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Oil Price and Real GDP Growth in Pakistan

Bushra Sultan and Muhammad Waqas

University of Lahore, Sargodha Campus, Pakistan

Abstract: The objective of this study is to analyze the relationship between oil price and real GDP growth of Pakistan from 1980-2012. All the variables are found to be stationary at first difference. Therefore Johnson Co-integration and error correction method is utilized to check long-run and short-run relationship among variables. There exists both long-run and short-run relationship. The results show the oil price influence agriculture GDP negatively in Pakistan.

Key words: Oil Price · Trade Balance · Inflation

INTRODUCTION

Pakistan is semi-industrial economy which is mainly in chemical, textile, agriculture, food processing etc. Rise in oil price has different impacts on net importer and exporter of oil (both including crude and products). Pakistan has imported oil from Middle East and export from Saudi

Arab (Noreen *et al*, 2007) our economy totally depends on oil import to run its economic mechanism. There is an important effect of oil shock on growth economies due to limited purchasing power by oil importers.On the other hand oil price shock slows the trade and export [1,3].

Ghalayini (2011) [1] tell the volatile oil price and its shocks has influence the economic performance through number of channels. Price of oil transfer financial reserves of oil importing and exporting countries through trade June 2006 oil reserves in Pakistan around 300 million. Located reserves in Southern half of the country and 3 biggest oil producing fields are in southern Indus. [2] the oil price and real GDP growth. How they affect our economy. It is one of the important primary indicators to measure the condition of our country or our economy. All goods and services are produced in country in a given period. It is normally measured in annual basis. The price of oil is high and has a large impact on macroeconomic variable like output, inflation or unemployment.

In this research rise in oil price preceded 10 out of 11 last recessions and price of oil is main indicator. In our discussion price shocks of oil has continuous effect in policy because the cause of oil price shocks are not included in many models. Pakistan is the 27th largest in the world in term of (PPP) purchasing power party or 44 largest in term of GDP. Pakistan has a population over 190 million (the world's 6thlargest) GDP per capita is low. (Ginn,2004) [3].

In 1980s our country has not experienced many new oil fields. As a result production of oil remains flat, at 60,000 barrels per day. So Pakistan has no prospect to reach self-sufficiency in oil government in hence private firms to develop domestic production. Production of oil is changed minus to oil consumption. Negative value means the production of oil is zero and depend on oil import and positive number tells that country is net exporter. In oil sector there are seven refiners working in our country as on 01.07.2006 total capacity of refining per day 284660 barrels or 12.88 million ton per annum (MPNR 2005-2006). There are nine oil marketing companies (OMC) operating in country like Pakistan state oil (PSO) owned company is the market oil leader in Pakistan having black oil 78 percent white oil market share 57%. It imports storage, distribution and various market petroleum products including HSD, mogas, jet fuel, fuel Oil, LDO, SKO, LPG, petro-chemical and CNG, PSO are importers of products and has good infrastructure for this purpose [4].

Corresponding Author: Bushra Sultan, University of Lahore, Sargodha Campus, Pakistan.

Crude oil Reserve as on June (Source Pakistan Energy 2006)

	Original Recoverable Reserve		Cumulative Production		Balance Recoverable Reserve	
	Million barrels	Million Toe	Million barrels	Million Toe	Million barrels	Million Toe
2006	883.471	118.52	558.998	74.99	324.473	43.53

Bacon (2006) [4] study tells when there is an increase in oil price the productivity of industry will decrease due to higher cost of manufacture and inflation is raised. There is another factor which help to raise the demand of oil in developing countries level of reserves are limited and for reconstruction the supply phase is uncertain. Oil Price rise in 2003 with April 2006 prices are double till January 2004. Demand or supply and some other factors all those lead to slowly rise in prices.

Malik (2008) [4] World demand for oil growth at rate of 1.3% from 1990s to 2003.There is inflationary pressure on economy due to rise in oil price which causes problems like balance of payment, budget deficit increases which down economic growth. World demand will rise 1.3% per year by 2030. In developed countries demand will rise 70 percent.The last three four years the GDP growth of our country is rising 8.4%.In 2004-2005, 6.65 in 2005-2006 and now in 2006-2007 our growth rate is reaching 7 %. Per capita of our country is estimating 14 million but when economic growth is low then poverty is decrease in our country. We viewed 2008 to 2010 poverty rise from 22.3 percent to 37 percent. Day by day oil prices are going to be high and our economy growth trends are high. Theoretically rise in oil price income or demand both are squeeze. [2] Price increases rapidly on the other side aggregate supply becomes down and cost of input are high. Profit is low than investment spending is on decline and in expanded period output is fall. Investment play important role in economic development. This investment came from aid and tax collection. [3]The growth of Pakistan's GDP increased from 2004 to 2005 at level of 8 percent. Mean while the increasing effect did not remain the same in 2006 to 2007 GDP decreased from 6.5 percent. The objective of the study is to investigate the relationship between oil price and real GDP growth of Pakistan for the period of 1980 to 2012.

Literature Review: Ginn (2004) [3] discusses higher oil price recessions 10 out of last 11. There is an effect on oil price shock on macroeconomic that concerns with policymakers. The evidence that effects may be declining but now in additional evidence tells that it is not the matter of oil price shock but it is underlying cause. Primary cause in 1970s is a global demand for oil shock this research paper tell the macroeconomic effect of a global demand for oil shock are greater than oil price shock. He estimates four variable VAR shock by using quarterly date from 1974 to 2011and structural VAR using long -run restrictions. In this paper he compares the effect of natural rate of unemployment, oil related, aggregate supply and aggregate demand shock on unemployment rate, economic output or inflation rate in U.S.

Ahmad (2013) [5] this study examine that the developing countries like Pakistan which dependents on the oil as input in every field or every industrial sector, when oil value increases, cost of input also increase, production cost increases and unemployment rate rises. The existing literature and current study he focused on develop country Pakistan. The relationship between oil price and unemployment he used monthly data in current study from period 1991:01-2010:12 and used 238 observations for each variable andToda-Yamamoto test. The current result tells the effect of oil price on unemployment but there is no significant association unemployment and real interest rate. This study is based on the efficiency wage model. In Pakistan change in interest rate due to increase in oil prices. We can conclude from the result that oil prices should be used in long-run for forecasting real interest rate and unemployment Khan (2013) [6]

Atukeren (2008) [7] study tells the high level of oil prices in which era between 2003 is to mid-2008 on economy of Swiss. Medium of disequilibrium macroeconomic model is used. In this study we focus on effect of oil price on real GDP growth but also focus on the effect of demand-side price, labor market and output. Monetary policy also helps the negative effect of oil price shocks. Our result indicates that prices of oil will high still non-negligible negative impact on economic activities rather than the observed average real growth rate of economy.

Shahbaz *et al* (2013)[8] study view the link between exchange rate and oil price in Pakistan and using continuous wavelet like wavelet power, cross-wavelet power. The cross-wavelet analysis tells the covariance of price of oil and exchange rate and gives the result of these variables. Squared wavelet discloses both variables that are out of phase and real exchange rate was leading

during the entire study period corresponding to the 10 -15 months scale. This study of present results are unique that would have not been drawn if any of will be utilized in any other time series. In most of the study period exchange rate was leading and passing effect on oil price shocks which is the main contribution of this study.

Larijani *et al* (2013) [9] examines the asymmetric effects of oil price shock on Iran economy growth as an exporting of oil country during 1980 -2010 using the Johansen co integration test. In economic growth the short-run result indicates the oil shocks. Negative shocks are much greater than positive shocks. In short we say that the relationship between two variables is asymmetric. It means that response of production growth is stronger to the negative shocks than to the positive shocks. On economic growth the effect of oil revenue in long-run is opposite sign but in short-run both negative and positive. This study has some policy implications for decision makers for the planning of macroeconomic. This study also tells the saving funds and stabilization of real sector to minimize the effect of oil busts and booms.

Campolmi (2008) [10] this study view that real oil price is increased by 103%.The rise in these prices of oil shocks are compared with past years 1973. On the other side real GDP growth, CPI (Consumer Price Inflation), real wage and wage inflation in U.S in 1970s are different from the exhibited 2000s this show the great difference. [7] Oil is used in production in two-country framework there are 2 kinds of shocks which are as (a) reduction in oil supply (b) persistence increase in foreign productivity. Rise in oil price has some effects inflation increases and reduction in GDP. This paper tell the two approaches first show the difference of change in oil price in 1970s and current one, second show the some alternative technique with respect to taken current literature.

Malik (2007) [4] study viewed that high price of oil in Pakistan. Pakistan totally depends on fuel which is imported from other countries. In international market oil price is raising the negative effect on balance of payment or budget of a country and inflation pressure on economy. Oil is important source of energy in long run development. Global oil prices have been rising steadily since 2003to 2006 prices are doubled in 2004.Speculative factors are demandand supply and there is interrelation that leads to raise oil cost about 28% of total commercial energy is imported in Pakistan. Continuous rise in oil prices in our country has negative impact on foreign reserves. Shah (2013) [11] study tells the macroeconomic fluctuation which has dynamic effect of oil shocks on aggregate supply and demand in four economies: like Pakistan, Malaysia, Thailand or Indonesia. In small economies our aim to find of oil price shocks which plays important role in output and price fluctuation after 1990s. Oil price shock tell the positive effect of an output in one import country (Malaysia)and two oil importing countries (Pakistan or Thailand). The main shocks are aggregate demand and supply which are the main source of domestic price and fluctuation in output.

Gronwald (2006) [12] the relationship between real GDP growth and oil price shocks some VAR model are used. There are some keys which he use (1) The observed impact of oil price shocks can essentially be explained by a small number of large price increase (2) Relationship has been changed over time with strong evidence of structure break in 1986 (3) new oil price in theoretical and empirical terms are allowed a non-arbitrary data and difference between large or movement of normal oil price. In addition to general procedure in the literature discussion and use non-linear methods in this paper valid by specification of manifoldand diagnostic test.

Blanchard (2007) [10,11] the macroeconomic performance and set of industrialization economics after oil price shocks in 1970s to last years and focused on different oil prices. When rare rise in oil price there are four different hypotheses which effect inflation and economic activity (1) small share of oil in production (2) monetary policy improve (3) labor market are more flexible (4) lack of concurrent adverse shocks. These all play important role in our economy. To identify the effect of oil price shocks using structural VAR technique. When oil price rises one of the main cause recessions occur.

Malik (2008) [4, 7] study examine the impact of crude oil price and other variables on output using the IS, monetary policy and augmented Philips curve for Pakistan. Output and oil price has strong relationship when oil price increases then economy may effect. GDP is on the path of sustainable and long term growth. Sustainable growth is possible when there is growth in real sectors like in manufacturing. Demand side focused on the investment side. When investment rise it indicates strong investor confidence in our economy then infrastructure, productivity and production capacities are improve. This helps in sustaining process of economic growth. Therefore investment expenditure is the major contributor of GDP.

Variables and Data Sources: The study use time series data of Pakistan from the period of 1980 to 2012 collected from Index Mundi, State bank of Pakistan and Economic survey of Pakistan. Oil price, Gross domestic product, trade balance and consumer price index are the variables used in this analysis.

MATERIALS AND METHODS

It is necessary to check the long-run and short-run among the variables in time series model before estimation. In literature there are lots of uni-variate and multivariate techniques to check the co integration between the variables. We have to detect order of integration before applying any co integration technique. Time-series data is non-stationary and in order to get spurious regression result. Researchers use different unit root test.

Unit Root Test:

Augmented Dickey Fuller (ADF) Unit Root Test: [13] Dicky and Fuller unit root test suggests a new unit test to check ADF. To remove the autocorrelation these tests include lagged terms of dependent variable as a one of the independent variable. Time-series data have a trend and ADF test gives following three potential.

$$\Delta Y_t = \varphi Y_{t-1} + \sum \pi_i \Delta Y_{t-1} + e_t (\text{Intercept}) \quad \text{(i)}$$

$$\Delta Y_t = \alpha_o + \varphi Y_{t-1} + \sum \pi_i \Delta Y_{t-1} + e_t \quad \text{(With trend) (ii)}$$

$$\Delta Y_t = \alpha_o + \varphi Y_{t-1} + a_2 t + \sum \pi_i \Delta Y_{t-i} + e_t$$

(With trend and Intercept) (iii)

Equation (i) shows that the model has no trend and no intercept in data equation (ii) Exhibits the model with intercept only equation (iii) states that the model with both trend and intercept. Deterministic element α_o and $\alpha_2 t$ differentiate the above. Three equations form each other. While using ADF test there are two main things which a researcher should follow. Denote the lagged first difference terms. If we select zero lagged then this will be DF test. ADF test is also used to remove serial correlation between residual, sufficient lagged are included. When we select different possibilities of ADF which we discuss above, their critical value is changed. McKinnon (1991) table of critical value is used to check the acceptance or rejection of null hypothesis.

Johansen Co-Integration Approach: After the previous work of Granger (1981) about co integration, many studies elaborated this concept. Johansen (1988) introduces an approach to check co-integration more than two series. All the drawbacks are removed which Engle-Granger approach has. In Johansen approach ECM is also extended into (VECM) Vector Error Correction Model. Suppose that there are three endogenous variables A, B and C. This can be written as in matrix form;

$$Z_t = [A_t, B_t, C_t] \quad \text{(vii)}$$

$$Z_t = \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + ... + \beta_k Z_{t-k} + \mu_t \quad \text{(viii)}$$

In the context of VECM we can write as

$$\Delta Z_t = \delta_1 \Delta Z_{t-1} + \delta_2 \Delta Z_{t-2} + ... + \delta_{k-1} \Delta Z_{t-k-1} + \omega Z_{t-1} + \mu_t \quad \text{(ix)}$$

Where as

$$\delta_i = (1 - \beta_1 - \beta_2 - ..... - \beta_k)(i = 1, 2, ..., k-1) \quad \text{(x)}$$

$$\omega = -(1 - \beta_1 - \beta_2 - ..... - \beta_k) \quad \text{(xi)}$$

ω Shows the 3×3 matrix, which depicts the true long run relationship between $Z_t = [A_t, B_t, C_t]$ the $\omega = \sigma\chi'$, in which σ shows the speed of adjustment towards equilibrium and long run coefficients matrix is θ'. In single equation case $\theta' Vt$-1 is error correction term. To find out for multivariate case now assumes $k = 2$. So the model is

$$\begin{bmatrix} \Delta A_t \\ \Delta B_t \\ \Delta C_t \end{bmatrix} = \delta_1 \begin{bmatrix} \Delta A_{t-1} \\ \Delta B_{t-1} \\ \Delta C_{t-1} \end{bmatrix} + \omega \begin{bmatrix} \Delta A_{t-1} \\ \Delta B_{t-1} \\ \Delta C_{t-1} \end{bmatrix} + e_t \quad \text{(xii)}$$

Or we can say that

$$\begin{bmatrix} \Delta A_t \\ \Delta B_t \\ \Delta C_t \end{bmatrix} = \delta_1 \begin{bmatrix} \Delta A_{t-1} \\ \Delta B_{t-1} \\ \Delta C_{t-1} \end{bmatrix} + \begin{bmatrix} \sigma_{11}\sigma_{12} \\ \sigma_{21}\sigma_{22} \\ \sigma_{31}\sigma_{32} \end{bmatrix} \begin{bmatrix} \theta_{11}\theta_{21}\theta_{31} \\ \theta_{12}\theta_{22}\theta_{32} \end{bmatrix} \begin{bmatrix} A_{t-1} \\ B_{t-1} \\ C_{t-1} \end{bmatrix} + e_t \quad \text{(xiii)}$$

For simplicity just analyze the first equation's error correction part. The first row of P matrix is;

$$\omega_1 Z_{t-1} = ([\sigma_{11}\theta_{11} + \sigma_{12}\theta_{12}] \\ [\sigma_{11}\theta_{21} + \sigma_{12}\theta_{22}][\sigma_{11}\theta_{31} + \sigma_{12}\theta_{32}]) \begin{bmatrix} A_{t-1} \\ B_{t-1} \\ C_{t-1} \end{bmatrix} + e_t \quad \text{(xiv)}$$

This can also be written as;

$$\omega_1 Z_{t-1} = \sigma_{11}(\theta_{11}A_{t-1} + \theta_{21}B_{t-1} + \theta_{31}C_{t-1}) + \sigma_{12}(\theta_{12}A_{t-1} + \theta_{22}B_{t-1} + \theta_{32}C_{t-1}) \quad \text{(xv)}$$

Equation clearly expresses the two co-integrating vectors and the terms of their speed of adjustment σ_{11} and σ_{12}.

Regarding the rank of matrix, there are three cases which are as follow;

- The variables in Zt are I (0), if ω has a full rank.
- There are no co-integrating relationships, when the ω is zero.
- There are $r = (n - 1)$ co-integrating relationships, when ω has a reduced rank.

To check the goodness of fit, diagnostic test like Serial correlation, functional form, normality and heteroskedasticity tests and stability test like Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUM sq) are performed.[1]

RESULTS AND DISCUSSIONS

Johansen Maximum Likelihood Test for Co-Integration: By using Pantula Principal the model with unrestricted intercept and no trend is selected among the five co-integration models both Eigen value and Trace statistic reject the Null hypothesis of no co-integration because the value of trace test is 47.85 greater then 5% and 1% critical values. Result reveals that there is one co-integrating vector, based on the Eigen values and trace statistics.

ECM Regression Results: After investigating the long run relationship among variables, it is important to investigate the short run dynamics. Error correction term shows the speed of convergence towards equilibrium.

Table 1:

	Intercept			Trend and intercept		
Variables	Level	1st Difference	Conclusion	Level	1st Difference	Conclusion
LOP	-1.3186	-4.3611	I(1)	-1.71936	-5.71974	I(1)
CPI	-3.1051**		I(0)	-3.1747	-7.7622	I(1)
LTB	-1.2348*	-7.5851*	I(1)	-2.0496*	-7.4890*	I(1)
LGDP	-1.7760*	-3.7447*	I(1)	-2.0589*	-3.7763**	I(1)

Result of ADF unit root test

*=1 % level of significance,**5 % level of significance,***10 % level of significance critical value 1919.the results of ADF test show that all variables are stationary at first level excluding the variable CPI,which is stationary at level I(0).

Table 2:

Hypothesis	Trace test	5% critical value	Hypothesis	Maximum-Eigen statistic	5% critical values
R=0	53.28788	47.85613	R=0	33.49948	27.58434
R=1	19.78839	29.79707	R=1	10.93925	21.13162
R=2	8.849142	15.49471	R=2	8.646189	14.26460
R=3	0.202954	3.841466	R=3	0.202954	3.841466

Table 3:

Variables	Coefficients	t-values
Constant	-8.56	
ΔOP	-6.61	-1.44353
ΔTB	0.5672	0.19149
ΔCPI	4.55	2.15
ECM	-0.27	
R-Squared	0.479	
Adj. R-squared	0.245	
F-statistic	2.04	
Log-likelihood	-669.7	

Note: ΔGDP is dependent variable.

[1]Methodology taken from Waqas and Awan (2012)

It is significant and negative in sign. The speed of Correction towards equilibrium depends upon the value of error correction term.

CONCLUSION

The objectives of the study is to analyze the effects of oil price on economic growth by using annual data of Pakistan from 1980-2102.The study used variables oil Price, trade balance, Gross Domestic production and Consumer price index is the results of these variables of ADF unit root test are stationary at I(1). Johansen approach of co-integration shows long run regression between the variables. The study shows the oil price influences GDP negatively in Pakistan. They both exist in long-run and short-run.

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