.093400
1986	72135.20	5.300000	2.020000	0.072400
1987	69608.10	7.000000	4.020000	0.235500
1988	76753.70	5.300000	4.540000	0.239400
1989	80878.00	4.000000	7.390000	0.375200
1990	84344.60	5.500000	8.010000	0.581600
1991	87503.50	5.700000	9.910000	0.795200
1992	89345.40	7.500000	17.30000	1.285200
1993	90596.50	7.200000	22.05000	1.398700
1994	92833.00	6.800000	21.89000	1.339100
1995	96220.70	6.400000	21.89000	6.061600
1996	100216.2	6.400000	21.89000	6.373400
1997	104514.0	8.500000	21.89000	6.911300
1998	108814.1	7.600000	21.89000	5.112000
1999	114570.7	8.500000	102.1100	6.571400
2000	117945.1	11.50000	102.1100	8.903200
2001	122522.3	9.600000	112.9400	9.036900
2002	1901334.	8.800000	126.8800	7.538900
2003	203409.9	10.80000	137.2200	5.002800
2004	216208.5	10.20000	133.5000	12.49080
2005	231463.6	9.400000	132.1500	17.88010
2006	248599.0	9.900000	128.6500	17.51060
2007	266477.2	10.90000	125.8300	19.26950
2008	283175.4	12.80000	126.4800	22.83730
2009	299823.9	11.20000	149.9000	18.71950
2010	317281.7	11.53600	150.4800	15.83530
2011	335180.1	14.60000	158.2100	29.33390
2012	348490.8	12.40000	159.3900	28.94700
2013	348600.4	12.8333	161.5000	29.14045

Regression Results

Dependent Variable: AGP				
Method: Least Squares				
Date: 08/07/15 Time: 02:28				
Sample: 1980 2013				
Included observations: 34				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	267326.1	259428.4	1.030443	0.3110
DOP	-10984.94	11872.78	-0.925221	0.3622
UEP	-34404.72	40361.21	-0.852420	0.4007
EXR	4908.337	1802.025	2.723790	0.0107
R-squared	0.269707	Mean dependent var		200393.7
Adjusted R-squared	0.196678	S.D. dependent var		316913.2
S.E. of regression	284043.7	Akaike info criterion		28.06177
Sum squared resid	2.42E+12	Schwarz criterion		28.24135
Log likelihood	-473.0502	F-statistic		3.693143
Durbin-Watson stat	2.502939	Prob(F-statistic)		0.022493

Source: Author's *Computation*

Log-Linear Run Result

Dependent Variable: LOG(AGP)				
Method: Least Squares				
Date: 08/07/15 Time: 02:29				
Sample: 1980 2013				
Included observations: 34				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	10.38124	1.058160	9.810655	0.0000
LOG(DOP)	0.059661	0.184378	0.323580	0.7485
LOG(UEP)	0.230313	0.466102	0.494127	0.6248
LOG(EXR)	0.275463	0.188857	1.458579	0.1551
R-squared	0.639355	Mean dependent var		11.73852
Adjusted R-squared	0.603291	S.D. dependent var		0.922703
S.E. of regression	0.581163	Akaike info criterion		1.862561
Sum squared resid	10.13252	Schwarz criterion		2.042133
Log likelihood	-27.66353	F-statistic		17.72813
Durbin-Watson stat	1.721250	Prob(F-statistic)		0.000001

Unit Root
AGP

ADF Test Statistic	**-3.427521**	**1% Critical Value***	**-3.6496**
		5% Critical Value	**-2.9558**
		10% Critical Value	**-2.6164**
***MacKinnon critical values for rejection of hypothesis of a unit root.**			
Augmented Dickey-Fuller Test Equation			
Dependent Variable: D(AGP)			
Method: Least Squares			
Date: 08/07/15 Time: 02:32			
Sample(adjusted): 1982 2013			
Included observations: 32 after adjusting endpoints			
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
AGP(-1)	-0.863656	0.251977	-3.427521	0.0018
D(AGP(-1))	-0.070771	0.184833	-0.382890	0.7046
C	184144.5	76964.88	2.392579	0.0234
R-squared	0.467470	Mean dependent var		9084.084
Adjusted R-squared	0.430744	S.D. dependent var		441669.5
S.E. of regression	333235.5	Akaike info criterion		28.36015
Sum squared resid	3.22E+12	Schwarz criterion		28.49756
Log likelihood	-450.7623	F-statistic		12.72851
Durbin-Watson stat	2.010987	Prob(F-statistic)		0.000108

AGP

ADF Test Statistic	**-6.517440**	**1% Critical Value***	-3.6576
		5% Critical Value	-2.9591
		10% Critical Value	-2.6181
***MacKinnon critical values for rejection of hypothesis of a unit root.**			
Augmented Dickey-Fuller Test Equation			
Dependent Variable: D(AGP,2)			
Method: Least Squares			
Date: 08/07/15 Time: 02:33			
Sample(adjusted): 1983 2013			
Included observations: 31 after adjusting endpoints			
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(AGP(-1))	-2.008951	0.308242	-6.517440	0.0000
D(AGP(-1),2)	0.337719	0.177848	1.898918	0.0679
C	19199.93	68026.26	0.282243	0.7798
R-squared	0.779301	Mean dependent var		-46.17742
Adjusted R-squared	0.763537	S.D. dependent var		778091.0
S.E. of regression	378365.6	Akaike info criterion		28.61688
Sum squared resid	4.01E+12	Schwarz criterion		28.75565
Log likelihood	-440.5616	F-statistic		49.43496
Durbin-Watson stat	2.173114	Prob(F-statistic)		0.000000

DOP

ADF Test Statistic	**0.467853**	**1% Critical Value***	**-3.6496**
		5% Critical Value	**-2.9558**
		10% Critical Value	**-2.6164**
***MacKinnon critical values for rejection of hypothesis of a unit root.**			
Augmented Dickey-Fuller Test Equation			
Dependent Variable: D(DOP)			
Method: Least Squares			
Date: 08/07/15 Time: 02:34			
Sample(adjusted): 1982 2013			
Included observations: 32 after adjusting endpoints			
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
DOP(-1)	0.034311	0.073338	0.467853	0.6434
D(DOP(-1))	-0.170946	0.201211	-0.849585	0.4025
C	0.792184	0.787141	1.006407	0.3225
R-squared	0.024833	Mean dependent var		0.907005
Adjusted R-squared	-0.042420	S.D. dependent var		3.237885
S.E. of regression	3.305848	Akaike info criterion		5.318323
Sum squared resid	316.9304	Schwarz criterion		5.455736
Log likelihood	-82.09317	F-statistic		0.369241
Durbin-Watson stat	2.143442	Prob(F-statistic)		0.694462

DOP

ADF Test Statistic	**-6.076494**	**1% Critical Value***	**-3.6576**
		5% Critical Value	**-2.9591**
		10% Critical Value	**-2.6181**
***MacKinnon critical values for rejection of hypothesis of a unit root.**			
Augmented Dickey-Fuller Test Equation			
Dependent Variable: D(DOP,2)			
Method: Least Squares			
Date: 08/07/15 Time: 02:35			
Sample(adjusted): 1983 2013			
Included observations: 31 after adjusting endpoints			
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(DOP(-1))	-1.587773	0.261298	-6.076494	0.0000
D(DOP(-1),2)	0.398920	0.173522	2.298956	0.0292
C	1.489636	0.606973	2.454204	0.0206
R-squared	0.636350	Mean dependent var		0.006927
Adjusted R-squared	0.610375	S.D. dependent var		4.953453
S.E. of regression	3.091945	Akaike info criterion		5.187243
Sum squared resid	267.6834	Schwarz criterion		5.326016
Log likelihood	-77.40227	F-statistic		24.49851
Durbin-Watson stat	1.909394	Prob(F-statistic)		0.000001

UEP

ADF Test Statistic	**-0.821926**		**1% Critical Value***		**-3.6496**
			5% Critical Value		**-2.9558**
			10% Critical Value		**-2.6164**
	***MacKinnon critical values for rejection of hypothesis of a unit root.**				
	Augmented Dickey-Fuller Test Equation				
	Dependent Variable: D(UEP)				
	Method: Least Squares				
	Date: 08/07/15 Time: 02:36				
	Sample(adjusted): 1982 2013				
	Included observations: 32 after adjusting endpoints				
Variable	**Coefficient**		**Std. Error**	**t-Statistic**	**Prob.**
UEP(-1)	-0.102947		0.125251	-0.821926	0.4178
D(UEP(-1))	-0.377321		0.179332	-2.104038	0.0442
C	1.120896		1.089020	1.029271	0.3119
R-squared	0.207918		Mean dependent var		0.179166
Adjusted R-squared	0.153292		S.D. dependent var		1.841384
S.E. of regression	1.694382		Akaike info criterion		3.981573
Sum squared resid	83.25694		Schwarz criterion		4.118985
Log likelihood	-60.70516		F-statistic		3.806189
Durbin-Watson stat	2.174301		Prob(F-statistic)		0.034054

UEP

ADF Test Statistic	**-7.170254**	**1% Critical Value***		**-3.6576**
		5% Critical Value		**-2.9591**
		10% Critical Value		**-2.6181**
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(UEP,2)				
Method: Least Squares				
Date: 08/07/15 Time: 02:36				
Sample(adjusted): 1983 2013				
Included observations: 31 after adjusting endpoints				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(UEP(-1))	-2.039508	0.284440	-7.170254	0.0000
D(UEP(-1),2)	0.431129	0.169786	2.539252	0.0169
C	0.480418	0.279885	1.716483	0.0971
R-squared	0.778956	Mean dependent var		0.091397
Adjusted R-squared	0.763167	S.D. dependent var		3.120657
S.E. of regression	1.518683	Akaike info criterion		3.765330
Sum squared resid	64.57917	Schwarz criterion		3.904103
Log likelihood	-55.36262	F-statistic		49.33577
Durbin-Watson stat	1.630135	Prob(F-statistic)		0.000000

EXR

ADF Test Statistic	**-0.113200**	**1% Critical Value***		**-3.6496**
		5% Critical Value		**-2.9558**
		10% Critical Value		**-2.6164**
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(EXR)				
Method: Least Squares				
Date: 08/07/15 Time: 02:38				
Sample(adjusted): 1982 2013				
Included observations: 32 after adjusting endpoints				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
EXR(-1)	-0.005078	0.044858	-0.113200	0.9107
D(EXR(-1))	-0.057381	0.189826	-0.302281	0.7646
C	5.635451	3.887226	1.449736	0.1579
R-squared	0.004313	Mean dependent var		5.027812
Adjusted R-squared	-0.064356	S.D. dependent var		14.80024
S.E. of regression	15.26905	Akaike info criterion		8.378593
Sum squared resid	6761.173	Schwarz criterion		8.516006
Log likelihood	-131.0575	F-statistic		0.062803
Durbin-Watson stat	1.998375	Prob(F-statistic)		0.939256

EXR

ADF Test Statistic	**-3.739007**	**1% Critical Value***		**-3.6576**
		5% Critical Value		**-2.9591**
		10% Critical Value		**-2.6181**
***MacKinnon critical values for rejection of hypothesis of a unit root.**				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(EXR,2)				
Method: Least Squares				
Date: 08/07/15 Time: 02:38				
Sample(adjusted): 1983 2013				
Included observations: 31 after adjusting endpoints				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(EXR(-1))	-1.028341	0.275030	-3.739007	0.0008
D(EXR(-1),2)	-0.035471	0.188466	-0.188210	0.8521
C	5.334495	3.117759	1.711003	0.0981
R-squared	0.534247	Mean dependent var		0.066129
Adjusted R-squared	0.500979	S.D. dependent var		21.94157
S.E. of regression	15.49983	Akaike info criterion		8.411301
Sum squared resid	6726.855	Schwarz criterion		8.550074
Log likelihood	-127.3752	F-statistic		16.05887
Durbin-Watson stat	2.005210	Prob(F-statistic)		0.000023

Johansen Cointegration

Date: 08/07/15 Time: 02:41				
Sample: 1980 2013				
Included observations: 29				
Test assumption: Linear deterministic trend in the data				
Series: AGP DOP UEP EXR				
Lags interval: 1 to 4				
	Likelihood	**5 Percent**	**1 Percent**	**Hypothesized**
Eigenvalue	**Ratio**	**Critical Value**	**Critical Value**	**No. of CE(s)**
0.981199	196.4037	47.21	54.46	None **
0.856740	81.16151	29.68	35.65	At most 1 **
0.387478	24.81179	15.41	20.04	At most 2 **
0.306087	10.59686	3.76	6.65	At most 3 **
*(**) denotes rejection of the hypothesis at 5%(1%) significance level				
L.R. test indicates 4 Cointegrating equation(s) at 5% significance level				
Unnormalized Cointegrating Coefficients:				
AGP	DOP	UEP	EXR	
1.06E-06	-0.132989	-0.026934	0.017472	
8.98E-06	0.148591	-0.091068	-0.035611	
-1.74E-06	0.040880	-0.360777	0.009078	
-1.34E-06	-0.071124	0.242198	-0.001323	
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)				
AGP	DOP	UEP	EXR	C
1.000000	-125203.4	-25357.52	16449.18	-68843.11
	(31630.6)	(11504.1)	(4556.62)	
Log likelihood	-497.9704			
Normalized Cointegrating Coefficients: 2 Cointegrating Equation(s)				
AGP	DOP	UEP	EXR	C
1.000000	0.000000	-11917.70	-1582.545	-3500.662
		(3603.41)	(146.455)	
0.000000	1.000000	0.107344	-0.144019	0.521890
		(0.08160)	(0.00332)	
Log likelihood	-469.7955			
Normalized Cointegrating Coefficients: 3 Cointegrating Equation(s)				
AGP	DOP	UEP	EXR	C
1.000000	0.000000	0.000000	-1959.723	-79289.01

			(65.5789)	
0.000000	1.000000	0.000000	-0.140622	1.204524
			(0.00119)	
0.000000	0.000000	1.000000	-0.031649	-6.359313
			(0.00381)	
Log likelihood	-462.6880			

Dependent Variable: D(AGP)				
Method: Least Squares				
Date: 08/24/15 Time: 16:07				
Sample(adjusted): 1983 2013				
Included observations: 31 after adjusting endpoints				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	127070.8	96669.70	1.314484	0.2052
D(AGP(-1))	-0.034184	0.301976	-0.113202	0.9111
D(AGP(-2))	0.035192	0.230661	0.152569	0.8804
D(DOP)	-7098.116	27953.39	-0.253927	0.8024
D(DOP(-1))	-8712.863	24124.28	-0.361166	0.7222
D(DOP(-2))	-10309.98	23590.57	-0.437038	0.6673
D(EXR)	-1181.427	4696.448	-0.251557	0.8042
D(EXR(-1))	-3843.309	4961.478	-0.774630	0.4486
D(EXR(-2))	-5604.671	4880.314	-1.148424	0.2658
D(UEP)	-29138.33	49488.99	-0.588784	0.5633
D(UEP(-1))	-56832.12	53374.44	-1.064782	0.3011
D(UEP(-2))	11492.71	49546.17	0.231960	0.8192
ECM(-1)	-716200.9	222184.5	-3.223451	0.0047
R-squared	0.641057	Mean dependent var		9327.406
Adjusted R-squared	0.401762	S.D. dependent var		448968.1
S.E. of regression	347258.3	Akaike info criterion		28.64862
Sum squared resid	2.17E+12	Schwarz criterion		29.24997
Log likelihood	-431.0536	F-statistic		2.678937
Durbin-Watson stat	1.591686	Prob(F-statistic)		0.028848

Parsimonious ECM

Dependent Variable: D(AGP)				
Method: Least Squares				
Date: 08/24/15 Time: 16:10				
Sample(adjusted): 1983 2013				
Included observations: 31 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	55650.76	76359.05	0.728804	0.4742
D(AGP(-1))	-0.109421	0.283243	-0.386315	0.7031
D(AGP(-2))	-0.017812	0.200788	-0.088709	0.9302
D(DOP)	1.922646	26.98150	-0.071258	0.9439
D(DOP(-2))	1.971837	21.52374	0.091612	0.9279
D(EXR)	4.35.5555	44.43113	-0.098029	0.9228
D(EXR(-2))	6.183443	46.51807	-1.329256	0.1980
D(UEP)	-9.243438	40.69022	-0.227166	0.8225
D(UEP(-2))	-41.89028	39.97948	1.047795	0.3066
ECM(-1)	-5.843659	19.48978	-2.998320	0.0068
R-squared	0.596935	Mean dependent var		9327.406
Adjusted R-squared	0.424193	S.D. dependent var		448968.1
S.E. of regression	340685.8	Akaike info criterion		28.57101
Sum squared resid	2.44E+12	Schwarz criterion		29.03358
Log likelihood	-432.8506	F-statistic		3.455642
Durbin-Watson stat	1.751506	Prob(F-statistic)		0.009188

Pairwise Granger Causality Tests

Pairwise Granger Causality Tests			
Date: 08/24/15 Time: 16:17			
Sample: 1980 2013			
Lags: 2			
Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
DOP does not Granger Cause AGP	32	1.50264	0.24057

AGP does not Granger Cause DOP		2.98061	0.06767
EXR does not Granger Cause AGP	32	3.50454	0.04435
AGP does not Granger Cause EXR		0.20132	0.81887
UEP does not Granger Cause AGP	32	4.02758	0.02946
AGP does not Granger Cause UEP		0.91837	0.41128
EXR does not Granger Cause DOP	32	3.49270	0.04477
DOP does not Granger Cause EXR		0.72009	0.49582
UEP does not Granger Cause DOP	32	0.63621	0.53705
DOP does not Granger Cause UEP		4.11617	0.02752
UEP does not Granger Cause EXR	32	0.95067	0.39904
EXR does not Granger Cause UEP		6.42645	0.00521