The Impact of Commercial Banks' Credit to Agriculture on Agricultural Development in Nigeria: An Econometric Analysis

Sunny Ibe Obilor
Department of Banking/Finance
Imo State Polytechnic, Umuagwo, P.M.B. 1472, Nigeria.

Abstract

This study aimed at evaluating the impact of commercial banks' credit to agricultural sector under the Agricultural Credit Guarantee Scheme Fund in Nigeria. Until the mid-seventies, agriculture was the primary foreign exchange earner for Nigeria. Now it has lost its prime position to the mineral sector. Of these factors, inadequate capital is considered as the single most important factor affecting the performance of the sector. It therefore empirically examined the impact of Agricultural Credit Guarantee Scheme Fund, agricultural product prices, government fund allocation and commercial banks' credit to agricultural sector on agricultural productivity. The result revealed that Agricultural Credit Guarantee Scheme Fund and Government fund allocation to agriculture produced a significant positive effect on agricultural productivity, while the other variables produced a significant negative effect. It is recommended that farmers should be encouraged to be applying for loans from the participating banks to enhance their agricultural activities and productivity.

Keywords: Agriculture, Finance, Credit, Development, Commercial Bank, Government, Farmers, Price index.

1. Introduction

The structure of the Nigerian economy is multi-sector in which the banks and the agricultural sectors have roles to play. Long before now, the relationship between the banking industry and the agricultural sector in Nigeria has been a contentious issue. If one were to take a census of all the pronouncements on the matter by various governments since independence and classify them into those praising the efforts of the banking industry and those castigating them as regards granting credit to agriculture may likely notice that the ratio of those in favour of the later will be in the ratio of four or more is to one. This could further be reflected in the legislation of governments and the directives of quasi government institutions like the CBN on the issue. The setting up of a wholly government owned bank in the name of the Nigerian Agriculture, Cooperative and Rural Development Bank (NACRDB) with an aim of solely lending to agricultural endeavours on short, medium and long-term basis is predicated on the philosophy that the mainstream banking industry does not adequately cater for the urgent need of credit required for rapid transformation of the agricultural sector of the economy.

This study dwells on the few areas: (i.) existing policies and institutional network for agricultural credit in Nigeria under ACGSF policy; (ii) assessment of the impact of credit on agricultural performance; and (iii.) identification of some major constraints that dwarf the growth of this sector to achieve its desired goal and expectation in the economy of the country.

1.1 Statement of the Problems

Presently in Nigeria with her vast expanse of rich soil, a sizable number of her citizens suffer from hunger and starvation as a result of neglect of agriculture. Few agro-industries around depend greatly on importation of necessary raw materials in their production and many of the Nigerian youths roam about unemployed. It is of note that various policies have been made to solve these problems in which the banks have been targeted to provide the pivotal roles in the area of funding through provision of credits. However, the facts remains that the banks precisely the commercial banks have not come to grapple with the problem as much has not been felt in the area of credits to agriculture. The accusation was that commercial banks prefer granting credit to commerce or trading to agriculture and where the credit was allowed, the interest payable seems outrageous with some tight securities, which place restrictions and scare many prospective farmers.

On the contrary, where the credits are ready to be granted, some of the fanners or clients are unable to furnish the necessary collateral and honesty required by the banks as guarantee to cushion the effects of leakages or unforeseen exposures should there be default. Also there are fears of diversion of the loans to non-agricultural projects as it is attitude of some people to embrace luxurious household family spending thereby suffocating the purpose for which the credit was given. Clearly, some good clients that can be insulated from this accusation are unavoidably weighed down by uncontrollable factors such as changes in policies, rules, regulations and certain difficulties in obtaining official permit.

On the above highlighted problems, this study will examine the efforts of some stakeholders such as the commercial banks, government policy with respect to the Agricultural Credit Guarantee Scheme Fund in Nigeria, her financial allocation to agriculture and the farmers in relationship to the agricultural production output.

1.2. Objectives of the Study

The aim of this study can be subsumed under the following specific objectives:

i. To evaluate the impact of credit disbursed by the commercial banks to the agricultural sector on agricultural productivity.
ii. To examine the extent to which government fund allocation has gone in boosting agricultural productivity.
iii. To evaluate the impact of agricultural product prices in encouraging agricultural production in Nigeria.
iv. To empirically examine the impact of Agricultural Credit Guarantee Scheme Fund on the agricultural sector.
v. To suggest ways the commercial banks can effectively contribute in boosting agricultural production in Nigeria.

1.2 Hypotheses

Hypothesis One:

H_0: Commercial banks' credit to agricultural sector has not significantly influenced agricultural productivity in Nigeria.

Hypothesis Two:

H_0: Agricultural credit guarantee scheme loan by purpose has not led to any significant growth in agricultural productivity.

Hypothesis Three:

H_0: Government fund allocation to agricultural sector has not led to any significant positive growth in agricultural productivity.

Hypothesis Four:

H_0: Prices of agricultural products have not made significant positive impact on agricultural productivity.

2.0 Literature Review

According to the United Nations Food and Agricultural Organization production year book, agriculture was defined to include cereals, starchy roots, sugar, edible oil, crops, nuts, fruits, vegetables, wine, cocoa, tea, coffee, livestock and livestock products. Also included in the group are industrial oil seeds, tobacco, fibre, vegetable and rubber. Further to knowing the subject agriculture, Anyanwu et a1 (1979) defined agriculture as the cultivation of the land for the purpose of producing food for man, feed for animals and fibre or raw materials for industries. It also includes the processing and marketing of crops. With regard to the above viewpoint, the central role of agriculture in the individual and the country's life at large cannot be overemphasized.

Lambe (1983) attributed low agricultural productivity to problem of manpower development in agricultural sector, parochialism in the aspect of training, lack of appraisal and demoralization of agricultural staff, proffering solution; he offered that training should be made available to agricultural personnel. He also recommended for availability of funds to the staff, that the sector should harness its resources and opted that service conditions be made more favourable and competitive so as to attract the right type of personnel into the sector as to him, the low rate of Nigeria's agricultural production is due to lack of sufficient personnel.

2.1 The Concept of Bank Credit

Credit is the extension of money from the lender to the borrower. Spencer (1977) noted that credit implies a promise by one party to pay another for money borrowed or goods and services received. Credit cannot be divorced from the banking sector as banks serve as a conduit for funds to be received in form of deposits from the surplus units of the economy and passed on to the deficit units who need funds for productive purposes. Banks are therefore debtors to the depositors of funds and creditors to the borrowers of funds. Bank credit is the borrowing capacity provided to an individual, government, firm or organization by the banking system in the form of loans. According to CBN (2003), the amount of loans and advances given by the banking sector to economic agents constitute bank credit. Bank credit is often accompanied with some collateral that helps to ensure the repayment of the loan in the event of default. Credit channels savings into productive investment thereby encouraging economic growth. Thus, the availability of credit allows the role of intermediation to be carried out, which is important for the growth of the economy. The total domestic bank credit can be divided in to two: credit to the private sector and credit to the public sector. Thus, for this paper, we adopt the definition of credit given by CBN (2003), which is defined above.

2.2 Bank Credit and the Nigerian Economy

Since its inception, the banking system has been providing credit to the Nigerian economy. In order to examine the role of bank credit to the economy, the aggregate bank credit to the economy is used to estimate its impact growth, which is proxies by gross domestic product. This credit is classified into credit to the public sector (government) and credit to the private sector. This section presents and examines credit to these sectors from 1992 to 2008 with a view to assessing its impact on the growth of the Nigerian economy.

Data on aggregate domestic credit of deposit money banks reveal that between 1993 and 1994, credit to the economy grew from 64.5 per cent to 67.3 per cent. Between 1995 and 2008, credit to economy fluctuated as follows with 24.1% in 1995, 34.7% in 1996, 25.9% in 1997, 14.8% in 1998, 55.7% in 1999, 42.1% in 2000, 32.7% in 2001, 37.9% in 2002, 15.3% in 2003, 38.4% in 2004, 20.5% in 2005, 40.2% in 2006, 86.1% in 2007 and 45.7% in 2008. The highest growth rate was recorded in 2007, which could be attributed to the gains on post-consolidation of Nigerian Banks.

3.0 Methodology

This section presents the research method adopted for the study. This research provides us with the framework for the data analysis adopted for the study. The method of the study adopted emphasizes library research and field work. It also discusses the methods of data collection, data analysis and data presentation. Finally, the rest of this work is presented in the following sections:

3.1 Library Research

The library research is undertaken for the purpose of taking a survey of both theoretical and empirical evidence of works that have so far been done in the chosen field of study. This involves research of published works such as books, journals and annual reports. The research methodology adopted by previous researchers and the collection of secondary data for analysis are also inclusive. In the course of library inquiry for this research I visited the CBN library, many university libraries, the Federal Bureau of Statistics and the Ministry of Agriculture library.

3.2 The Field Work

The field work involved visiting the management of some banks, government agencies, agricultural establishments, co-operative societies and some farmers. This was done for the purpose of data collection. In the course of the field work both secondary and primary data were collected in the area of agricultural production and banks credit to the sector.

3.3 The Secondary Data Collection

These are data in published forms such as the CBN Annual and Quarterly Reports, the CBN Statistical Bulletin, data on the banks credit to agricultural sector, interest rates, published data on seminars, journals, magazines, newspapers and some information retrieved from the websites in relation to the subject of this research which include an agricultural production index, number and value of loans guaranteed by the Agricultural Credit guarantee Scheme (ACGS).

3.4 Nature of Data

The study is focused on commercial banks' credit to agricultural sector in Nigeria. Considering the macroeconomic nature of the study, our information was based on secondary data. The data used are the aggregate amount of the commercial banks' system credit to the agricultural sector since the commencement of the scheme.

We considered the commercial banks' credits to agriculture in the aggregate because of the fluctuating performance, frequent liquidation and distress of these banks, which as a result made it difficult to obtain their individual records in respect of loan advancement portfolio to agricultural sector since the inception of the Agricultural Credit Guarantee Scheme Fund programme in 1978. Moreover, some of the banks that earlier participated in the programme have been liquidated, new ones sprang up and their contribution under the umbrella of commercial banks towards the programme is calculated jointly.

The contributions of the seventeen commercial banks towards the Agricultural Credit Guarantee Scheme Fund by available records in 1978 which the number was further reduced to six commercial banks in 2002 are used as a representative of the performance of all the commercial banks that have participated in the Agricultural Credit Guarantee Scheme Fund programme since its inception in 1978 – 2002.

3.5 Method of Data Analysis

The analysis proceeds from the assumption that agricultural production output can be explained by changes in the input variables of agriculture in a given time frame.

In as much as agricultural production output as the dependent variable of the study can be affected by rate of change of some other factors, it is necessary and sufficient to denominate all those other variables as rates of change. On this strength, since the concern of the study is on commercial banks credit as a factor that exerts influence on agricultural output level, the researcher believes that some other variables that affect economic activity with respect to the subject of our study are included in the model. These other variables include Agricultural Credit Guarantee Scheme's credit by purpose, federal government financial allocation to agriculture and agricultural products price index.

3.6 Model Specification

Given the above explanation, our function on this study is taken as:

API = f(CBCA, ACLP, GFAA, APPR)

Where

API = Agricultural Production Output Index
CBCA = Commercial Bank's Credit to the Agricultural Sector
ACLP = Agricultural Credit Guarantee Scheme loan by purpose
GFAA = Government Financial Allocation to Agricultureal sector
APPR = Agricultural Produce Price.

Further, to obtain an objective test on the influence of commercial banks' credit to agricultural production output index in Nigeria, we therefore break the above functional relationship stepwise on individual basis. Thus, this will help us to have accurate contribution or ascertain the influence of commercial banks' credit to the agricultural sector, which forms the theme of our research. However, our test of other variables on their individual basis will also aid us to achieve an objective comparison and state an unbiased judgement

Thus the relationship becomes

API = f(CBCA)
API = f(ACLP)
API = f(GFAA)
API = f(APPR)

All these variables remain as earlier defined. The equation can now be explicitly specified in the following linear relationships:

API = b¬0 + b¬1CBCA + b2ACLP + b3GFAA + b4APPR + e

Then stating it individually as below, we have

API bo + b1CBCA + e
API bo + b2ACLP + e
API bo + b3GFAA + e
API bo + b4APPR + e

From the above models, we can now draw the following apriori inferences:

i.) If the dependent variable API responds positively to the set of explanatory variables CBCA, ACLP, GFAA and APPR as may be shown by the parameter estimates b0, b1, b2, b3 and b4, we will conclude that agricultural production output can be positively influenced by these variables as mentioned above.

ii.) But where the parameter estimates obtained are insignificant by exhibiting negative signs and values, we will conclude that the variables do not influence or stimulate significantly agricultural production output in Nigeria.

3.7 Analysis with Eviews (Tests for Stationarity and Unit Root).

The theory behind autoregressive and/or moving average (ARMA) estimation is based on stationary time series. A series is said to be (weakly or covariance) stationary if the mean and autocovariances of the series do not depend on time. Any series that is not stationary is said to be nonstationary.
A common example of a nonstationary series is the random walk:

There are two principal methods of detecting nonstationarity:

Visual inspection of the time series graph and its correlogram;
Formal statistical tests of unit roots.

The later will be used. A difference stationary series is said to be integrated and is denoted as I(d) where d is the order of integration. The order of integration is the number of unit roots contained in the series, or the number of differencing operations it takes to make the series stationary. Standard inference procedures do not apply to regressions which contain an integrated dependent variable or integrated regressors. Therefore, it is important to check whether a series is stationary or not before using it in a regression. The formal method to test the stationarity of a series is the unit root test.

3.8 Unit Root Tests

Unit root tests are based on null hypothesis that H0: $\rho = 1$ against the alternative H1: $\rho < 1$. They are called unit root tests because under the null hypothesis the characteristics polynomial has a root equal to unity. On the other hand, stationarity tests take the null hypothesis that Yt is trend stationary.

3.9 Dickey-Fuller Test

One common test is Dickey-Fuller test. It considers a AR(1) process

$Yt = \rho Yt\text{-}1 + ut$

Where ut is an independent identically distributed (IID) sequence of random variables. The test here should be:

H0: $\rho = 1$ vs. H1: $\rho < 1$

3.10 Linear Regression Model (with Eviews).

Using the linear regression model;

$Yi = \beta 1 + \beta 2X2i + \ldots + \beta kXki + ui = X\_i\text{^}' \beta + ui, \quad i = 1, \ldots, n,$

Where $Xi = [1, X2i, \ldots, Xki]'$is a $k \times 1$ vector of explanatory variables, $\beta = (\beta 1, \ldots, \beta k)'$ is a $k \times 1$ vector of coefficients, and ui is a random error term.

The OLS test statistics used here is called t-statistics.

Hence $t= (\beta\hat{}\_j\text{-}\beta\_j\text{^}0)/(se[\beta\hat{}\_j])$,

which is asymptotically distributed under the null hypothesis.

Because of the problem of heteroscedasticity and autocorrelation of the error terms due to the regression assumptions, Durbin-Watson-statistics (DW) will be used. It is defined by Durbin and Watson in their work as:

$$\boldsymbol{DW} = \frac{\sum_{i=2}^{n}(\hat{u}_i - \hat{u}_{i-1})^2}{\sum_{i=1}^{n}\hat{u}_i^2}$$

The Durbin-Watson statistic can be difficult to interpret.
The range of values of DW is from 0 to 4. Values of DW around 2 indicate no serial correlation in the error terms, values less than 2 suggest positive serial correlation, and values grater than 2 suggest negative serial correlation.

Appendix 1 established upper and lower bounds (dU and dL respectively) for the critical values. The testing procedure is as follows:

if DW < dL we reject the null hypothesis of no autocorrelation in favour of first-order autocorrelation;
if DW > dU we do not reject the null hypothesis.

3.11 Estimation Output of the Eviews Regression

The estimated coefficients of the model are given in the column Coefficients (the coefficient in front of C denote estimate of the intercept term (constant)). In column t–statistics, the value of the test statistic is provided to test that the hypothesis $\beta i = 0$. The column Prob contains the probability values. The overall significance of the regression is reflected in the value of F-statistic. The p-value given in Prob (F-statistic) tests the null hypothesis of insignificance of all slope coefficients.

4.0 Results and Discussions

The aim of this section is focused on testing the hypothesis stated in section three by using the statistical tool of regression. This will help to provide us with the basis of summarizing and concluding the study with respect to the result obtained. It will also help for good information and opinion towards commercial banks credit activities in the area of agricultural business and development in Nigeria.

This research will make use of the secondary data collected for the purpose of this study.

4.1 Data Presentation

The data used here are those concerning agricultural production output index and variables such as commercial banks' credit to agriculture, agricultural credit guarantee scheme loan by purpose, federal government financial allocation to agriculture and agricultural products price index, which falls within the time frame 1983 – 2007. The data is presented in Table 1 of the appendix.

4.2 Results and Discussions

The aim of this chapter is focused on testing the hypothesis stated in chapter one by using the statistical tool of regression.

Analysis with Eviews (Test for Stationarity)
Unit Root Test. Augmented Dickey-Fuller Test
Hypothesis:
H0: $\rho = 1$(the characteristics polynomial has a root equal to unity)
i.e. Yt is trend stationary.
HA: $\rho < 1$.

Table 4.2 Summarised Results of the Unit Root Tests

Variables	Level	1st Diff	2nd Diff	Intcpt	Trend & Intcpt	Lagged Diff	Critical value		
							1%	5%	10%
API	-1.095140	××××	××××	××××	××××	1	-13.7497	-2.9969	-2.6381
CBCA	-1.700821	××××	××××	××××	××××	1	-3.7497	-2.9969	-2.6381
ACLP	0.000968	××××	××××	××××	××××	1	-3.7497	-2.9969	-2.6381
GFAA	-2.314971	××××	××××	××××	××××	1	-3.7497	-2.9969	-2.6381
APPR	-1.589975	××××	××××	××××	××××	1	-3.7497	-2.9969	-2.6381

Summary of the result of the unit test

The absolute value of ADF for each of the variables as shown in the Table is less than that the critical value at 1%, 5% and 10% respectively. This indicates that each and every one of them is trend stationary.

The Regression Analysis with Eviews

The low value of the Durbin-Watson statistic reported in appendix 6 is indicative of the presence of serial correlation in the residuals of the estimated equation. If uncorrected, serial correlation in the residuals will lead to incorrect estimates of the standard errors, and invalid statistical inference for the coefficients of the equation.
Estimation Equation:

API = 378.255129 + 5.815918931e-06*CBCA + 7.037807139e-06*ACLP - 0.0001306882904*GFAA - 0.0005531043069*APPR + [AR(1)=0.9559228584]

The test results suggest that we need to modify our original specification to take account of the serial correlation. One approach is to include lags of the independent variables. Another common method of accounting for serial correlation is to include autoregressive (AR) and/or moving average (MA) terms in the equation. We use the first-order autoregressive (AR(1)).

The high value of the Durbin-Watson statistic reported in appendix 8 is indicative of the absence of serial correlation in the residuals of the estimated equation. Also, DW value of 1.209137 is greater than lower bounds (dL) at 5% critical value as can be seen on table 4.3, it is as well less than the upper bounds, so we accept the null hypothesis of no autocorrelation. Our k = 5, and our n = 25.
Estimation Equation:

API = 378.255129 + 5.815918931e-06*CBCA + 7.037807139e-06*ACLP - 0.0001306882904*GFAA - 0.0005531043069*APPR + [AR(1)=0.9559228584]

Analysis of the Impact of the Independent Factors on the Dependent Variable

The above relationship model is generated based on the impact of Commercial banks' credit to agriculture (CBCA), Agricultural credit guarantee scheme loan by purpose (ACLP), Government financial allocation to agriculture (GFAA) and Agricultural product pricing index (APPR) during the period 1983 – 2007. After adjusting end points to take care of possible errors, Eviews included from 1984 to 2007 only.

From appendix 8, in the column t-statistic, the value of test statistics is provided to test that the hypothesis $\beta i = 0$. The coefficients C, ACLP, AR(1) and GFAA are statistically significant under a 5% level of significance as indicated by low P-values (column Prob). The other coefficients (CBCA and APPR) are not statistically significant as indicated by their high probability values. The overall significance of the regression is reflected in the value of F-statistic which is high enough to reject the null hypothesis of the insignificance of all slope coefficients (p-value is given in Prob (F-statistic)). The overall regression fit, as measured by the R2 statistic, indicates a moderate fit.

4.3 Testing Of Hypothesis (with Eviews)

Hypothesis One:

H_0: Commercial Banks' credit to agricultural sector has not significantly influenced agricultural productivity in Nigeria.

Decision: This is tested using the t-test. From Appendix 8, the high probability of the critical value of 0.9265 (which is higher than t-statistics (0.093493)) indicates the significance of the null hypothesis. Thus, we accept the null hypothesis at 5% level of significance, and conclude that commercial banks' credit to agricultural sector for the period 1984 to 2007 has no significant positive impact on agricultural productivity in Nigeria.

Hypothesis Two:

H_0: Agricultural Credit Guarantee Scheme Loan by Purpose has not led to significant growth in agricultural productivity.

Decision: The low probability of the critical value of 0.2137 which is lower than the t-statistics (1.288965) indicates the rejection of the null hypothesis. Thus we conclude that agricultural scheme loan by purpose has led to a significant positive growth in agricultural productivity in Nigeria.

Hypothesis Three:

H_0: Government fund Allocation to the agricultural sector has not led to a significant positive growth in agricultural productivity.

Decision: Appendix 8 reports the probability of the critical value as 0.1294 which is lower than the absolute value of t-statistics (-1.589204). This is indicative of the rejection of the null hypothesis. Thus we conclude that government fund allocation to the agricultural sector has led to a significant positive growth in agricultural productivity.

Hypothesis Four:

H_0: Prices of agricultural products have not made any significant positive impact on agricultural productivity.

Decision: The high probability of the critical value suggests the acceptance of H_0. Thus we conclude that prices of agricultural products have not made any significant positive impact on agricultural productivity.

5.1 Conclusion

From the statistical computation, analyses and findings of the test carried out, it shows that:

The joint action of commercial banks credit to the agricultural sector, agricultural credit guarantee loan by purpose, government financial allocation to agricultural sector and agricultural products prices are significant factors that can influence agricultural production in Nigeria.

Commercial banks' credit to agricultural sector for the period 1984 to 2007 has no significant positive impact on agricultural productivity in Nigeria.

Agricultural scheme loan by purpose has led to a significant positive growth in agricultural productivity in Nigeria.

Government fund allocation to the agricultural sector has led to a significant positive growth in agricultural productivity.

Prices of agricultural products have not made any significant positive impact on agricultural productivity.

5.2 Recommendations

From the information about this study, the agricultural credit guarantee scheme fund has a tripartite involvement of the Nigeria government through the Central Bank of Nigeria as the management agent under the Ministry of Finance, the banks in this case the commercial banks and the farmers i.e. borrowers. The study notes that all these organs must be pro-active to deal with the changing attitudes of the customers (beneficiaries of the loan).

The beneficiaries should recognize the practice and advantages of accumulated savings, which is often allowed to group when existing facilities are not fully adjusted. This can help the banks to hope that the loan will be paid and usher sustainability of bank and customer friendly relationship.

The scheme should put more commitments in implementing vigorously the policy of granting loan by purpose so that those segments of the nation's agricultural produce that are targeted for improved productivity will be achieved.

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Appendix

Appendix One

Result of Regression Analysis with Eviews

Dependent Variable: API
Method: Least Squares
Sample: 1983 2007
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	145.8045	10.95743	13.30646	0.0000
CBCA	-1.66E-05	0.000193	-0.085732	0.9325
ACLP	1.94E-05	8.34E-06	2.325182	0.0307
GFAA	-6.11E-05	0.000565	-0.108270	0.9149
APPR	0.012972	0.003968	3.268728	0.0038
R-squared	0.762647	Mean dependent var		206.9160
Adjusted R-squared	0.715176	S.D. dependent var		67.22186
S.E. of regression	35.87555	Akaike info criterion		10.17485
Sum squared resid	25741.10	Schwarz criterion		10.41862
Log likelihood	-122.1856	F-statistic		16.06566
Durbin-Watson stat	0.466977	Prob(F-statistic)		0.000005

Appendix Two

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	24.24667	Probability	0.000094
Obs*R-squared	14.01650	Probability	0.000181

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 01/04/11 Time: 21:34
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.660088	7.539697	0.750705	0.4620
CBCA	5.18E-05	0.000132	0.392931	0.6987
ACLP	5.97E-06	5.80E-06	1.029645	0.3161
GFAA	-0.000320	0.000390	-0.820897	0.4219
APPR	-0.002533	0.002747	-0.922069	0.3681
RESID(-1)	0.809326	0.164361	4.924091	0.0001
R-squared	0.560660	Mean dependent var		-3.71E-14
Adjusted R-squared	0.445044	S.D. dependent var		32.74975
S.E. of regression	24.39705	Akaike info criterion		9.432364
Sum squared resid	11309.10	Schwarz criterion		9.724895
Log likelihood	-111.9046	F-statistic		4.849334
Durbin-Watson stat	1.339589	Prob(F-statistic)		0.005016

Appendix Three

The Result of the first-order Autoregressive Process (AR)

Dependent Variable: API
Method: Least Squares
Sample(adjusted): 1984 2007
Included observations: 24 after adjusting endpoints
Convergence achieved after 10 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	378.2551	156.5228	2.416613	0.0265
CBCA	5.82E-06	6.22E-05	0.093493	0.9265
ACLP	7.04E-06	5.46E-06	1.288965	0.2137
GFAA	-0.000131	8.22E-05	-1.589204	0.1294
APPR	-0.000553	0.001173	-0.471521	0.6429
AR(1)	0.955923	0.033082	28.89581	0.0000
R-squared	0.988006	Mean dependent var		211.6250
Adjusted R-squared	0.984675	S.D. dependent var		64.31778
S.E. of regression	7.962233	Akaike info criterion		7.199614
Sum squared resid	1141.149	Schwarz criterion		7.494127
Log likelihood	-80.39537	F-statistic		296.5582
Durbin-Watson stat	1.209137	Prob(F-statistic)		0.000000
Inverted AR Roots	.96			