

THE IMPACT OF OIL PRICE VOLATILITY ON GOVERNMENT SPENDING IN ALGERIA: AN ECONOMETRIC ANALYTICAL STUDY USING THE COINTEGRATION METHODOLOGY DURING THE PERIOD 1980-2024

* **Yahia BENSLIMANE**
University of Djelfa
Lab of MQEMADD
Email: y.benslimane@univ-djelfa.dz

Reçu le: 03/09/2025 **Accepté le :** 19/10/2025 **Publication en ligne le:** 09/12/2025

ABSTRACT:

The purpose of this paper is to study the effect of oil price fluctuations on government spending in Algeria during the period 1980-2024. In the analytical study, we found a synchronous cointegration relationship between the study variables. In the econometric study, we first examined the stationarity of the two variables and found that they are integrated of the same order. Subsequently, we found evidence of cointegration between them. We also found through our estimation that a relationship exists in both the short and long term, meaning that any increase in oil prices leads to an increase in government spending in the short term, while an inverse relationship exists in the long term.

Keywords: Oil price fluctuations, Cointegration, Error correction model.

I. INTRODUCTION

Oil prices are a crucial factor in shaping the economic and fiscal policies of countries that produce and rely on oil as a primary source of revenue. Oil is a strategic resource that directly affects public budgets, especially in nations heavily dependent on oil revenues to finance their government spending. Given the continuous fluctuations in the oil market due to geopolitical, economic, and technical factors, a central question arises regarding the extent to which these fluctuations impact governments' ability to plan financially and achieve economic stability. In this context, this article analyzes the effect of oil price volatility on government spending, highlighting the challenges posed by periods of price decline and the opportunities for expansion during boom periods, with a focus on real-world examples from rentier economies.

Algeria is a leading producer and exporter of oil and gas, with hydrocarbon revenues forming the backbone of its national economy. Consequently, the Algerian economy cannot be separated from the continuous fluctuations in global oil markets. Experience has shown

* Yahia BENSLIMANE

that any volatility in oil prices has a direct and profound impact on the state's general budget and its ability to finance various development projects.

I.1. RESEARCH PROBLEM

Algeria is a rentier state whose economy is heavily dependent on oil and gas revenues, as hydrocarbon earnings constitute the largest share of the state budget and its foreign currency income. Given the volatile nature of the global oil market, Algeria finds itself directly exposed to the effects of these fluctuations, whether in terms of financial abundance or economic pressures when prices fall. This leads to a central research problem, which is:

What is the effect of oil price fluctuations on the volume of government spending in Algeria during the study period?

To address this problem, we have divided this research paper as follows: first: A review of previous studies on the research topic, second the analytical Study An analysis of government spending programs in Algeria through the examination of graphical curves, third Empirical Study: The practical application of our research methods, and finally the conclusion wich is a summary of our findings.

I.2. RESEARCH HYPOTHESES

- There is a relationship between oil prices and the volume of government spending in Algeria. An increase in oil prices leads to a rise in spending, while a decrease leads to its contraction.
- Algeria suffers from a lack of income diversification, which makes government spending highly sensitive to fluctuations in oil prices.

II. LITERATURE REVIEW

- **KESSABI Chaabane-BELABBAS Rabah:** The impact of oil price fluctuations on government spending in Algeria, an econometric study using the Autoregressive Distributed Lag (ARDL) model, during the period 2000-2018. The researchers concluded that there is a long-term equilibrium relationship between oil prices and government spending in Algeria (KESSABI Chaabane-BELABAS Rabah, 2020).
- **SAADEDINE Abdeldjabbar :** The effect of oil price fluctuations on guiding public spending policy in Algeria: an analytical and econometric study for the period 1986-2018. The researcher concluded that there is a cointegration relationship between oil prices and government spending in Algeria (SAAD EDINE Abdeldjebar, 2020).
- **HAFSI Yacine Benbaou-HELLAL Abdelsalam:** The impact of changes in oil prices on government spending in Algeria in the short and long term: an econometric study using the time series analysis approach. The researchers concluded that there is a causal

relationship in the short term but a lack of relationship in the long term between the two variables (HAFSI Yacine Benbaou- HELLAL Abdessalam, 2021).

- **DJABRI Fatima Zahraa-FARRAH Elias Elhanani**: The effect of oil price fluctuations on government spending in Algeria: an econometric study using the ARDL model, during the period 1987-2013. The researchers concluded that there is a long-term relationship between the two study variables (JABRI Fatima Zahraa- HENANI FERAH Lias, 2018).

III. THE ANALYTICAL STUDY OF GOVERNMENT SPENDING PROGRAMS IN ALGERIA AND THEIR RELATIONSHIP WITH OIL PRICES

Government spending is considered one of the most important tools of fiscal policy. It is seen as a crucial instrument for achieving economic growth in Algeria, especially when oil revenues are high. It is the primary tool the government uses to increase the volume of investments, aiming to raise employment rates, achieve its social objectives, and ultimately drive economic growth.

Oil revenues played a major and effective role in shaping Algeria's spending policy during the 1970s and early 1980s. During this period, Algeria implemented a series of development plans and programs: the first quadrennial plan (1970-1973) and the second quadrennial plan (1974-1977). Huge investment sums were allocated to both the hydrocarbon and industrial sectors compared to the total investments. Despite this, the achieved goals were not as desired. The focus on industry led to the neglect of agriculture, and consequently, its contribution to national production decreased. Starting in 1980, the first quinquennial plan (1980-1984) was initiated, which was characterized by an increase in financial appropriations and an attempt to create balance and integration between the industrial and agricultural sectors (LAMI Mohamed, 2011).

However, with the global oil crisis and the choc in oil prices starting in 1986, investments began to decline and continued to do so until the 1990s (SELLAMI Ahmed, 2015). The public treasury experienced a deficit starting in 1992, due to falling revenues against rising public expenditures. From 1993, and because of the difficult financial situation Algeria was experiencing, the government resorted to rescheduling debt and adopting the economic reforms imposed by the International Monetary Fund (IMF) and the World Bank (KERBALI Baghdad, 2005)..

With the start of the new millennium, oil prices rebounded, which had a positive impact on the Algerian economy, revenues saw a significant increase, leading the government to boost spending by adopting several development programs and plans, which include (SALHI Nadja-MEKHNACH Fatiha, 2013):

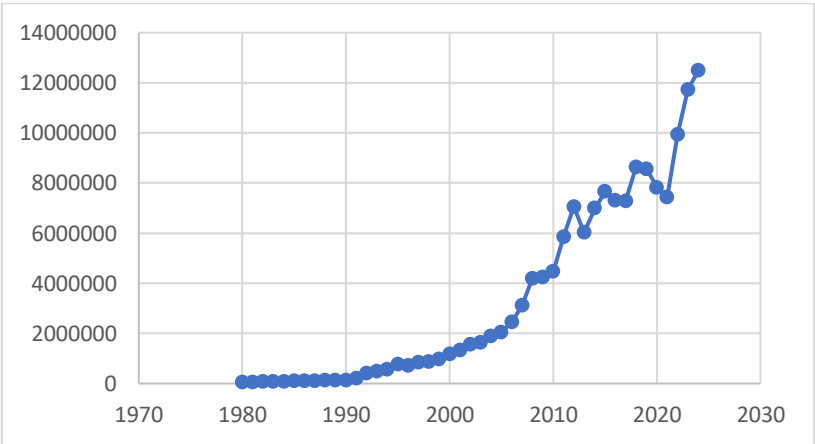
- Economic Recovery Support Program (PSRE) 2001-2004: The government allocated an amount of 525 billion Algerian Dinars to this program.
- Complementary Program for Growth Support (PCSC) 2005-2009: The government allocated an amount of 4,203 billion Algerian Dinars (DZD) to this program, subsequently,

The Impact of Oil Price Volatility on Government Spending in Algeria: An Econometric Analytical Study Using the Cointegration Methodology During the Period 1980-2024

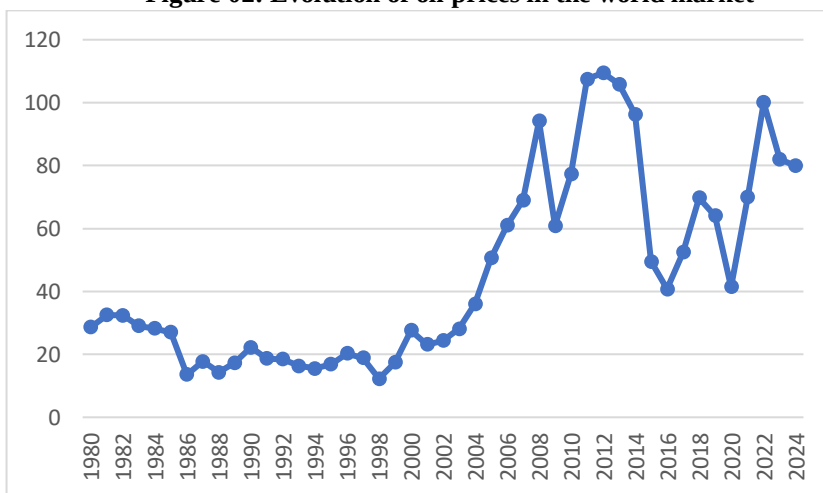
two special programs were added to it: one for the southern regions (FSDRS) valued at 432 billion DZD, and another for the High Plateaus regions (PHP) valued at 668 billion DZD. In addition, remaining resources from the Economic Recovery Support Program (PSRE) amounting to 1,071 billion DZD were included, along with additional funds of 1,191 billion DZD and special transfers to treasury accounts worth 1,140 billion DZD. Consequently, the final total reached 8,705 billion DZD.

- Economic Growth Support Program (PCCE) 2010-2014: The amount allocated to this program was 21,214 billion Algerian Dinars.
- Economic Growth Consolidation Program 2015-2019: The state adopted a policy of rationalizing public spending and allocated approximately \$300 billion in 2015 to address the economic situation resulting from the drop in global oil prices (BENMOHAMED Houda, 2020).

Figure 01: Evolution of Government Spending in Algeria During the Period 1980-2024



Source: Prepared by the researcher using Excel, based on data from the World Bank

Figure 02: Evolution of oil prices in the world market

Source: Prepared by the researcher using Excel, based on data from the World Bank

Based on our reading of the graphical representation showing the evolution of the government spending curve, we observe that during the 1980s, government intervention, represented by public expenditure, achieved only a slight increase. This can be attributed to several factors that influenced the 1980s, including the oil price crisis, economic instability, internal and external imbalances, and an increase in external debt, especially with the state's adoption of the socialist approach during that period.

However, starting in the early 1990s, the state shifted towards an open economy as an alternative to the previous approach and pursued an expansionary policy through a year-on-year increase in government spending, this led to a rise in the national product compared to the previous period, despite the security challenges that Algeria faced.

Starting in 2001, due to the increase in revenues from rising oil prices, the government began implementing development programs by boosting government spending even more than in the previous period. This increase led to a rise in the gross national product, which in turn was reflected in higher growth rates compared to earlier periods.

We also observe that the volume of government spending increased from one program to the next starting in the year 2000. This was due to the financial surplus that Algeria experienced as a result of the registered rise in hydrocarbon prices, which was accompanied by an increase in annual growth rates.

The Economic Growth Support Program (PCCE) recorded the largest volume of government spending, with an amount of 21,214 billion DZD, compared to the Economic Recovery Support Program (PSRE) which had an amount of 525 billion DZD at the beginning of the oil price increase.

IV. THE ECONOMETRIC STUDY

In this section, we will build an econometric model based on economic theory and the previous studies, we will utilize cointegration and the error correction model, this requires defining the model's variables in addition to studying the stationarity of the time series used.

IV.1. MODEL VARIABLES

A good selection of variables, based on economic theory and the reality of the Algerian economy, allows us to build a higher-quality model that yields more meaningful results, we have chosen the variables as follows:

- Logarithm of Government Spending (LG): The dependent variable.
- Logarithm of Oil Prices (LPP): The independent variable.

These variables are annual time series data taken from the National Office of Statistics and the IMF website for the period 1980-2024.

IV.2. TIME SERIES STATIONARITY ANALYSIS

A time series is considered stationary if it fluctuates around a constant mean with a variance that is not time-dependent. In this regard, we used the Augmented Dickey-Fuller (ADF) test to examine the stationarity of the time series, as it is a statistical test. The analysis was conducted using the Eviews10 statistical software. The stationarity analysis is as follows:

Table 01: ADF Test Results

At Level			
		LG	LPP
With Constant	t-Statistic	-1.895	-1.1262
	Prob.	0.3316	0.6971
With Constant & Trend	t-Statistic	-1.0317	-2.3552
	Prob.	0.9288	0.3969
Without Constant & Trend	t-Statistic	5.3891	0.3405
	Prob.	1	0.7792
At First Difference			
		d(LG)	d(LPP)
With Constant	t-Statistic	-5.108	-5.8126
	Prob.	0.0001***	0***
With Constant & Trend	t-Statistic	-4.8874	-5.8629
	Prob.	0.0015***	0.0001***
Without Constant & Trend	t-Statistic	-3.5687	-5.8113
	Prob.	0.0007***	0***

Source: Prepared by the researcher using Eviews10 software (Appendix 01).

Notes:

a: (*)Significant at the 10%; (**)Significant at the 5%; (***)

Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

c: Probability based on MacKinnon (1996) one-sided p-values

From our reading of Table No. 01 (Appendix No. 01), it is clear that:

- The null hypothesis is accepted at the level, meaning the variables are non-stationary due to the presence of a unit root.
- The variables are stationary at the first difference due to the absence of a unit root.
- This indicates that both study variables are integrated of order one, or **I(1)**.

IV.3. COINTEGRATION TEST OF JOHANSEN

Table 02: Cointegration Test

Date: 08/07/25 Time: 14:47 Sample (adjusted): 1982 2024 Included observations: 43 after adjustments Trend assumption: No deterministic trend (restricted constant) Series: LG LPP 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 *	0.283538	20.93814	20.26184	0.0403
At most 1	0.142302	6.600660	9.164546	0.1492
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Prepared by the researcher using Eviews10 software

Based on the previous table, which represents the Johansen test, we observe the existence of a cointegration relationship (*Trace Statistic* = 20.93 > *Critical Value* = 20.26).

IV.4. ESTIMATING THE COINTEGRATION EQUATION IN THE SHORT AND LONG TERM

We estimated the cointegration relationship in both the short and long term, and the results are shown in Appendix No. 02:

$$DLG_t = -0.023e_{t-1} + 0.162DLG_{t-1} - 0.124DLG_{t-2} + 0.145DLPP_{t-1} + 0.013DLPP_{t-2}.....(01)$$

(0.006)
(0.164)
(0.157)
(0.079)
(0.082)
R² = 0.19

From Equation N° (01), it is clear that the coefficient of determination (R²) reached 0.19, which indicates that the change in the independent variables explains 19% of the change and fluctuations in government spending.

From the equation, it is also clear that the error correction term (coint), which represents the speed of adjustment to long-term equilibrium, has a negative sign (-0.023) and is statistically significant. The calculated t-statistic (in absolute value) is 3.62, which is greater than the critical value at the 5% significance level. This supports the use of an error

correction model to represent the effect of the independent variables on the level of employment, this means that if a shock occurs, it would take approximately $(1 / 0.023)$ years for the employment level to reach its long-term equilibrium.

Furthermore, the Fisher statistic has a value of 2.23, which is greater than the critical value at the 5% significance level, indicating that the variables used collectively have a significant effect on the model.

IV.5. ESTIMATION OF THE LONG-RUN COINTEGRATION EQUATION

$$LG_t = 8.481 - 0.166DLPP_{t-1} \dots \dots \dots (02)$$

Based on the long-run estimation equation (02), we observe that the independent variables are not economically side, specifically, the variable for oil prices, which explains the government expenditure variable, has a negative sign, this finding is inconsistent with the nature of the Algerian economy and economic theory.

The result suggests that a 1% increase in oil prices leads to a 0.166% decrease in government expenditure in the long run, this finding implies the need for the state to seek other sources to finance government spending.

IV.6. RESIDUAL TEST

IV.6.1. TEST FOR HOMOSCEDASTICITY OF MODEL RESIDUALS

To ensure the homoscedasticity of the model's residual variance, we use the White test, and the results are shown in the following table:

Table 03: Autocorrelation and Partial Autocorrelation Functions of Model Residuals

Date: 08/07/25 Time: 14:46 Sample: 1980 2024 Included observations: 42					
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 0.020	0.020	0.0187	0.891
		2 -0.074	-0.074	0.2709	0.873
		3 0.091	0.094	0.6616	0.882
		4 -0.024	-0.035	0.6907	0.952
		5 -0.216	-0.204	3.0313	0.695
		6 -0.207	-0.221	5.2403	0.513
		7 -0.015	-0.042	5.2528	0.629
		8 0.011	0.020	5.2598	0.729
		9 -0.215	-0.215	7.8591	0.548
		10 0.036	-0.028	7.9351	0.635
		11 -0.047	-0.200	8.0664	0.707
		12 0.026	-0.007	8.1087	0.777
		13 -0.049	-0.128	8.2605	0.826
		14 0.022	-0.071	8.2929	0.874
		15 0.082	-0.062	8.7521	0.890
		16 0.201	0.164	11.624	0.769
		17 0.047	0.011	11.784	0.813
		18 -0.117	-0.215	12.837	0.801
		19 0.107	0.066	13.755	0.798
		20 0.107	0.077	14.723	0.792

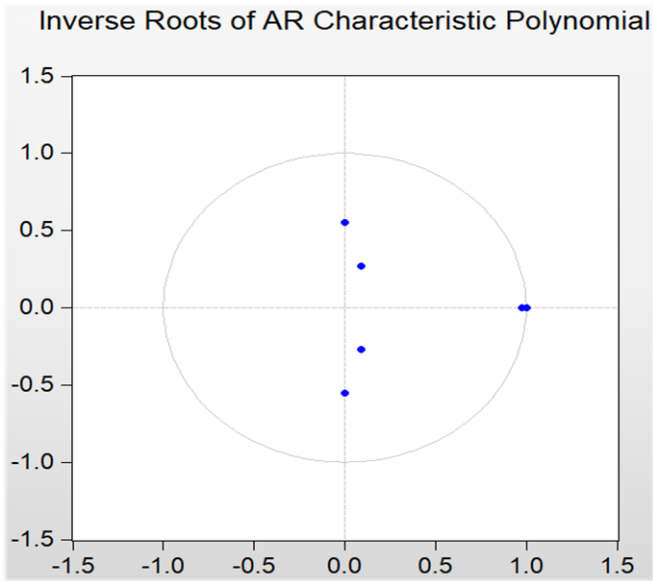
Source: Prepared by the researcher using Eviews10 software

Based on the figure above, the analysis of the government expenditure equation's residual autocorrelation function shows that all values of the autocorrelation function are within the confidence interval, furthermore, the calculated Ljung-Box statistic (Q-Stat) is less than the critical value at a lag of $p=20$ (with $\text{prob} > 0.05$), therefore, we accept the null hypothesis, which means there is no "memory" within the model's residual series. Consequently, the residuals are considered white noise, indicating they are stable and not autocorrelated.

IV.6.2. STATIONARITY OF THE VECTOR ERROR CORRECTION MODEL (VECM)

The results of the VECM stationarity test are shown in the following figure:

Figure 04: Stationarity of the Vector Error Correction Model (VECM)



Source: Prepared by the researcher using Eviews10 software

Based on the figure above, it is clear that the estimated model satisfies the stationarity conditions. Therefore, all coefficients are less than one, and all roots lie within the unit circle.

V. CONCLUSION

The analytical study of the relationship between oil price fluctuations and the volume of government expenditure in Algeria has shown that there is a significant relationship between them in both the short and long term, where an increase in oil prices leads to a rise in gross domestic product, which in turn leads to an increase in both

government spending and investment. This generates numerous job opportunities to cover these investments, and the reverse is also true.

We found also the same result in our econometric study, where we estimated the government expenditure function in Algeria using a Vector Error Correction Model (VECM), in the short run, we found a positive relationship, while in the long run, we found an inverse relationship between oil prices and government expenditure, this suggests that oil prices significantly impact the volume of government spending in Algeria, as the country's exports are heavily dependent on oil revenues.

Therefore, Algeria should seek alternative sources for government spending, such as diversifying its non-hydrocarbon exports, to avoid any potential shocks in oil prices.

VI. BIBLIOGRAPHY

Theses and dissertations

1- **محمد لامي** ، دراسة تأثير النفقات العامة على معدل النمو الاقتصادي-دراسة حالة الجزائر (1970-2009)، جامعة الجزائر 3، 2010-2011.

Research paper :

2- **أحمد سلامي** ، العلاقة السببية بين الإنفاق الحكومي والنمو الاقتصادي في الجزائر، دراسة تطبيقية للفترة 1970-2013، مجلة أبحاث اقتصادية وإدارية العدد 17، جوان .

3- **بغداد كربالي** ، نظرة عامة على التحولات الاقتصادية في الجزائر، مجلة العلوم الإنسانية، جامعة محمد خيضر بسكرة، العدد الثامن، جانفي 2005.

4- **ناجية صالح** ، فتحة مخناش ، تقييم آثار برامج الاستثمارات العامة وانعكاساتها على التشغيل والاستثمار والنمو الاقتصادي خلال الفترة 2001-2014، المؤتمر الدولي حول تقييم آثار الاستثمارات العامة وانعكاساتها على التشغيل والنمو الاقتصادي في الجزائر خلال الفترة 2001-2014، مارس 2013، جامعة سطيف 1.

5- **شعبان قصابي** ، رابع بلعباس: أثر تقلبات أسعار النفط على الانفاق الحكومي في الجزائر، دراسة قياسية باستعمال ، خلال الفترة 2000-2018، مجلة الاستراتيجية والتنمية، ARDL نموذج الانحدار الذاتي ذي الفجوات الزمنية الموزعة المجلد 1 مكرر (الجزء الثاني) جانفي 2020..

6- **عبد الجبار سعد الدين** ، أثر تقلبات أسعار النفط في توجيه سياسة الانفاق العام في الجزائر دراسة تحليلية قياسية للفترة 1986-2018، مجلة إدارة الأعمال والدراسات الاقتصادية المجلد (06) العدد (02) 2020.

7- **ياسين بن بوع حفصي** ، عبد السلام هلال: تأثير تغير سعر النفط على الانفاق الحكومي في الجزائر على المدى القصير وRevue algérienne d'économie et gestion والطويل دراسة قياسية باستعمال منهج تحليل السلاسل الزمنية، Vol15, N02(2021).

8- **فاطمة الزهراء جابري**، الياس الهناني فراح، أثر تقلبات أسعار النفط على الانفاق الحكومي في الجزائر، دراسة قياسية ، خلال الفترة 1987-2013، مجلة اقتصاديات المال والأعمال المجلد (02) العدد (01) مارس ARDL باستعمال نموذج ، 2018.

Appendix 01

UNIT ROOT TEST RESULTS TABLE (ADF)

Null Hypothesis: the variable has a unit root

		<u>At Level</u>	
		LG	LPP
With Constant	t-Statistic	-1.8950	-1.1262
	Prob.	0.3316	0.6971
		n0	n0
With Constant & Trend	t-Statistic	-1.0317	-2.3552
	Prob.	0.9288	0.3969
		n0	n0
Without Constant & Trend	t-Statistic	5.3891	0.3405
	Prob.	1.0000	0.7792
		n0	n0
		<u>At First Difference</u>	
		d(LG)	d(LPP)
With Constant	t-Statistic	-5.1080	-5.8126
	Prob.	0.0001	0.0000
		***	***
With Constant & Trend	t-Statistic	-4.8874	-5.8629
	Prob.	0.0015	0.0001
		***	***
Without Constant & Trend	t-Statistic	-3.5687	-5.8113
	Prob.	0.0007	0.0000
		***	***

Notes:

a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

c: Probability based on MacKinnon (1996) one-sided p-values.

Appendix 02

Vector Error Correction Estimates

Date: 08/07/25 Time: 14:42

Sample (adjusted): 1983 2024

Included observations: 42 after adjustments

Standard errors in () & t-statistics in []

Cointegrating Eq:	CointEq1	
LG(-1)	1.000000	
LPP(-1)	0.166341 (1.48529) [0.11199]	
C	-8.481454 (2.48048) [-3.41929]	
Error Correction:	D(LG)	D(LPP)
CointEq1	-0.023375 (0.00645) [-3.62661]	-0.007061 (0.01336) [-0.52848]
D(LG(-1))	0.162696 (0.16450) [0.98902]	-0.321943 (0.34098) [-0.94418]
D(LG(-2))	-0.124801 (0.15738) [-0.79298]	0.154175 (0.32622) [0.47261]
D(LPP(-1))	0.145807 (0.07981) [1.82700]	0.018830 (0.16542) [0.11383]
D(LPP(-2))	0.013512 (0.08218) [0.16442]	-0.208913 (0.17035) [-1.22638]
R-squared	0.194323	0.083980
Adj. R-squared	0.107222	-0.015049
Sum sq. resids	0.133351	0.572939
S.E. equation	0.060034	0.124438
F-statistic	2.231022	0.848030
Log likelihood	61.20580	30.59213
Akaike AIC	-2.676467	-1.218673
Schwarz SC	-2.469601	-1.011807
Mean dependent	0.053246	0.009335
S.D. dependent	0.063537	0.123512
Determinant resid covariance (dof adj.)	5.23E-05	
Determinant resid covariance	4.06E-05	
Log likelihood	93.18016	
Akaike information criterion	-3.818103	
Schwarz criterion	-3.280253	
Number of coefficients	13	