Pakistan Economic and Social Review
Volume 53, No. 2 (Winter 2015), pp. 269-284

PASS-THROUGH OF WORLD OIL PRICES TO INFLATION: A TIME SERIES ANALYSIS OF PAKISTAN

NABILA ASGHAR AND TANVEER AHMED NAVEED*

Abstract. Inflation plays vibrant role in economic stability and is considered to be an integral component of sound macroeconomic policies. Consumer prices are very much linked with the oil prices. A change in oil prices is assumed to be passing through to other goods prices directly or indirectly. The main objective of this study is to investigate long-run pass-through of world oil prices to domestic inflation in Pakistan using monthly data from January 2000 to December 2014. The standard Augmented Dickey-Fuller (ADF) unit root test is applied to test the order of integration of selected variables. The Autoregressive Distributed Lag (ARDL) bounds testing approach is applied to investigate long-run pass-through of world oil prices to domestic inflation in Pakistan in the presence of control variable, *i.e.* exchange rate. The results of the study clearly explain that in the long-run international oil prices and exchange rate significantly affect the inflation rate in Pakistan. Furthermore, oil price (LOILP) has positive relationship with inflation and Nominal Exchange Rate (LER) has negative relationship with inflation rate in Pakistan. The findings of the Granger causality test reveal that there is unidirectional causality that runs from world oil prices to inflation rate, from inflation to exchange rate, and from world oil prices to exchange rate in Pakistan.

Keywords: Pass-through, Oil price, Inflation, Exchange rate

JEL classification: C22, E42, P24

---

*The authors are, respectively, Assistant Professor of Economics at the University of Punjab, Lahore-54590 (Pakistan), and Assistant Professor of Economics at the University of Gujrat, Gujrat (Pakistan).
Corresponding author e-mail: nabeelakhan83@gmail.com

I. INTRODUCTION

Inflation plays an important role in economic stability of an economy and is considered to be integral component of sound macroeconomic policies. Low inflation could impact growth negatively while high inflation can affect poor more severely than rich. After 1973, when Pakistan experienced highest inflation rate (38 percent), in 2008-09 severity again has been observed when inflation rate augmented by 17 and economic growth declined to 0.4 percent (*Pakistan Economic Survey*, 2008-09, 2013-14). This high inflation is due to internal and external factors. In foreign factors exchange rate, global inflation, food prices, and, more importantly, world oil prices are factors affecting domestic price stability in developing countries like Pakistan.

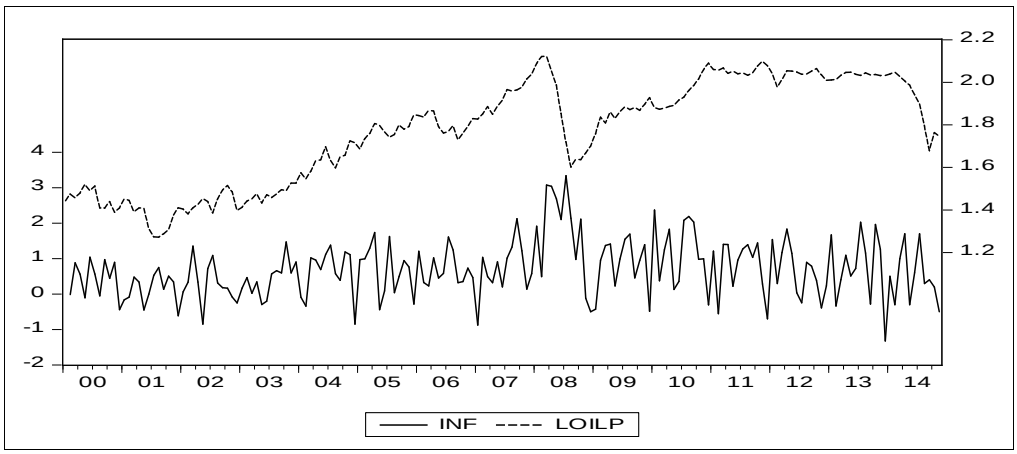
In general, consumer prices are very much linked with the oil prices, because oil products are not only used as a final product but are also used as an input in many of the production processes and economic activities. A change in the oil prices is assumed to be passing through to other goods prices directly or indirectly. Oil prices affect the consumption of consumers in many fields. The increase in the oil prices is reflected into increase in the producer prices that are finally pass-through to the consumer prices. Furthermore, it has been observed that an increase in oil prices have a significant impact on exchange rate and it also exerts pass-through adverse impact on the development process. The pass-through effect of global oil prices on domestic inflation deteriorates the living standard, causes political unrest and increases unemployment in developing countries like Pakistan.

During the last five decades, the global economy has faced several big oil shocks. In 1973, world has faced first oil shock, when OPEC economies reduced oil exports due to Arab War against Israel. Resultantly, world oil prices moved up from $ 4.15 in 1973 to $ 9.07 in 1974. Second oil shock occurred in 1979, when Iran faced severe political instability that caused a massive reduction in oil production in Iran, resultantly oil prices shifted from $ 12.46 in 1978 to $ 35.24 in 1981.

From 2000 to 2008 world oil prices created new records that severely affected the economy of every country of the world. In 2007-08, world oil prices have approached to ever highest $ 145 per barrel. But in the second quarter of 2014-15, oil price moved down to $ 44 per barrel, which is lowest in last 10 years. These oil price shocks affect economic growth, foreign trade, balance of payments, inflation and other economic variables adversely. Furthermore, an increase in oil prices may lead to slow economic growth, which results in an increase in domestic consumer prices and in turn affects the process of economic growth badly.

FIGURE 1

World Oil Prices and Inflation Rate of Pakistan
(Monthly data from 2000M1-2014M12)



Source: Thomson Reuters and IFS 2014

The world oil shocks during 1970s and 2008 have attracted a lot of attention of researchers to investigate the impact of oil prices on macroeconomic indicators. Many empirical studies suggest a strong pass-through effect of oil prices on consumer prices. Gisser and Goodwin (1986) point out that macroeconomic variables are significantly affected by oil prices in United States. Both, 1973 and 1979 oil shocks have contributed significantly in an increase in price level in developing countries (Burbidge and Harrison, 1984). Whereas, Hooker (2002) investigates the pass-through effect of oil prices by estimating Phillips curve model. The study reveals that oil price pass-through effect appears to be negligible after 1980 in USA. Moreover, LeBlanc and Chinn (2004) find that crude oil prices have very small effects on consumer prices in developed economies. Different studies suggest that affects of oil prices on consumer prices and other economic activities vary for the different investigation periods and across the countries. This study is an attempt to extend the empirical literature on pass-through impact of global oil prices on domestic inflation for Pakistan using monthly data from January 2000 to December 2014.

II. LITERATURE REVIEW

Several theoretical and empirical studies have been conducted to investigate the effect of exchange rate, global inflation, energy prices, international food inflation and international crude oil prices on domestic inflation, and growth

of different countries. Two consecutive oil crises and stagflation in the different countries during the 1970s has received considerable attraction of researchers and academicians to analyze the relationship between international oil prices and domestic economic activities. The review of literature indicates that there is a strong relationship between world oil prices and inflation.

Chou and Tseng (2011) estimate the short-run and long-run pass-through effects of international oil prices on CPI index in Taiwan using data from 1982 to 2010. The results of the study show that oil prices have significant and long-run pass-through effect on domestic price level of Taiwan. The results indicate that short-run pass-through effect of oil prices on inflation rate in Taiwan is not significant.

Shioji and Uchino (2010) explore the effect of world oil prices on domestic inflation in Japan by employing Vector Autoregressive (VAR) approach on data for the period 1980 to 2000. The results of the study reveal that pass-through effects of international crude oil prices on domestic prices have declined at aggregate level as well as at sectoral level. L'Oeillet and Licheron (2008) observe the relationship between international oil prices and inflation rate by estimating Phillips curve on European zone data for the time period 1970-2007. The study finds a declining pass-through of international oil prices to domestic consumer prices.

As far as Pakistan is concerned, Tufail and Batool (2013) investigate the effect of gold and stock prices on consumer prices in Pakistan using cointegration and vector error correction models for the data from 1960 to 2010. The results of the study show that gold prices significantly affect inflation in Pakistan. The results of the study suggest that along with effective monetary policy government should monitor and regulate the gold market to control inflation in Pakistan. Jaffri *et al.* (2013) have analyzed global inflation pass-through to domestic inflation of Pakistan using quarterly data for the period 1993-2012. The results of the study reveal that global energy prices and food inflation significantly and positively affect inflation in Pakistan. The study suggests that there is a need to formulate monetary policy in collaboration with fiscal policy carefully to control foreign inflation pass-through to domestic inflation in Pakistan.

III. THEORETICAL LINK

Conceptually, the pass-through of world oil prices into domestic inflation refers to a rate at which the fluctuations in the oil price are reflected in the general price level (Mandal *et al.,* 2012). Oil prices fluctuations have been

considered by policymakers, econometricians and economists as a main source of business cycle instability since mid 1970s. Many efforts have been made to examine the means whereby world oil prices exert upsets effect on the domestic inflation, economic growth and other macroeconomic variables (Jones and Kaul, 1996; Brown and Yücel, 2002).

Theoretically, increase in oil prices is expected to affect the inflation rates through different channels. Direct effect explains the effects through the demand side: a rise in the world oil prices is considered as an exogenous inflationary shock because energy is part of households' basket (for details *see*, Pierce and Enzler, 1974; Hickman, Huntington and Sweeney, 1987).

While, on the other hand, indirect effect works through supply side, *i.e.* it can be observed via producer prices (Rasche and Tatom, 1977). An increase in oil prices exerts bad impact on supply of goods and services which leads to an increase in the cost of energy causing the reduction of basic inputs required for production of goods and services and ultimately leads to an increase in inflation. Third, high oil prices can be translated into higher consumer prices expectations and higher wages. In response to that workers can demand for higher wages to compensate the decline in real income which may lead to an increase in cost-push inflation.

IV. DATA AND MODEL SPECIFICATION

This study uses monthly data for world oil prices in dollars, inflation rate and exchange rate for the period of January 2000 to December 2014. During these 15 years world has experienced two oil shocks, *i.e.* world oil crisis 2007-08 and world oil price shock 2014-15. The data on world oil prices is taken from Energy Information Administration (Thomson Reuters) and data on exchange rate and inflation is collected from *International Financial Statistics* (IFS) and monthly *Statistical Bulletin* of State Bank of Pakistan (SBP).

MODEL: ERROR CORRECTION VERSION OF ARDL MODEL

$$\Delta INF_t = \alpha + \varphi INF_{t-1} + \rho LOILP_{t-1} + \delta LER_{t-1} + \beta \sum_{i=i}^{i=m} \Delta INF_{t-1} + \phi \sum_{i=0}^{i=m} \Delta LOILP_{t-i} + \gamma \sum_{i=0}^{i=m} \Delta LER_{t-i} + \varepsilon_t \quad (1)$$

Null hypothesis:

$H_0 = \varphi = \rho = \delta = 0$ (No cointegration)

$H_0 = \varphi \neq \rho \neq \delta \neq 0$ (Existence of long-run relationship)

INF Inflation rate (Monthly Data)

LOILP Log of World Oil Prices in US $ per Barrel (Monthly Data)

LER Log of Nominal Exchange Rate (Monthly Data)

LONG-RUN PASS-THROUGH OF OIL PRICES ON INFLATION IN PAKISTAN

The short-run pass-through measures the impact of rise in oil prices on inflation at the same time. Whereas, long-run pass-through effect estimates aggregated pass-through by considering previous period oil price changes and inflation.

$$LRPT_{OILP} = \frac{\rho_{t-1}}{1-\varphi_{t-1}} \tag{2}$$

V. EMPIRICAL RESULTS AND DISCUSSIONS

The standard Augmented Dickey-Fuller (ADF) unit root test is applied to check the order of integration of selected variables (Dickey and Fuller, 1979). Table 1 shows ADF unit root test results, which indicate that out of three variables two are stationary at level, *i.e.* INF, ER, while one has unit root, *i.e.* Oilp. As variables are not stationary at same order of integration, *i.e.* I(1), so Johanson Cointegration would not be the valid procedure for analysis. Thus ARDL bound testing approach would be appropriate technique for econometric analysis.

TABLE 1

Unit Root Estimation

Variables	Level		1st Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
INF	–4.943319* (0.0000)	–5.099266* (0.0002)	–7.467654* (0.0000)	–7.496760* (0.0000)
LOILP	–1.617780 (0.4714)	–1.886390 (0.6574)	–10.51776* (0.0000)	–10.54170* (0.0000)
LER	–0.212764 (0.9332)	–1.692567 (0.7507)	–5.673454* (0.0000)	–5.680976* (0.0000)

The VAR Lag Order Selection, Akaike information criterion (AIC) explains that 2 lags are feasible for this model (for details *see* Annexure I).

Table 2 shows the results of bound test for co-integration analysis. The computed F-statistic of 14.94 is greater than the upper bound at 1 percent level, so we can safely conclude that there is evidence of a long-run relationship among the variables under consideration.

TABLE 2

Bounds Test for Cointegration Analysis[1]

Critical value	Lower Bound Value	Upper Bound Value
1%	5.15	6.36
5%	3.79	4.85
10%	3.17	4.14

The estimated long-run equation is given below:

$$(INF)_t = 2.664482^* + 1.88^* (LOILP)_t - 1.35^* (LER)_t \quad [1](3)$$

Equation (3) reveals that the coefficients of the long-run relationship between INF, OILP and ER appear to be significant. Furthermore, it indicates that LOILP has positive relationship with inflation rate and LER has negative relationship with inflation rate in Pakistan as per expectations. These findings are consistent with the study of Chou and Tseng (2011). The long-run relationship between variables indicates that an increase in world oil prices by one percent may lead to an increase in inflation by 1.88 percent. Furthermore, if domestic currency appreciates by one percent then in response to that inflation will be reduced by 1.35 percent. The results of this study clearly explain that in the long-run international oil prices and exchange rate significantly affect the inflation rate in Pakistan over the sample period.

---

[1]**Note**: Computed F-statistic: 14.86473 (Significant at 0.01 marginal values). Critical values are cited from Pesaran *et al.* (2001), Table CI (*iii*), Case 111: Unrestricted intercept and no trend.

Calculation of multipliers:

long-run multiplier between LOILP and INF= –[(LOILP(–1))/ INF(–1)]

= –[(1.611063) / (–0.857786)] = 1.88

long-run multiplier between LER and INF = –[(LOILP(–1))/ INF(–1)]

= –[(–1.161622) / (–0.857786)] = –1.35

LONG-RUN PASS-THROUGH OF OIL PRICES ON INFLATION IN PAKISTAN

The study explains long-run pass-through of world oil prices to inflation in Pakistan empirically by using monthly data from 2000M01 to 2014M12. Results of the study show strong pass-through of world oil prices to domestic inflation in Pakistan. It has serious implications for the policymakers of small open economies like Pakistan for maintaining price stability. The mass of long-run pass-through largely depends upon food and energy items' share in CPI, exchange rate, world oil prices and world CPI because petroleum payments have largest share in imports bill of Pakistan and CPI includes energy items in its baskets. Thus results of the study are consistent with prevailing economic condition of Pakistan. The pass-through estimates $LRPT_{OILP} = 0.867$ are consistent with the study of Chou and Tseng (2011) for developing economies which investigate oil prices' short-run and long-run pass-through into domestic consumer prices. The results of the study explain that oil prices have significant long-run pass-through effects on inflation in Pakistan and short-run pass-through has not been found significant.

TABLE 3

Granger-Causality Test (Wald Test F-statistic)

Null Hypothesis	F-Statistic	Prob.
OILP does not Granger Cause INF	7.13082*	0.0011
INF does not Granger Cause OILP	0.36723	0.6932
ER does not Granger Cause INF	0.64375	0.5266
INF does not Granger Cause ER	8.11265*	0.0004
ER does not Granger Cause OILP	1.34574	0.2631
OILP does not Granger Cause ER	9.10812*	0.0002

*, *** denote significant at 1% and 10% level. Figures in brackets refer to marginal significance values.

The findings of Granger causality test are presented in Table 3. The estimates explain that there is unidirectional causality that runs from world oil prices to inflation rate. The F-statistics and p-values clearly depict the rejection of null hypothesis. The results show that world oil prices significantly cause inflation in Pakistan. These results are consistent with the

study of Subhani *et al.* (2012). Theoretically, oil prices cause inflation because of direct effect that occurs by the transmission from oil prices to the prices of refined goods that are part of Consumer Price Index (CPI). Energy being a component of household's basket, the indirect effect of producer prices is reflected into the prices of final products including input prices which influence CPI in Pakistan. The results presented in Table 4 explain unidirectional causality which runs from inflation to exchange rate and from world oil prices to exchange rate in Pakistan.

VI. CONCLUSION

The empirical analysis of the relationship between oil prices and domestic inflation has received a lot attention of the researchers and policymakers. The results of most of the studies in developing and developed countries conducted in different time periods have revealed that oil prices exert adverse impact on the development process. Being an oil importing country, Pakistan has been spending a considerable amount of foreign exchange on oil imports which is a significant part of total imports and ratio of oil imports to total imports has been increasing over time. Furthermore, Pakistan has experienced double digit inflation during the last decade and the measures taken by the government to reduce the intensity of inflation failed to achieve the objectives. This brings up the need to have a fresh look into the impact of energy prices on domestic inflation in Pakistan economy using appropriate estimation technique.

The present study is an attempt to investigate the impact of global oil prices on domestic inflation in Pakistan using monthly data for the period January 2000 to December 2014. The standard Augmented Dickey-Fuller (ADF) unit root test has been applied to check the order of integration of selected variables. The results of ADF test provide justification of using ARDL approach for finding the long-run relationship between the variables under consideration. Granger causality test is applied to investigate the direction of causality between the variables. From the above analysis it can be concluded that in long-run international oil prices and exchange rate significantly affect inflation rate in Pakistan. The oil prices have positive relationship with inflation and Exchange rate has negative relationship with inflation rate in Pakistan. Furthermore, the findings of Granger causality test reveal that Oil Prices Granger cause inflation, Inflation Granger causes Exchange Rate, and Oil Prices Granger Cause Exchange Rate. Keeping in view the above empirical analysis it is suggested that government should formulate policies which help in establishing relative consistency in oil

prices and domestic prices and try to reduce the adverse effects of severe fluctuations of world oil prices on Pakistan economy. Furthermore, these policies should be helpful in reducing the impact of the pass-through of oil prices on domestic prices.

The major limitation of this study is that it includes only one control variable along with the inflation and oil prices. The inclusion of more control variables in the model may be helpful in obtaining the true picture of the analysis. The analysis based on the above suggested model may help the policymakers to formulate and implement policies which may reduce the intensity of oil shocks on the smooth functioning of the economy.

REFERENCES

Bårdsen, G. (1989), Estimation of long-run coefficients in error correction models. *Oxford Bulletin of Economics and Statistics*, Volume 51(3), pp. 345-350. http://dx.doi.org/10.1111/j.1468-0084.1989.mp51003008.x

Bhagwati, J. N. (1988), Export-promoting trade strategy: Issues and evidence. *The World Bank Research Observer*, Volume 3(1), pp. 27-57. http://dx.doi.org/10.1093/wbro/3.1.27

Brown, S. P. A. and M. K. Yücel (2002), Energy prices and aggregate economic activity: An interpretative survey. *The Quarterly Review of Economics and Finance*, Volume 42(2), pp. 193-208. http://dx.doi.org/10.1016/S1062-9769(02)00138-2

Burbidge, J. and A. Harrison (1984), Testing for the effects of oil-price rise using vector autoregression. *International Economic Review*, Volume 25(2), pp. 459-484. http://dx.doi.org/10.2307/2526209

Chou, K. W. and Y. H. Tseng (2011), Pass-through of oil prices to CPI inflation in Taiwan. *International Research Journal of Finance and Economics*, Issue 69, pp. 73-83.

Dickey, D. A. and W. A. Fuller (1979), Distribution of estimators for autoregressive time series with unit root. *Journal of the American Statistical Association*, Volume 74(366a), pp. 427-431. http://dx.doi.org/10.1080/01621459.1979.10482531

Gisser, M. and T. H. Goodwin (1986), Crude oil and macro economy: Tests of some popular notions: Note. *Journal of Money, Credit and Banking*, Volume 18(1), pp. 95-103. http://dx.doi.org/10.2307/1992323

Government of Pakistan, *Pakistan Economic Survey* (2010-2011). Finance Division, Economic Advisor's Wing, Islamabad, Pakistan.

Greenwood, J. and B. D. Smith (1997), Financial markets in development, and the development of financial markets. *Journal of Economic Dynamics and Control*, Volume 21(1), pp. 145-181. http://dx.doi.org/10.1016/0165-1889(95)00928-0

Hickman, B. G., H. G. Huntington and J. L. Sweeney (eds.) (1987), *Macroeconomic Impacts of Energy Shocks*. North Holland, Amsterdam.

Hooker, M. A. (2002), Are oil shocks inflationary? Asymmetric and nonlinear specifications versus changes in regime. *Journal of Money, Credit and Banking*, Volume 34(2), pp. 540-561. http://www.jstor.org/stable/3270701

IFS (2008), *International Financial Statistics* 2008, International Monetary Fund, Washington.

Jaffri, Atif Ali, R. Asjed and S. Bashir (2013), Passthrough of global inflation to domestic inflation: An empirical evidence for Pakistan. *Journal of Managerial Sciences*, Volume 7, No. 1, pp. 105-111.

Jones, C. M. and G. Kaul (1996), Oil and the stock markets. *The Journal of Finance*, Volume 51(2), pp. 463-491. http://dx.doi.org/10.1111/j.1540-6261.1996.tb02691.x

L'Oeillet, G. and J. Licheron (2008), Oil prices and inflation in the euro area: A nonlinear and unstable relationship. No. halshs-00323614.

LeBlanc, M. and M. D. Chinn (2004), Do high oil prices presage inflation? The Evidence from G-5 countries. Social Sciences Research Network. http://dx.doi.org/10.2139/ssrn.509262

Mandal, K., I. Bhattacharyya and B. B. Bhoi (2012), Is the oil price pass-through in India any different? *Journal of Policy Modeling*, Volume 34(6), pp. 832-848. http://dx.doi.org/10.1016/j.jpolmod.2012.06.001

Pesaran, M. Hashem, Yongcheol Shin and Richard J. Smith (2001), Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, Volume 16(3), pp. 289-326. http://dx.doi.org/10.1002/jae.616

Pierce, J. L. and J. J. Enzler (1974), The effects of external inflationary shocks. *Brookings Papers on Economic Activity*, Volume 1, pp. 13-61.

Rasche, R. H. and J. A. Tatom (1977), The effects of the new energy regime on economic capacity, production, and prices. *Federal Reserve Bank of St. Louis Review*, May 1977, pp. 2-12.

Shioji, E. and T. Uchino (2010), Pass-through of oil prices to Japanese domestic prices. National Bureau of Economic Research *Working Paper* # W15888. http://dx.doi.org/10.3386/w15888

Subhani, M. I., S. A. Hasan, A. Osman and T. Rafiq (2012), An investigation of Granger causality between tax revenues and government expenditures. *European Journal of Scientifics Research*, Volume 68(3), pp. 340-344.

Tang, W., L. Wu and Z. X. Zhang (2009), Oil price shocks and their short- and long- term effects on the Chinese economy. *East West Center Working Paper* No. 102. http://dx.doi.org/10.2139/ssrn.1396943

Tufail, S. and S. Batool (2013), An analysis of the relationship between inflation and gold prices: Evidence from Pakistan. *The Lahore Journal of Economics*, Volume 18(2), pp. 1-35.

World Bank (1989), *World Development Report* 1989. Oxford University Press, New York.

World Bank (2009), *World Development Indicators* (WDI). Washington, DC. http://www.worldbank.org/data/wdi2009.

ANNEXURE I

1. VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: D(INF)
Exogenous variables: C INF(–1) OILP(–1) ER(–1)
Date: 04/25/15 Time: 07:24
Sample: 2000M01 2014M11
Included observations: 159

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–186.0485	NA	0.639340	2.390547	2.467752*	2.421899
1	–186.0204	0.054434	0.647210	2.402772	2.499279	2.441962
2	–180.9854	9.689911	0.615191*	2.352018*	2.467826	2.399046*
3	–180.7071	0.532101	0.620814	2.361096	2.496205	2.415962
4	–180.6585	0.092425	0.628305	2.373062	2.527473	2.435767
5	–180.4084	0.471768	0.634283	2.382496	2.556208	2.453038
6	–180.4029	0.010360	0.642296	2.395005	2.588018	2.473386
7	–180.2983	0.194658	0.649607	2.406268	2.618583	2.492487
8	–179.7615	0.992578	0.653446	2.412095	2.643710	2.506151
9	–179.7215	0.073449	0.661437	2.424170	2.675087	2.526065
10	–179.3933	0.598664	0.667110	2.432620	2.702838	2.542353
11	–175.0847	7.804351*	0.639984	2.391002	2.680521	2.508573
12	–174.8582	0.407365	0.646319	2.400732	2.709552	2.526141
13	–174.4843	0.667795	0.651519	2.408608	2.736730	2.541855
14	–174.3760	0.192054	0.658969	2.419824	2.767247	2.560909
15	–173.1878	2.092413	0.657525	2.417457	2.784181	2.566380
16	–172.1254	1.857531	0.657135	2.416672	2.802698	2.573433
17	–171.7166	0.709708	0.662181	2.424108	2.829435	2.588707
18	–171.6356	0.139468	0.670037	2.435669	2.860297	2.608106

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

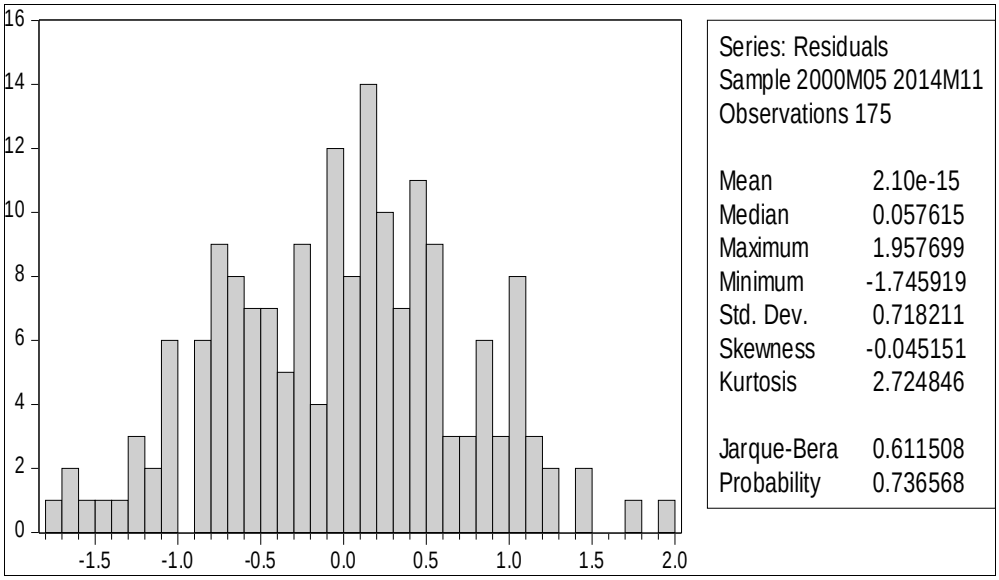
AIC: Akaike information criterion

SC: Schwarz information criterion

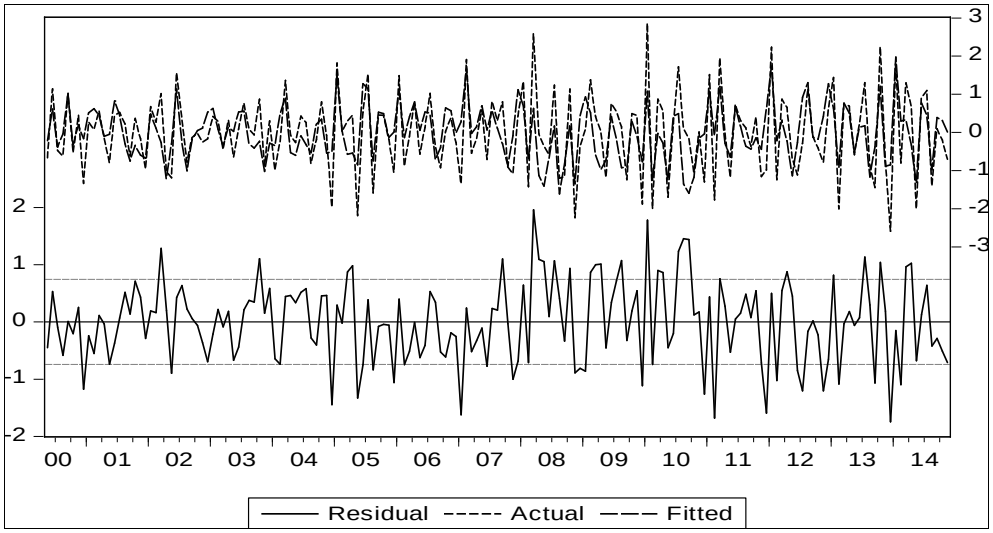
HQ: Hannan-Quinn information criterion

2. Test for Serial Correlation

Test for Normality



3. Residuals, Actual and Fitted



4. F-statistics Obtained for Bound Testing

Wald Test: Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	14.94350	(3, 163)	0.0000
Chi-square	44.83049	3	0.0000
Null Hypothesis: C (2) = 0, C (3) = 0, C (4) = 0 Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C (2)		–0.857786	0.133442
C (3)		1.611063	0.377838
C (4)		–1.161622	0.390104

Restrictions are linear in coefficients.

5. Pairwise Granger Causality Tests

Pairwise Granger Causality Tests Date: 04/25/15 Time: 07:43 Sample: 2000M01 2014M11 Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
OILP does not Granger Cause INF	176	7.13082	0.0011
INF does not Granger Cause OILP		0.36723	0.6932
ER does not Granger Cause INF	176	0.64375	0.5266
INF does not Granger Cause ER		8.11265	0.0004
ER does not Granger Cause OILP	177	1.34574	0.2631
OILP does not Granger Cause ER		9.10812	0.0002