Quest Journals
Journal of Research in Humanities and Social Science
Volume 3 ~ Issue 11 (2015) pp: 07-23
ISSN(Online) : 2321-9467
www.questjournals.org

Research Paper

The Effects of Public Expenditure on Agricultural Production Output in Nigeria.

[1]EWUBARE, Dennis Brown. [2]EYITOPE, J. Ajayi
Department of Agriculture and Applied Economics/Ext. Rivers State University of Science and technology Port Harcourt Rivers State Nigeria.
Afritech International Limited 3B Evo Road, G RA Phase 2 , Port Harcourt, Nigeria.

Received 08 November, 2015; **A**ccepted 20 November, 2015 © The author(s) 2015. Published with open access at **www.questjournals.org**

ABSTRACT:- The study examined the effects of government spending on the agricultural sector in Nigeria. The objectives were to: ascertain the effects of government expenditure (GEA), deposit money banks loan (DBA) and gross capital formation (GCF) on agricultural production output in Nigeria. The quasi-experimental research design was employed. The study employed time series data in its analysis. Data adopted in the study were generated from the Central Bank of Nigeria annual statistical bulletin 2013 and National Bureau of Statistics bulletin 2013. The ordinary least square of multiple regression, the Joanson co integration techniques, and the error correction model were used for the analysis. The E-view 7.1 statistical software was employed for the study. The results showed that the coefficient of determination is 0.9468 and the coefficient of the ECM appeared with negative sign and statistically significant. Durbin/Watson value is 1.954 and the f-statistics of 33.84 is significant at 5% level. In specific terms. The lag two and three forms of the explanatory variables GEA were positive and statistically significant. The DBA was positive but statically not significant at 5% level. The coefficient of GCF for the lag two and three periods were rightly signed and statistically significant at 5% level. Bases on the above findings, the study recommends for an increase funding of the agricultural sector in Nigeria.

Keywords:- *Production, Expenditure, Funding, Growth, Development.*

I. INTRODUCTION

1.1 Background to the study

One of the major challenges facing mankind is to provide an equitable standard of living, adequate food, clean water, safe shelter and energy, a healthy and secured environment, an educated public, and satisfying job for this and future generations, It is not an overstatement to assert that the growth and development of any nation depend, to a large extent, on the development of agriculture. The saying that "agriculture is the mainstay of the Nigerian economy may have become a cliché. It nevertheless underscores the emphasis placed on agriculture as the engine of growth in the Nigerian economy. Generally, the sector contributes to the development of an economy in four major ways-product contribution, factor contribution, market contribution and foreign exchange contribution. In realization of this, the government has embarked on various policies and programmes aimed at strengthening the sector in order to continue performing its roles, as well as measures for combating poverty. Notwithstanding the enviable position of the oil sector in the Nigerian economy over the past three decades, the agricultural sector is arguably the most important sector of the economy. Agriculture's contribution to the Gross Domestic product (GDP) has remained stable at between 30 and 42 percent, and employs about 75 per cent, of the labour force in Nigeria (Mitchel 2005). Many factors have been identified to enhance or retard growth in the agricultural sector. This factors is majorly capital.

1.2 Statement of the problems

If government expenditure acts as a complementary effect for private investment, we can expect an increase in government expenditure will enhanced growth in production especially in the agricultural sector. The problem of efficiency of government expenditure on the agricultural sector depends on kind of expenditure. Despite the relative rise in government expenditure in the agricultural sector in Nigeria over these years, there

*Corresponding Author: EWUBARE, Dennis Brown.
Department of Agricultural and Applied Economics/Ext. Rivers State University of Science and Port Harcourt Rivers State Nigeria.

are still public outcries over low production of agricultural produce in Nigeria. The lack of synergy between public and private expenditure in boosting agricultural production is a major challenge to agricultural development in Nigeria. Based, on the above problems, the study answered the following research questions. What is the effect of government expenditure on agricultural production in Nigeria? , has deposit money banks loan on agricultural sector impacted significantly on agricultural productivity in Nigeria? What is the effect of gross capital formation on agricultural production in Nigeria?

1.3 Objectives of the Study

The broad objective of this study is to ascertain the effects of government expenditure on agricultural production output in Nigeria, while its specific objectives were to: ascertain the effect of government expenditure on agriculture production in Nigeria, to examine the effect of deposit money banks loan on agricultural production in Nigeria, to determine the effect of gross capital formation on agricultural production in Nigeria.

II. LITERATURE REVIEW

1.4.1 Theoretical Framework

There have been contributions from various schools of thought such as the classical, neoclassical, Keynesian etc on whether government should intervene to short-run fluctuations in economic activity. The classicalists believe that market forces bring the economy to long-run equilibrium through adjustment in the labour market. The classical and neoclassical economists deem fiscal policies as ineffective due to the well-known crowding-out effect. While the Keynesians say that government expenditure does not obstruct economic growth instead it accelerates it through full-employment, increased aggregate demand and so forth.

1.4.2 Musgrave Theory of Public Expenditure Growth

Musgrave (1997) argued that what matters most for government spending is how effective it is. If the so called "productive" category of government spending is not effective, it can have a negative impact on growth. This theory was propounded by Musgrave as he found changes in the income elasticity of demand for public services in three ranges of per capita income. He posits that at low levels of per capita income, demand for public services tends to be very low, this is so because according to him such income is devoted to satisfying primary needs and that when per capita income starts to rise above these levels of low income, the demand for services supplied by the public sector such as health, education, transport and agriculture starts to rise, thereby forcing government to increase expenditure on them. He observes that at the high levels of per capita income, typical of developed economics, the rate of public sector growth tends to fall as the more basic wants are being satisfied

1.4.3 The Wagner's Law/ Theory of Increasing State Activities

Wagner's law (1885-1917) postulates that: (i) the extension of the functions of the states leads to an increase in public expenditure on administration and regulation of the economy; (ii) the development of modern industrial society would give rise to increasing political pressure for social progress and call for increased allowance for social consideration in the conduct of industry (iii) the rise in public expenditure will be more than proportional increase in the national income and will thus result in a relative expansion of the public sector

1.4.4 The Keynesian Theory

The Keynesian school of thought suggested that government spending can contribute positively to sectorial growth (like the agricultural sector) in the economy. Thus, an increase in government consumption is likely to lead to an increase in employment, profitability and investment through multiplier effects on aggregate demand. Consequently, government expenditure increases the aggregate demand which brings about an increased output depending on expenditure multipliers. Keynes regards public expenditures as an exogenous factor which can be utilized as a policy instruments to promote growth.

1.4.5 The Neoclassical Growth Theory

The neoclassical who based their research on Solow (1956) growth model were of the view that government expenditure is detrimental to economic growth in the long-run. It is as such because of the argument they brought forward. To them, government expenditure engenders the crowding out effect and in times of budget deficit, taxes are raised which increases production costs and leads to increased price and low demand or the government results to borrowing. Also, government spending discourages private investments. Robert Solow and T.W. Swan introduced the Solow's model in 1956. Their model is also known as Solow-Swan model or simply Solow model. In Solows model, other things being equal, saving/investment and population growth rates are important determinants of economic growth. Higher saving/investment rates lead to accumulation of more capital per worker and hence more output per worker. In the absence of technological change & innovation, an increase in capital per worker would not be matched by a proportional increase in output per worker because of diminishing returns. Hence capital deepening would lower the rate of return on capital

1.4.6 The Endogenous Growth Theory

The basic improvement of endogenous growth theory over the previous models is that it explicitly tries to model technology (that is, looks into the determinants of technology) rather than assuming it to be exogenous. Mostly, economic growth comes from technological progress, which is essentially the ability of an economic organization to utilize its productive resources more effectively over time. Much of this ability comes from the process of learning to operate newly created production facilities in a more productive way or more generally from learning to cope with rapid changes in the structure of production which industrial progress must imply (Verbeck, 2000).

1.6 Conceptual Framework

Conceptually, agriculture is the production of food, feed, fiber and other goods by the systematic growing and harvesting of plants and animals. It is the science of making use of the land to raise plants and animals. It is the simplification of natures food webs and the rechanneling of energy for human planting and animal consumption (Olorunfemi 2008). Until the exploitation of oil reserves began in the 1980s, Nigeria's economy was largely dependent on agriculture. Ikala (2010) opined that agriculture is the profession of majority of humans. The United Nations Organization (2008) estimated that the world as a whole, over 50% of the world population is engaged in agriculture or dependent of it for a living, this is a general description of the sector. On the other hand, it includes farming, fishing, animal husbandry and forestry. Oji-Okoro (2011), stated that agricultural sector is the largest sector in the Nigerian economy with its dominant share of the GDP, employment of more than 70% of the active labour force and the generation of about 88% of non-oil foreign exchange earnings.

1.6.2 Public Expenditure

Public expenditure is the main instrument used by Governments especially in developing countries to promote economic growth which is an essential ingredient for sustainable development. Economic growth brings about a better standard of living of the people through provision of better infrastructure, health, housing, education services and improvement in agricultural productivity and food security (Loto 2012). Nearly all the sectors in the national economies of developing countries demand more budgetary allocations every year. For instance, the agricultural sector under the Maputo Declaration of 2003 requires African Governments to increase expenditure on agricultural sector to at least 10 percent of the national budgetary resources (New Partnership for Africa'sDevelopment (NEPAD), 2011).

1.7 Empirical Literature

Using time series data, Lawal (2011) attempted to verify the amount of federal government expenditure on Agriculture in the thirty-year period 1979 – 2007. Significant statistical evidence obtained from the analysis showed that government spending does not follow a regular pattern and that the contribution of the agricultural sector to the GDP is in direct relationship with government funding to the sector. Oboh (2008) used error correction model to investigate Farmers' allocative behavior in credit utilization in Benue State. The study reveals that the usefulness of any agricultural credit programme does not only depend on its availability, accessibility and affordability, but also on its proper and efficient allocation and utilization for intended uses by beneficiaries.

Iganiga and Unemhilin (2011) studied the effect of federal government agricultural expenditure and other determinants of agricultural output on the value of agricultural output in Nigeria. A Cobb Douglas Growth Model was specified that included commercial credits to agriculture, consumer price index, annual average rainfall, population growth rate, food importation and GDP growth rate. The study performed comprehensive analysis of data and estimated the Vector Error Correction model. Their results showed that federal government capital expenditure was found to be positively related to agricultural output. Adekanye (2005) used panel data threshold to examine the role of banks on the growth of Nigerian economy. The study observed that in making credit available, banks are rendering a great social service, because through their actions, production is increased, capital investment are expanded and a higher standard of living is realized. Gregorious and Ghosh (2007) made use of the heterogeneous panel data to study the impact of government expenditure on economic growth. Their results suggest that countries with large government expenditure tend to experience higher economic growth. This study is unique from other study in the area of the choice of explanatory variables.

Unlike other study this study employed combination of explanatory variables to check the impact of both core and checked variables on the dependent variable.

Oboh and Ekpebu (2010) used ordinary least square to examined the determinants of formal agricultural credit allocation to the farm sector in Nigeria. The study found out that there is the need to critically assess factors affecting the rate of credit allocation by beneficiaries of NACRDB. Akintola (2004) used autocorrelation to carry out a study on the role of banking industry in financing agriculture. He identified banks' traditional roles to include financing of agriculture sectors of the economy. Credit of banks to the Nigerian economy has been increasing over the years.

1.8 Methods of Study

The quasi-experimental design was employed. The study employed secondary data in its analysis. Data adopted in the study were generated from the Central Bank of Nigeria annual statistical bulletin 2013 and National Bureau of Statistics bulletin 2013.

1.8.1 Model Specification

The Model for the study is specified as follows:

AGR= F (GEA, DBA, GCF) ……………………………………… 1.8.1

AGP = β0 + β1GEA + β2DBA + β3GCF + μ ……………………... 1.8.2

Where

AGR =Agricultural Production

GEA = Government expenditure in Agriculture Net

DBA= Deposit money bank loan to agriculture

U. Error Term

1.8.2 Techniques of Data Analysis

Unit Root Tests

A preliminary investigation into the analysis commenced with confirmation of the order of integration of the series, where the series is confirmed to be order 1, then, co-integration can then be performed. Dickey-Fuller and Philip Perron unit root tests was calculated for individual series to provide evidence as to whether the variables are integrated. This was followed by a multivariate co-integration analysis.

Augmented Dickey-Fuller (ADF) and Philip Peron (PP) tests involved the estimation of one of the following equations respectively: The unit root model is presented thus:

$\Delta Y_1 = \alpha Y_{t-1} + \sum_{i=1} \beta \Delta Y_{t-1} + \delta + Y_1 + \varepsilon_1$ (1.8.3) for levels

$\Delta\Delta Y_1 = \alpha \Delta Y_{t-1} + \sum_{i=1}^{m} \beta \Delta\Delta Y_{t-1} + \delta + Y_1 + \varepsilon_1$ (1.8.4) for first difference

Co integration Model

This study adopted the Johansen (1988) procedure in co-integration. The concept of co-integration creates the link between integrated process and the concept of steady equilibrium. The first step in co-integration analysis shall be to test the order integration of the variables. According to Ajetomobi. (2006), a series is said to be integrated if it accumulated some past effects, so that following any disturbance, the series will rarely return to any particular mean value, hence is non-stationary. Non-stationary time series has always been regarded as a problem in econometric analysis. The Granger representation theorem states that if set variables are co-integrated (1, 1); implying that the residual is co-integrated of 1(0), then there exists an error correction model describing the relationship.

The Error Correction Model

The error correction model (ECMs) estimates presents the short run behaviour and the long run static equations. The parameter λ, which shall be negative, in general shall measures the speed of adjustment towards the long run equilibrium relationship between the variables. The optimum lag lengths to be included in in the model shall be determined based on Akaike Information Criterion (AIC).

III. DISCUSSION OF RESULTS

Unit Root Test for Stationarity (Augmented Dickey Fuller)

Table 1.9.1: The Unit Root Test Results

Variables	ADF Test	Critical Value			Order of integration
		1% critical value	5% Critical value	10% critical value	
AGR	-5.158095	-3.646342	-2.954021	-2.615817	At Level.
GEA	-6.531010	-3.670170	-2.963972	-2.62107	3rd Diff.
DBA	-6.853067	-3.670170	-2.963972	-2.62107	2nd Diff.
GCF	-4.068589	-3.661661	-2.960411	-2.619160	1st Diff.

Source: Author's computed Result (E-view 7.1)

The estimated unit root results in table 1.9 of chapter four shows that the all the time series were stationary. Although, not all the time series were stationary at their levels except Agricultural Output (AGR). Nevertheless, Gross Capital Formation (GCF) became stationary at first difference 1(1). While Deposit Money Bank Loan to Agriculture (DBA) became stationary when differenced twice 1(2) and Total Government Expenditure (GEA) is integrated of order three 1(3).

Table 1.9.2: Johansen Cointegration Test Results

Eigen value	Max-Eigen Statistic	5% critical value	Prob. **	Hypothesized N0 of CE(s)
0.856828	105.0381	47.85613	0.0000	None *
0.719661	46.72687	29.79707	0.0002	At most 1 *
0.220622	8.574186	15.49471	0.4062	At most 2
0.035888	1.096431	3.841466	0.2950	At most 3

***Source:** Author's Computed Result (E-view 7.1)*

Note: * denote rejection of the hypothesis at the 0.05 level. **Mackinnon-Haug-Michelis (1999) p-values. Max-eigenvalue test indicate 2 co-integrating eqn(s) at 0.05 level

The estimated co integration result on table 1.9.2 of chapter four shows that there are two co-integrating equations at 5% level of significance. Meaning that two variables are co-integrated at 5% significance level. This is strong evidence from the unit root test conducted, where all the variables were found to be stationary. Having established the stationarity of the time series, there is the need to conduct the Error Correction Model.

Error Correction Model (ECM)

Table 1.9.3: Parsimonious ECM Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18571.62	37271.89	0.498274	0.6240
D(AGP(-1))	-0.216838	0.120708	-1.796384	0.0884
D(AGP(-2))	-0.127599	0.105380	-1.210840	0.2408
D(AGP(-3))	0.249253	0.080430	3.099024	0.0059
D(GEA(-2))	0.369469	0.148514	-2.487765	0.0223
D(GEA(-3))	0.612278	0.132250	4.629683	0.0002
D(DBA(-2))	1.459915	0.888657	-1.642832	0.1169
D(DBA(-3))	0.615190	1.153520	0.533316	0.6000
D(GCF(-2))	7.551735	1.187026	6.361893	0.0000
D(GCF(-3))	9.334037	1.192151	-7.829576	0.0000
ECM(-1)	-4.525367	906.4587	-4.992358	0.0001

R-squared	0.946845	Mean dependent var	9653.027
Adjusted R-squared	0.918868	S.D. dependent var	456639.6
S.E. of regression	130067.6	Akaike info criterion	26.66607
Sum squared resid	3.21E+11	Schwarz criterion	27.17984
Log likelihood	-388.9911	Hannan-Quinn criter.	26.83043
F-statistic	33.84432	Durbin-Watson stat	1.954237
Prob(F-statistic)	0.000000		

***Source:** Author's Computed Result (E-view 7.1)*

IV. DISCUSSION OF PARSIMONIOUS ERROR CORRECTION RESULTS

Table 1.9.3 presented the parsimonious error correction results. From the table, it was discovered that the coefficient of determination (R^2) is 0.9468. Therefore, 95 percent variation in agricultural production output is explained by total government expenditure (GEA), deposit money banks loan to agriculture (DBA) and gross capital formation (GCF). The coefficient of the ECM appeared with the negative sign and statistically significant. Meaning that, the short run problems have been adjusted to long-run equilibrium. Also, the Durbin Watson value of 1.954 which is approximately 2.0, suggests a lesser level of autocorrelation. The F-statistic of 33.84 is significant at the 5% level. Meaning that the overall model is satisfactory. In specific term, the lag two and three forms of the explanatory variable (GEA), were positively signed and statistically significant. Meaning that total government expenditure have positive and significant impact on agricultural output in Nigeria during the period of study. This findings conform to apriori expectation. With these results we accept the alternative hypothesis which states that there is a significant relationship between total government expenditure and agricultural output in Nigeria. Meanwhile, the lag two and three periods of the explanatory variable, (DBA) was positively signed but statistically not significant at 5 percent level. With these results we accept the null hypothesis which states that there is no significant relationship between deposit money banks loan to agriculture and agricultural output in Nigeria. Furthermore, the coefficients of the explanatory variable, GCF for the lag two and three periods were rightly signed and statistically significant at 5 percent level. Meaning that, there is a positive relationship between gross capital formation and agricultural output in Nigeria during the period under review. Also, there is a significant relationship between gross capital formation and agricultural output in Nigeria during the period under review. Meaning that gross capital formation will impact on agricultural output in Nigeria during the period under review positively and significantly. Meaning that government policy towards agricultural spending should be encourage in order to improve agricultural output in Nigeria.

V. CONCLUSION/RECOMMENDATIONS

The study showed that funding is very crucial for the development of the agricultural sector in Nigeria, therefore for the agricultural sector to contribute significantly to the Nigerian economy and as a major source of sustainable employment generation in Nigeria. The study recommends for increase funding as additional funding would fast track growth and development of the sector. There should be synergy between various tiers of government, deposit money banks and international intervention and donor agencies in agricultural funding in Nigeria as this will make funding to the sector more efficient and effective in Nigeria.

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APPENDIX
Research Data

YEAR	AGP	GEA	DBA	GCF
1980	6501.800	14968.50	462.2000	10841.20
1981	57909.70	11413.70	590.6000	12215.00
1982	59450.80	11923.20	786.6000	10922.00
1983	59009.60	9636.500	940.4000	8135.000
1984	55918.20	9927.600	1052.100	5417.000
1985	65748.40	13041.10	1310.200	5573.000
1986	72135.20	16223.70	1830.300	7323.000
1987	69608.10	22018.70	2427.100	10661.10
1988	76753.70	27749.50	3066.700	12383.70
1989	80878.00	41028.30	3470.500	18414.10
1990	84344.60	60268.20	4221.400	30626.80
1991	87503.50	66584.40	5012.700	35423.90
1992	89345.40	92797.40	6978.900	58640.30
1993	90596.50	191228.9	10753.00	80948.10
1994	92833.00	160893.2	17888.80	85021.90
1995	96220.70	248768.1	25278.70	114476.3
1996	100216.2	337217.6	33264.10	172105.7
1997	104514.0	428215.2	27939.30	205553.2
1998	108814.1	487113.4	27180.70	192984.4
1999	114570.7	947690.0	118518.8	175735.8
2000	117945.1	701050.9	146504.5	268894.5
2001	122522.3	1017996.	200856.2	371897.9
2002	1901334.	1018178.	227617.6	438114.9
2003	203409.9	1225988.	243185.7	429230.0
2004	216208.5	1384000.	261558.6	456970.0
2005	231463.6	1743200.	262005.5	472140.4
2006	248599.0	1842588.	239752.3	479243.6
2007	266477.2	2348593.	149578.9	492421.2
2008	283175.4	3078252.	217112.2	512438.4
2009	299823.9	3280772.	202147.8	494701.1
2010	317281.7	3993249.	189613.0	499853.5
2011	335180.1	4233013.	202957.7	502331.0
2012	348490.8	4199978.	198239.5	498961.9
2013	348600.4	4252317.	196936.7	500382.1

SHORT RUN RESULTS

Dependent Variable: AGP
Method: Least Squares
Date: 09/09/15 Time: 21:13
Sample: 1980 2013
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26707.33	79046.60	0.337868	0.7378
GEA	-0.083316	0.078132	-1.066351	0.2948
DBA	0.453637	1.777784	0.255170	0.8003
GCF	0.986245	1.139569	0.865455	0.3937

R-squared	0.258337	Mean dependent var	200393.7
Adjusted R-squared	0.184170	S.D. dependent var	316913.2
S.E. of regression	286246.5	Akaike info criterion	28.07723
Sum squared resid	2.46E+12	Schwarz criterion	28.25680
Log likelihood	-473.3128	Hannan-Quinn criter.	28.13846
F-statistic	3.483204	Durbin-Watson stat	2.345520

Prob(F-statistic)	0.027870

Dependent Variable: LOG(AGP)
Method: Least Squares
Date: 09/09/15 Time: 21:51
Sample: 1980 2013
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.415806	1.124604	8.372549	0.0000
LOG(GEA)	0.071003	0.265961	0.266966	0.7913
LOG(DBA)	0.484848	0.209576	2.313469	0.0277
LOG(GCF)	-0.298913	0.328498	-0.909937	0.3701

R-squared	0.665207	Mean dependent var	11.73852
Adjusted R-squared	0.631728	S.D. dependent var	0.922703
S.E. of regression	0.559947	Akaike info criterion	1.788180
Sum squared resid	9.406206	Schwarz criterion	1.967752
Log likelihood	-26.39907	Hannan-Quinn criter.	1.849420
F-statistic	19.86919	Durbin-Watson stat	1.923428
Prob(F-statistic)	0.000000		

UNIT ROOT
AGP

Null Hypothesis: AGP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.158095	0.0002
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(AGP)
Method: Least Squares
Date: 09/09/15 Time: 21:52
Sample (adjusted): 1981 2013
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGP(-1)	-0.921270	0.178607	-5.158095	0.0000
C	190845.7	66379.69	2.875061	0.0072

R-squared	0.461861	Mean dependent var	10366.62
Adjusted R-squared	0.444502	S.D. dependent var	434776.1
S.E. of regression	324046.2	Akaike info criterion	28.27385
Sum squared resid	3.26E+12	Schwarz criterion	28.36455
Log likelihood	-464.5186	Hannan-Quinn criter.	28.30437
F-statistic	26.60594	Durbin-Watson stat	2.016696
Prob(F-statistic)	0.000014		

*Corresponding Author: EWUBARE, Dennis Brown.

GEA

Null Hypothesis: GEA has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.485824	1.0000
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GEA)
Method: Least Squares
Date: 09/09/15 Time: 21:53
Sample (adjusted): 1981 2013
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GEA(-1)	0.065150	0.026208	2.485824	0.0185
C	62730.55	43582.28	1.439359	0.1601

R-squared	0.166203	Mean dependent var	128404.5
Adjusted R-squared	0.139306	S.D. dependent var	214625.9
S.E. of regression	199116.1	Akaike info criterion	27.29986
Sum squared resid	1.23E+12	Schwarz criterion	27.39055
Log likelihood	-448.4476	Hannan-Quinn criter.	27.33037
F-statistic	6.179321	Durbin-Watson stat	2.025206
Prob(F-statistic)	0.018523		

GEA

Null Hypothesis: D(GEA) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.349254	0.9760
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GEA,2)
Method: Least Squares
Date: 09/09/15 Time: 21:53
Sample (adjusted): 1990 2013
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

D(GEA(-1))	0.239221	0.684948	0.349254	0.7321
D(GEA(-1),2)	-1.011247	0.685855	-1.474433	0.1625
D(GEA(-2),2)	-0.323089	0.780167	-0.414128	0.6851
D(GEA(-3),2)	-0.260579	0.924251	-0.281935	0.7821
D(GEA(-4),2)	-0.790163	1.032223	-0.765496	0.4567
D(GEA(-5),2)	-1.424918	1.128678	-1.262467	0.2274
D(GEA(-6),2)	-1.057900	1.081105	-0.978536	0.3444
D(GEA(-7),2)	-1.182542	0.885365	-1.335655	0.2030
D(GEA(-8),2)	-1.157313	0.475646	-2.433140	0.0290
C	63896.56	52776.78	1.210694	0.2461

R-squared	0.825839	Mean dependent var	1627.508
Adjusted R-squared	0.713879	S.D. dependent var	318203.6
S.E. of regression	170208.1	Akaike info criterion	27.22177
Sum squared resid	4.06E+11	Schwarz criterion	27.71262
Log likelihood	-316.6612	Hannan-Quinn criter.	27.35199
F-statistic	7.376169	Durbin-Watson stat	2.580274
Prob(F-statistic)	0.000554		

GEA

Null Hypothesis: D(GEA,2) has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.700264	0.0112
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GEA,3)
Method: Least Squares
Date: 09/11/15 Time: 07:41
Sample (adjusted): 1991 2013
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GEA(-1),2)	-8.958509	2.421046	-3.700264	0.0027
D(GEA(-1),3)	6.924685	2.275040	3.043764	0.0094
D(GEA(-2),3)	6.791851	2.131995	3.185678	0.0072
D(GEA(-3),3)	6.935252	2.053830	3.376741	0.0050
D(GEA(-4),3)	6.536893	2.001292	3.266336	0.0061
D(GEA(-5),3)	5.503622	1.922690	2.862459	0.0133
D(GEA(-6),3)	4.506801	1.620270	2.781512	0.0156
D(GEA(-7),3)	2.971150	1.116562	2.660980	0.0196
D(GEA(-8),3)	0.867529	0.481524	1.801632	0.0948
C	100002.2	48208.35	2.074374	0.0585

R-squared	0.958318	Mean dependent var	3452.735
Adjusted R-squared	0.929461	S.D. dependent var	595269.6
S.E. of regression	158098.9	Akaike info criterion	27.07885
Sum squared resid	3.25E+11	Schwarz criterion	27.57254

Log likelihood	-301.4068	Hannan-Quinn criter.	27.20301
F-statistic	33.20927	Durbin-Watson stat	1.936076
Prob(F-statistic)	0.000000		

GEA

Null Hypothesis: D(GEA,2) has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.531010	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GEA,3)
Method: Least Squares
Date: 09/11/15 Time: 07:48
Sample (adjusted): 1984 2013
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GEA(-1),2)	-2.213595	0.338936	-6.531010	0.0000
D(GEA(-1),3)	0.321627	0.186533	1.724241	0.0961
C	3432.103	37513.08	0.091491	0.9278

R-squared	0.853983	Mean dependent var	2939.007
Adjusted R-squared	0.843167	S.D. dependent var	518477.1
S.E. of regression	205328.1	Akaike info criterion	27.39725
Sum squared resid	1.14E+12	Schwarz criterion	27.53737
Log likelihood	-407.9587	Hannan-Quinn criter.	27.44207
F-statistic	78.95496	Durbin-Watson stat	1.860457
Prob(F-statistic)	0.000000		

DBA

Null Hypothesis: DBA has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.769467	0.8142
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DBA)

Method: Least Squares
Date: 09/11/15 Time: 07:52
Sample (adjusted): 1982 2013
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBA(-1)	-0.040682	0.052870	-0.769467	0.4478
D(DBA(-1))	0.020051	0.186245	0.107659	0.9150
C	9868.581	7228.122	1.365304	0.1827

R-squared	0.020015	Mean dependent var	6135.816
Adjusted R-squared	-0.047570	S.D. dependent var	29049.83
S.E. of regression	29732.75	Akaike info criterion	23.52695
Sum squared resid	2.56E+10	Schwarz criterion	23.66436
Log likelihood	-373.4311	Hannan-Quinn criter.	23.57249
F-statistic	0.296143	Durbin-Watson stat	2.010250
Prob(F-statistic)	0.745903		

DBA

Null Hypothesis: D(DBA) has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.238450	0.0271
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DBA,2)
Method: Least Squares
Date: 09/11/15 Time: 07:53
Sample (adjusted): 1983 2013
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DBA(-1))	-0.860205	0.265622	-3.238450	0.0031
D(DBA(-1),2)	-0.143025	0.187428	-0.763094	0.4518
C	5413.761	5694.103	0.950766	0.3499

R-squared	0.511984	Mean dependent var	-48.34774
Adjusted R-squared	0.477126	S.D. dependent var	41809.13
S.E. of regression	30232.19	Akaike info criterion	23.56297
Sum squared resid	2.56E+10	Schwarz criterion	23.70174
Log likelihood	-362.2260	Hannan-Quinn criter.	23.60820
F-statistic	14.68761	Durbin-Watson stat	2.039955
Prob(F-statistic)	0.000043		

DBA

Null Hypothesis: D(DBA,2) has a unit root

Exogenous: Constant
Lag Length: 1 (Fixed)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.853067	0.0000
Test critical values:	1% level		-3.670170	
	5% level		-2.963972	
	10% level		-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DBA,3)
Method: Least Squares
Date: 09/11/15 Time: 07:54
Sample (adjusted): 1984 2013
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DBA(-1),2)	-2.171224	0.316825	-6.853067	0.0000
D(DBA(-1),3)	0.379880	0.178827	2.124295	0.0430
C	-10.82589	6100.319	-0.001775	0.9986
R-squared	0.817376	Mean dependent var		115.2533
Adjusted R-squared	0.803848	S.D. dependent var		75438.11
S.E. of regression	33410.84	Akaike info criterion		23.76579
Sum squared resid	3.01E+10	Schwarz criterion		23.90591
Log likelihood	-353.4868	Hannan-Quinn criter.		23.81061
F-statistic	60.42220	Durbin-Watson stat		2.098833
Prob(F-statistic)	0.000000			

GCF

Null Hypothesis: GCF has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-0.494073	0.8797
Test critical values:	1% level		-3.653730	
	5% level		-2.957110	
	10% level		-2.617434	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GCF)
Method: Least Squares
Date: 09/11/15 Time: 07:55
Sample (adjusted): 1982 2013
Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GCF(-1)	-0.011479	0.023234	-0.494073	0.6250

D(GCF(-1))	0.463718	0.167709	2.765017	0.0098
C	10750.20	7112.696	1.511410	0.1415

R-squared	0.208636	Mean dependent var	15255.22
Adjusted R-squared	0.154059	S.D. dependent var	28595.40
S.E. of regression	26300.63	Akaike info criterion	23.28163
Sum squared resid	2.01E+10	Schwarz criterion	23.41905
Log likelihood	-369.5061	Hannan-Quinn criter.	23.32718
F-statistic	3.822800	Durbin-Watson stat	1.694602
Prob(F-statistic)	0.033609		

GCF

Null Hypothesis: D(GCF) has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.068589	0.0036
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GCF,2)
Method: Least Squares
Date: 09/11/15 Time: 07:55
Sample (adjusted): 1983 2013
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GCF(-1))	-0.756715	0.185989	-4.068589	0.0003
D(GCF(-1),2)	0.359111	0.176620	2.033234	0.0516
C	12024.03	5367.347	2.240219	0.0332

R-squared	0.371829	Mean dependent var	87.52258
Adjusted R-squared	0.326959	S.D. dependent var	30499.41
S.E. of regression	25021.43	Akaike info criterion	23.18462
Sum squared resid	1.75E+10	Schwarz criterion	23.32339
Log likelihood	-356.3616	Hannan-Quinn criter.	23.22986
F-statistic	8.286916	Durbin-Watson stat	1.877749
Prob(F-statistic)	0.001490		

COINTEGRATION

Date: 09/10/15 Time: 06:26
Sample (adjusted): 1982 2013
Included observations: 32 after adjustments
Trend assumption: Linear deterministic trend
Series: AGP GEA DBA GCF
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.637539	65.39730	47.85613	0.0005
At most 1 *	0.554121	32.92247	29.79707	0.0211
At most 2	0.192992	7.075806	15.49471	0.5688
At most 3	0.006675	0.214322	3.841466	0.6434

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.637539	32.47483	27.58434	0.0108
At most 1 *	0.554121	25.84666	21.13162	0.0101
At most 2	0.192992	6.861484	14.26460	0.5057
At most 3	0.006675	0.214322	3.841466	0.6434

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

AGP	GEA	DBA	GCF
3.36E-06	-8.29E-07	-1.82E-05	1.46E-05
-4.61E-06	-7.77E-07	4.17E-06	1.06E-05
1.61E-06	8.67E-07	4.13E-05	-2.58E-05
1.07E-06	1.57E-06	-3.90E-06	-4.83E-06

Unrestricted Adjustment Coefficients (alpha):

D(AGP)	-229476.9	74143.48	-57268.87	3742.304
D(GEA)	74682.46	96199.05	-15722.85	-2570.973
D(DBA)	4040.894	-6576.331	-9202.241	-1281.222
D(GCF)	-4935.687	3057.752	2132.543	-1637.932

1 Cointegrating Equation(s): Log likelihood -1602.628

Normalized cointegrating coefficients (standard error in parentheses)

AGP	GEA	DBA	GCF
1.000000	-0.246788	-5.410161	4.346286
	(0.08898)	(1.99878)	(1.36006)

Adjustment coefficients (standard error in parentheses)

D(AGP)	-0.770869
	(0.15996)
D(GEA)	0.250877
	(0.09803)
D(DBA)	0.013574
	(0.01831)
D(GCF)	-0.016580
	(0.01407)

2 Cointegrating Equation(s):		Log likelihood	-1589.705
Normalized cointegrating coefficients (standard error in parentheses)			
AGP	GEA	DBA	GCF
1.000000	0.000000	-2.732015	0.403510
		(1.15404)	(0.61370)
0.000000	1.000000	10.85200	-15.97636
		(5.60903)	(2.98279)
Adjustment coefficients (standard error in parentheses)			
D(AGP)	-1.112823	0.132627	
	(0.25871)	(0.05152)	
D(GEA)	-0.192798	-0.136666	
	(0.12704)	(0.02530)	
D(DBA)	0.043905	0.001760	
	(0.03021)	(0.00602)	
D(GCF)	-0.030683	0.001716	
	(0.02365)	(0.00471)	

3 Cointegrating Equation(s):		Log likelihood	-1586.274
Normalized cointegrating coefficients (standard error in parentheses)			
AGP	GEA	DBA	GCF
1.000000	0.000000	0.000000	-0.544324
			(0.26114)
0.000000	1.000000	0.000000	-12.21141
			(1.39292)
0.000000	0.000000	1.000000	-0.346936
			(0.07555)
Adjustment coefficients (standard error in parentheses)			
D(AGP)	-1.204901	0.082959	2.112882
	(0.26041)	(0.06279)	(1.99162)
D(GEA)	-0.218078	-0.150302	-1.606118
	(0.13071)	(0.03152)	(0.99968)
D(DBA)	0.029109	-0.006221	-0.481130
	(0.02950)	(0.00711)	(0.22565)
D(GCF)	-0.027254	0.003565	0.190572
	(0.02445)	(0.00590)	(0.18699)

OVERPARAMETARIZED ECM

Dependent Variable: D(AGP)
Method: Least Squares
Date: 09/10/15 Time: 06:34
Sample (adjusted): 1984 2013
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22367.44	29664.19	0.754022	0.4643
D(AGP(-1))	-0.356178	0.109067	-3.265693	0.0061
D(AGP(-2))	-0.213475	0.089897	-2.374659	0.0336
D(AGP(-3))	0.250390	0.058880	4.252550	0.0009
D(GEA)	0.855501	0.148533	5.759679	0.0001
D(GEA(-1))	-0.161442	0.135377	-1.192538	0.2544
D(GEA(-2))	-0.485817	0.123437	-3.935744	0.0017

D(GEA(-3))	0.397807	0.106843	3.723272	0.0026
D(DBA)	0.352718	0.536919	0.656929	0.5227
D(DBA(-1))	4.770630	1.033169	4.617473	0.0005
D(DBA(-2))	-1.141970	1.021943	-1.117450	0.2840
D(DBA(-3))	4.222222	0.932275	4.528945	0.0006
D(GCF)	2.309713	1.323374	1.745322	0.1045
D(GCF(-1))	-5.905427	1.172072	-5.038451	0.0002
D(GCF(-2))	9.738729	1.071622	9.087843	0.0000
D(GCF(-3))	-15.03997	1.140245	-13.19012	0.0000
ECM(-1)	-191450.0	110425.6	-1.733747	0.1066

R-squared	0.988264	Mean dependent var	9653.027
Adjusted R-squared	0.973819	S.D. dependent var	456639.6
S.E. of regression	73886.99	Akaike info criterion	25.55555
Sum squared resid	7.10E+10	Schwarz criterion	26.34956
Log likelihood	-366.3332	Hannan-Quinn criter.	25.80956
F-statistic	68.41670	Durbin-Watson stat	2.847467
Prob(F-statistic)	0.000000		

PARSIMONIUOS ECM

Dependent Variable: D(AGP)
Method: Least Squares
Date: 09/11/15 Time: 07:36
Sample (adjusted): 1984 2013
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18571.62	37271.89	0.498274	0.6240
D(AGP(-1))	-0.216838	0.120708	-1.796384	0.0884
D(AGP(-2))	-0.127599	0.105380	-1.210840	0.2408
D(AGP(-3))	0.249253	0.080430	3.099024	0.0059
D(GEA(-2))	0.369469	0.148514	-2.487765	0.0223
D(GEA(-3))	0.612278	0.132250	4.629683	0.0002
D(DBA(-2))	1.459915	0.888657	-1.642832	0.1169
D(DBA(-3))	0.615190	1.153520	0.533316	0.6000
D(GCF(-2))	7.551735	1.187026	6.361893	0.0000
D(GCF(-3))	9.334037	1.192151	-7.829576	0.0000
ECM(-1)	-4.525367	906.4587	-4.992358	0.0001

R-squared	0.946845	Mean dependent var	9653.027
Adjusted R-squared	0.918868	S.D. dependent var	456639.6
S.E. of regression	130067.6	Akaike info criterion	26.66607
Sum squared resid	3.21E+11	Schwarz criterion	27.17984
Log likelihood	-388.9911	Hannan-Quinn criter.	26.83043
F-statistic	33.84432	Durbin-Watson stat	1.954237
Prob(F-statistic)	0.000000		