Impact of Oil Price and Shocks on Economic Growth of Pakistan: Multivariate Analysis

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by

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ABSTRACT

Oil is becoming the most prominent indicator of economic growth in Pakistan with increase of its demand. Also oil prices are doing their main contribution to impact the GDP of Pakistan including different shock dummies in data. In this study, Cobb-Douglas production function has used to construct model by introducing total oil consumption and Pakistan's oil price variable to investigate the impact on GDP. ADF (1979), Johansen Maximum Likelihood method of cointegration (1988) and Granger causality test by applying restriction on dynamic model are used to test the order of integration, Long run and short run dynamics and causal relationship between variable using annual data since 1972-2011 in context of Pakistan. Through examining the results the long run and dynamic relationship has detected for all the variables except total and oil price variables for model has no short run impact on GDP. Oil prices impacting real GDP negatively in long run but positively in short run (Rasmussen and Roitman, 2011). There is evidence of causality between Oil consumption (including sectors) and economic growth.

Keywords: Oil Prices, Oil Consumption of Pakistan, Oil Shocks, Economic Growth

Cointegration, Error Correction Model,

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Note: This study is extracted from the M.Phil of Econometrics thesis of Sidra Nazir.

1. INTRODUCTION

Since 2010 oil demand has increased rapidly in all over the world because of world oil price has driving down (Kitasei and Narotzky, 2011). The existing literature has suggested the many possible impacts of oil shocks on the economic growth (Brown and Yucel, 2002). Increase in the oil price cause to increase in the production cost, import bills and price of petroleum products, so the decline in the productivity due to increasing cost of input (oil) cause decline in the consumption level, investment and consequently in economic growth (Loungani, 1986). So oil price shocks limit the oil consumption which can be lead to lessen the economic growth. Consumption of energy plays vital role in enhancing the growth of economy (Hou, 2009). Oil consumption plays crucial role in every sector of economy i.e. transport, power sector and industrial sector (Zaman et al, 2011). There is difference in results of causal relationship related to energy-growth model of developed and developing country like Pakistan. Developed countries show more intensity toward energy consumption (Chontanawat, 2008). Many studies have been done on causality issue of energy and economic growth. But still there is dilemma to conclude the reliable results.

Majority of studies are available related to oil prices, its consumption and its impact on the economic growth for developed countries (Hamilton, 1983, Hooker, 1996). But recently there are lots of studies are available on the context of oil prices, its consumption and its impact on the economic growth Malik (2008), Khan and Qayyum (2007), Akram (2011), Zahid (2008), Kraft and Kraft (1978), Bekhet and Yusop (2009), Chang and Lai (1997), Asafu-Adjaye (2000), Rufael (2004), Lee and Chang (2005), Siddiqui (2004), Chontanawat (2008), Hou (2009), Bhusal (2010), Pradhan (2010). All these studies concluded diverse results regarding energy (oil) consumption and growth. These all studies have not given the satisfactory conclusion that which are specific determinants that impacts the relationship between consumption and growth of the economy. But by examining the all studies mentioned above it can be said that difference of result is due to use of different source of data, time span and econometrics techniques these are different for different countries, so results could be inconsistent.

The country like Pakistan whose major imports comprises on oil and oil products and Pakistan is depending heavily on the oil as input in industrial, transport and electricity sector. As many developing countries generate electricity from cheap sources like water, wind etc, but in Pakistan oil is the major source to produce electricity that is costly input. In Pakistan studies that estimate relationship between use of oil and economic growth specifically are i.e. Qazi and Riaz (2008), Ahmed (2013), Jawad (2013) and Kiani (2011) and Zaman et al (2011). In these studies three stage Granger causality test and ECM approach has been used to test causality

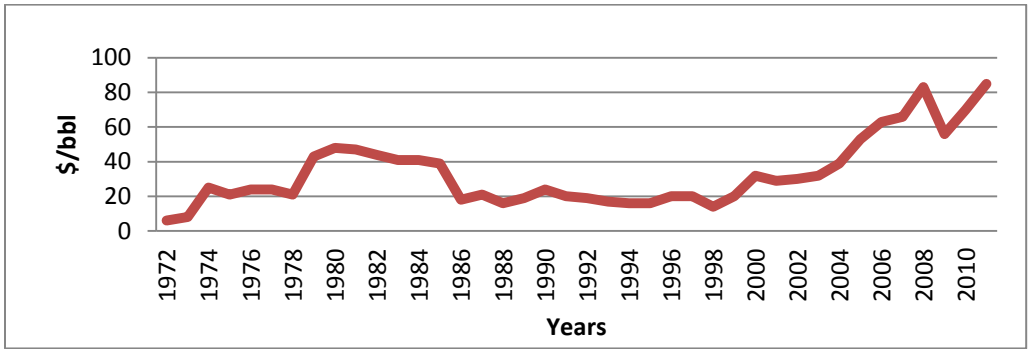
respectively and Johansen cointegration test for cointegration analysis. In these studies oil prices or oil price shock variable has denied, as its very important factor to effect the economic growth. The core objective is to analyze the results of oil prices and oil price shocks on economic growth. We also investigate impact of other shocks on economic growth of Pakistan. The other objective of the study is to investigate the impact of oil consumption on economic growth of Pakistan by using cointegration analysis and dynamic Error Correction Model.

The study is arranged as follows: the section 2 explains the oil sector of Pakistan, section 3 illustrates the methodology which includes sources of data and explanation of Augmented Dickey Fuller test, Johansen cointegration by Maximum Likelihood Method section 4 explains the results and discussion of the analysis. Finally section 5 demonstrates the conclusions of the study.

2. SALIENT FEATURES OF OIL IN PAKISTAN

Pakistan needs a continued long term economic growth of 7 percent to increase its general living standards and meaning full economic development. But it is observed that Pakistan's economy hardly ever grow more then 5 percent since its independence. The economic growth of Pakistan has declined since 2008 and viewed at 2.6 percent. The expected growth in 2012 is around 3 percent which is low then the targeted growth 4.2 percent and meanwhile the continental Asia is expected to grow more then 7.5 percent in that year. Slow macroeconomic fundamentals have been the main factors of low economic growth.

Figure 2.1: World Crude Oil Prices



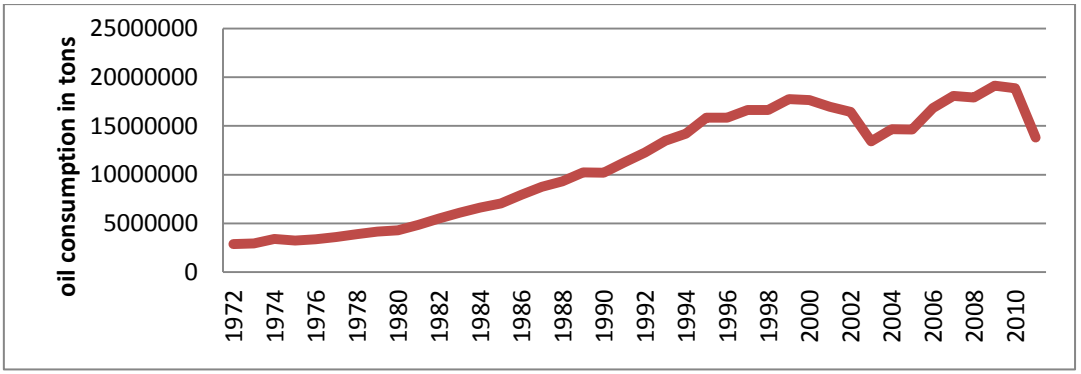
Source: World Bank Data Indicator

The world economy has suffered badly due to oil shocks since 1973 as shown in figure 2.1. There are five main oil shocks in the world which affected the whole universe. Oil shocks can be defined as the oil prices increases enough to effect

recession or slow down the economy. Oil shocks have great impact on the GDP of oil importing country, like Pakistan. Other then these external shocks Pakistan oil prices are also affected by the internal shocks due to different natural and political disasters in the country. Like, in 2004 Pakistan GDP was at high level that was due stable economy, the earth quack of 2005 in northern areas of Pakistan influence the great threat to the whole economy and caused inflation in all sectors. Flood of 2011 also ruined the overall structure of the economy. All these miss happenings causes to increase in the import prices and shortage of recourses because to increase oil prices that is the main input in different sector of economy.

In November 2011 Pakistan's oil consumption has increased 11%. The average crude oil production in 2011-12 is 66032 barrel per day. In 2011-12 there was almost 24.4% growth in the industrial sector of Pakistan and 3.5% growth in transport sector. Despite all energy shortfall Pakistan oil consumption decreases 3% in 2012 to 19.1 million tons against 19.7 million tons in 2011. This is 2nd consecutive year in which oil consumption has decreases. This is because due to decrease in FO sale, which comprises of 45% of total oil consumption of Pakistan. In this year consumption of oil in power generation sector has declines from 7 to 8.4 million tons. It's because of circular debt, cash problems and shortage of electricity and gas supplies increases due to its cheapness.

Figure 2.2: Total Oil Consumption of Pakistan: Tons (1972-2011)

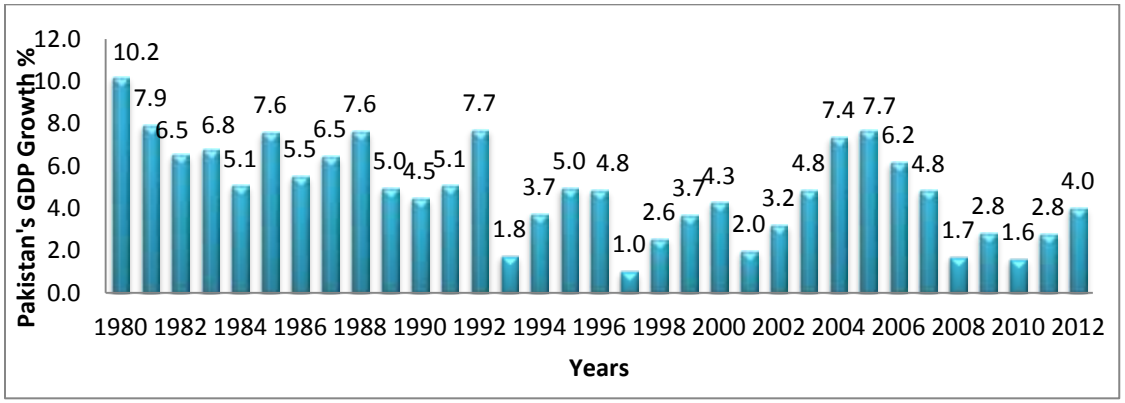


Source: Data taken from Pakistan energy year book by Hydrocarbon Development Institute of Pakistan.

If we examine the transport sector of Pakistan, the sale of petrol increased in 2012 due to CNG curtailment, consumption of petrol increases 14% in 2012 from 12% in 2011, as it was 8% in 2008. If we compare the last year oil consumption with this year, it has decreased due to cut down of NATO supply which causes circular debt to increase. In 2011-2012 total sale of oil is 17.8 million tons as it was 17.9 million tons in 2010-2011. These all trends of oil consumption in Pakistan can be examined through the figure 2.2.

Pakistan petroleum demand is 16 million tons per annum, from which only 18% recovered by local recourses and 82% from imports.

Figure 2.3: GDP Growth Rate of Pakistan



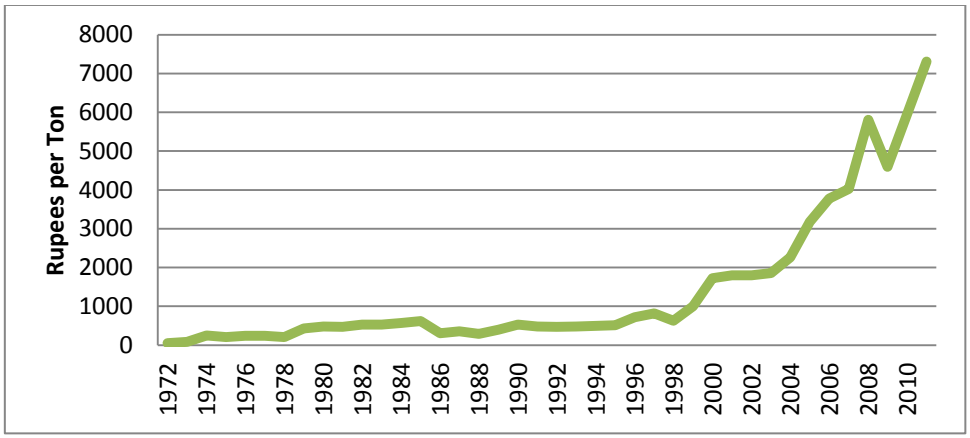
Source: Economic Survey of Pakistan (Various Editions)

The problem of Circular debt is due to not paid bills by Pakistan Electric Power Company (PEPCO) particularly Oil and Gas corporations, Independent Power Producers (IPPs) and Water and Power Development Authority (WAPDA). By examining the figures 2.1 and 2.4, in 1990 to 1995 Pakistan oil prices are equivalent to world oil prices. But by examine the year 2003 the international oil prices increases with respect to Pakistan oil prices. But from 2004 to date Pakistan oil prices shows trend as world oil prices showed. Since 2003 world oil prices shown increasing trend. In 2005 because of increase in petroleum prices GDP growth slows down about 7%. International petroleum requirement has improved at the rate of 1.3 %, so most of Asian countries started production of own resources. Pakistan real GDP grew at higher rate of 8.4 % in 2004-05 as given in figure 2.3, due to energy consumption increase it accelerates the economic growth. In 2007-08 high oil prices in the world market cause the decline in the exports that cause to reach the current account deficit at 8.4% of GDP, which was at 1.8% GDP in 2003-04. Before 2007-08 the GDP has increased due to oil consumption increase with the high oil prices. In 201, the world oil prices have increased up to 47% and Pakistan oil prices showed increase of 28%. In May 2011 the world oil price was recorded 115 US $/bbl as compared to previous year 2010 it was 83 US $/bbl, so world oil prices showed increase of almost 39%. Due to increase in world oil prices cause decrease in the oil consumption of Pakistan because Pakistan's oil prices also goes up to 28% in 2011.

Pakistan GDP growth in 2009 was 1.7% but in last five years GDP growth has increases from 3.1% in 2010 to 3.7% in 2012 and expected to reach at 4.3% in 2013. But in comparison with other south Asian countries Pakistan GDP showing less

growth, it's due to Pakistan economy is very closely related to world, having external exposure and heavy import of oil products. Oil prices increase effects the macroeconomic factors of Pakistan like; investment, consumption, BOP and unemployment. In 2011-12 the oil import bill reached at 11.14$ billion, there is increase of 38% as compared with 4.8$ billion in last year 2010-11. Trade deficit also increases in 2011-12 then previous year due to heavy imports. In economic survey of Pakistan (2011-12) it is claimed that Pakistan's economy showed better growth then other developing economies and GDP remained at its high growth of 3.7% (higher in last three years). But in 2011-12 Pakistan's current account balance is affected due to increase of oil prices as it can be seen in the figure 2.5. Oil prices have also great impact on CPI of Pakistan. That causes the increase in prices of electricity and gas. As we know that Pakistan is oil deficit country and due to increase in import bill, Pakistan has facing increase in circular debt in recent years. Circular debt is because of low refinery utilization, constraint in oil margins, and capability of imports and delay of projects. So there is need to reduce and finally cut down the subsidies to energy sector by government to stop the further increase in circular debt. So, the question is if oil consumption decreased (by 3% in 2011-12), why shouldn't GDP decreased (as it is 3.7 % in 2012, higher in last three years). So how can we say that oil consumption affects helps in boosting the economic growth? There is need to add oil prices factor in our analysis.

Figure 2.4: Real Oil Price of Pakistan



Source: Monthly statistical bulletins of Pakistan.

3. Literature Review

If we examine the ***international studies*** relate to oil consumption, growth and prices it can be seen that literature in context to energy-growth has been initiated with the study of Kraft (1978). It is notice that mostly authors seem interested in finding the

causal relationship between energy consumption and economic growth. Many initial studies have done bivariate analysis in this respect, which could generate biased results due to omission of relevant variables. Afterward more complex studies had examined in which aggregate as well as at disaggregate level studies delivered including oil consumption analysis but only few studies are available, such as; multivariate analysis like Levent and Korap (2007), panel data analysis using Hasio Granger causality test as Change and Lai (1997), maximum likelihood method of cointegration by Johansen (1988) and VECM approach as in Soytas and Sari (2002) were used in recent international papers. But these studies generated different results from each other even for same sample data as Askara and Long (1980), and very few studies has included the important oil shocks factor in their analysis as in Bekhet and Yusop (2009), these results could be different due having different techniques, different sample data, times series properties of the data and different country. So results could be different, although at international level, few studies have used advanced econometric techniques.

If we look up the studies in context of Pakistan, numbers of studies could be found on the issue of energy-growth, in case of Pakistan there are studies at aggregate energy level as well as disaggregate level of energy from these only few studies are available that are specifically on oil consumption and economic growth like Qazi and Riaz (2008), and only one study that is on oil consumption and economic growth including major and minor sectors of oil consumption Zaman et al (2011). If we examine the previous study of Zaman et al (2011), that was first study in Pakistan that had investigated the relationship between oil consumption in sectors of Pakistan and economic growth. In previous study oil price variable and shock dummies were not included that could have significant impact on the economy. Oil consumption variables are positively cointegrated with economic growth in Zaman et al (2011) study. But oil consumption variables (including oil sectors) show unidirectional causal relationship by using pair wise Granger causality test. In this study Johansen cointegration test has used and found all variables cointegrated. But these results could be biased by estimating single the dynamic equation for aggregate as well as aggregate oil consumption due to multicolinieearity. But in our study dynamic model for total oil consumption will be estimated. Also oil shocks factor has ignored that will be added in our study that have important impact to effect consumption and growth of economy.

So finally it is examined that different cointegration and causality relationships are concluded from different papers of total energy and economic growth including oil consumption-economic growth analysis. Most of studies show that energy (including oil consumption) has positive impact on the over all economy.

4. METHODOLOGY

Neo classical production function [Y = f (K, L)] has used for this study, that is presented by Cobb-Douglas (1928), it has been modified by including energy variables for energy-growth model.

Neoclassical economist gave the theory of output (production) function as fellows;

$$Y = f(K, L) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.1)$$

Among economists, Georgescu-Roegen (1975 and 1977) was the pioneer to remark on the lack of energy variable in the model. The Kraft and Kraft (1978) was first to use energy consumption variables in production function to analysis the energy-growth relationship. After that many studies comes in this line, as Khan and Qayyum (2007), Lee (2005) and Zaman (2011) has used in their study. Energy consumption plays very important part on affecting the economy as labor and capital do. In this study oil price of Pakistan has introduced in the model as Bekhet (2009) and Saibu (2011) used in their study. Oil prices significantly impact on GDP, consumption and overall economy. In literature existing studies like Ahmed (2013) has explained various transmission mechanisms for possible impact of oil price shocks on economic growth. First is the classic supply size effect, according to which, increase in oil prices leads to decline in the output level, because oil is considered as the basic input of the production (Beaudreau, 2005). Higher oil prices would result in the higher output costs, results in lowered production rate and declined growth rate. Second, the demand side effect discusses the adverse effect of oil price shocks on investment and consumption. The major input for the industries is capital that comes from the investments of local and foreign investors. When economic activities are at decline, investors withdraws their investments from markets and take money out of the country and invest in higher profitable and growing economies, resulting in further lowering of production and economic activities in the country (Brown and Yucel, 2002). Also Akram (2011) has introduced oil price variable in the production function in his study. So above model is modified as follows:

$$LY_t = f(LK_t, LL_t, LP_t, LOC_t, D_t, \mu_t) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.2)$$

Where;

LY_t = Log of Gross domestic product, real data of GDP taken as the proxy of economic growth.

LK_t = Log of gross fixed capital formation divided by GDP is used as the proxy of the capital stock (K) as many paper has used this proxy for capital stock (K),

LL_t = Log of labor force

LP_t = Log of average oil prices of Pakistan

LOC_t = Log of total oil consumption of Pakistan

D_t = Dummy variable for in cooperating the effect of oil prices shocks to Pakistan's economy.

μ_t = error term, that is normally distributed with zero mean and constant variance (0, σ^2).

It is assume that all variables are non- stationary and have long run relationship between economic growth and its determinant. General model of this study was specified above in equation (4.2). For the next analysis of this study there is needed to construct the vector auto regressive (VAR) model constructed for equation (4.2) given below in equation (4.3):

$$X_t = \sum_{i=1}^{k} \delta X_{t-i} + \gamma D_t + \alpha + \mu_t \quad \text{.....} \qquad (4.3)$$

$$\therefore \ \mu_t \sim N(0, \sigma^2)$$

Where, X_t is vector of variables (i.e. LY, LL, LK, LP, LOC) a 5x1 vector of integrated of order one I(1) taken as endogenous variables, D_t is the vector of exogenous variables, α is constant and μ_t is iid (0, σ^2).

Assuming the variables are non stationary and they have long run relationship among each other, we specify dynamic ECM model as:

$$\Delta X_t = \mu + \gamma t \ + \sum_{i=1}^{p} \Gamma_i \Delta X_{t-i} + \Pi \, ECM_{t-1} + \lambda D_t + v_t \quad \text{.....} (4.4)$$

$$\therefore \ \mu_t \sim N(0, \sigma^2)$$

In equation (4.4), $\Pi = \alpha \, \beta'$ and α is speed of adjustment of matrix and β' is matrix of long run coefficients. ΠX_{t-1} must be integrated of order zero I (0) and negative for having long run cointegration relationship. $\sum_{i=1}^{p} \Gamma_i \Delta X_{t-i}$; this term of model indicates short run part. λ indicates coefficient of shock dummies, γ coefficient of time trend of model μ and v_t are intercept and error term of the model respectively that are normally distributed as zero mean and constant variance.

Through the value of Π it can be shown that with how much speed model is converges toward equilibrium or we can say that error is correcting with speed of the Π. Its value also confirms our long run relationship.

ECM model of total oil consumption of Pakistan is given below; it will be estimated for finding the results of our study:

$$\Delta LY_t = \alpha_0 + trend + \Pi_1 ECM_{t-1} + \sum_{i=1}^{m} \alpha_{1i} \Delta LY_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta LK_{t-i} + \sum_{i=1}^{o} \alpha_{3i} \Delta LL_{t-i} + \sum_{i=1}^{p} \alpha_{4i} \Delta LP_{t-i} + \sum_{i=1}^{q} \alpha_{5i} \Delta LTOC_{t-i} + \eta D_i + \mu_{0t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.5)$$

It is the dynamic model for total oil consumption and growth. Where the expected relationship between variables could be, $\alpha_0 \lesseqgtr 0$, $\alpha_{1i} > 0$, $\alpha_{2i} > 0$, $\alpha_{3i} > 0$, $\alpha_{4i} < 0$, $\alpha_{5i} > 0$, $\Pi_1 < 0$ and $\eta < 0$. μ_{0t} error term of the dynamic model normally distributed as $(0,\sigma^2)$. In above dynamic models; α*'s,* are short run coefficients of variables in each model. Π_1 is coefficients of ECM_{t-1} of model. η is coefficient of shock dummies.

Here is the description of econometric techniques that we will use in this study for our findings, i.e. three step methods.

Step I: Unit root test is important for cointegration analysis. To check the order of integration for variables whether they are stationary I(0) or non-stationary I(1) for analysis of Johansen cointegration as all variables should be non-stationary at same order for example integrated of order one I(1).

Dickey and Fuller (1979, 1981) gives one of the generally used methods known as Augmented Dickey Fuller (ADF) test of identifying the order of integration I(d) of variables whether the time series data are stationary or not. Equation (4.6) is the general form of Augmented Dickey Fuller test that will be used to check the stationary of series.

$$\Delta X_t = \alpha + \beta t + \varphi X_{t-1} + \theta_1 \Delta X_{t-1} + \theta_2 \Delta X_{t-2} \ldots\ldots\ldots \theta_p \Delta X_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots (4.6)$$

Where, X_t denotes the time series variable to be tested, used in model. t is time period, Δ is first difference and φ is root of equation. βt is deterministic time trend of the series and α denotes intercept. The numbers of augmented lags (p) determined by the dropping the last lag until we get significant lag. The Augmented Dickey Fuller unit root concept is illustrated through equation $\Delta X_t = (\rho\text{-}1)\, X_{t-1} + \varepsilon_t$, Where, (ρ-1) can be equal to φ, if ρ =1 so series has the unit root, so root of equation is φ = 0.

Step II: If combination of two non-stationary variables generates linear combination, so they called cointegrated. So Johansen (1988) presented the Maximum Likelihood Method for estimating the more than one cointegration vector. But for this test all variables should have same order of integration I (d) i.e. I (1).

The method of Maximum Likelihood estimation will be used to estimate our long run coefficients and find the order of cointegration using two test statistics Maximum Eigenvalue test and Trace test.

Step III: The dynamic model of total oil consumption of Pakistan has explained above in equation 4.5, will be estimated through ordinary least square (OLS) method.

In Estimating the above model for getting the reliable results our model should be well specified and should fulfill all assumptions i.e. OLS statistical assumptions, otherwise our results could be spurious or misleading. Residual of any model is diagnosed for serial correlation through Breusch Godfrey LM test, to check the hetroscadasticity Breusch Pagan will be applied. For testing the normality of the residual of the model Jarque Bera test will be applied. Cumulative sum (CUSUM) and cumulative sum (CUSUM) of square test (Brown et. al., 1975) will be used to check the stability of the mean and variance stability with in the model respectively. For examine the how well our data is good fitted and independent variable are explained by dependent variable R^2 and adjusted R square value is tested.

For the estimation of above model we need data on variables. Five macroeconomic variables have taken for analysis by studying the previous literature. Annual data has taken for all variables since 1972 to 2011. These are related to Pakistan economy. The data is in real format means inflation factor has excluded from it. Data for GDP, Gross Fixed Capital Formation (K) and Labor force (L) has taken from federal bureau of statistics, total oil consumption (TOC) data taken from hydrocarbon institute of Pakistan (HDIP) ministry of petroleum and Oil prices (P) data taken from the monthly statistical bulletins of Pakistan. This data is converted into annual data by taking averages of monthly data.

5. RESULTS AND DISCUSSION

All data has been transformed into logarithm form. Augmented Dickey Fuller test has applied on the all eight variables. Before applying the ADF test, graphs of series has drawn to examine the pattern of series. By drawing the graphs of series it is noticed that there is trend in the series, so the time trend will be included in the model. Intercept is also included in the model because by examining the figures of series it can be noticed that data doesn't fluctuate around the zero mean. The average of sample is also not zero so that's why intercept will be included. These are only

assumptions to check that these are true or not in other words data is stationary or non-stationary.

First, the equation of ADF (with drift and time trend in the model) has estimated, for all the variables. At first, unit root has tested at level or without differencing the data. For oil prices, transport and power sector oil consumption lags are taken to remove the problem of serial correlation so Dickey Fuller test become Augmented Dickey Fuller test, otherwise it is Dickey Fuller test. The results are present in the Table 5.1. It can be seen from the Table that at level, variables are not stationary. So LY, LL, LP, LTOC and LK, are stationary at first difference. Therefore, all variables are integrated of order one, I (1).

Table 5.1: Unit Root Test of Augmented Dickey Fuller (Annual Data (T=40))

Level				
Variable	**Deterministic**	**Lags**	**ADF tau-stat**	**Outcome**
LY	Intercept	0	-2.48	I(1)
LTOC	Intercept	0	-2.34	I(1)
LK	Intercept	0	-2.05	I(1)
LL	Intercept and trend	0	-1.58	I(1)
LP	Intercept and trend	0	-2.47	I(1)
First Difference				
Variable	**Deterministic**	**Lags**	**ADF tau-stat**	**Outcome**
ΔLY	Intercept	0	-4.40	I(0)
ΔLTOC	Intercept and trend	0	-4.41	I(0)
ΔLK	Intercept	0	-3.99	I(0)
ΔLL	Intercept	0	-6.48	I(0)
ΔLP	Intercept	1	-5.96	I(0)

5.1 Cointegrating Analysis

In first model, for cointegration for estimating the Maximum likelihood estimates of the cointegration for the autoregressive process as explained by Johansen (1988), so the VAR model has estimated with five variables (LY, LP, LTOC, LL and LK) and two exogenous pulse dummies (dummy 1979, dummy 2008). In 1979 there was second big oil shock due to Iranian revolution, due to this oil prices of West Taxas Intermediate increase 250% (Angell, 2005). In 2007-08 whole word suffers the

financial crisis so prices go high all over the world (Hamilton, 2011). Now we identify the numbers of lags to be included in analysis.

Lag length selection criteria such as Log Likelihood (LogL), Likelihood Ratio test statistic (LR), Final Prediction Error (FEP), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan Quinnin formation criterion (HQ) has been used to identify the optimal lag. Results are present in the Table 5.2. As can be seen in the Table 5.2 that LR, FPE and AIC criteria indicate the two lags for estimating the VAR at 5%. So VAR model can be has estimated by using two lags.

Table 5.2: VAR Lag Order Selection for TOC and Growth

Lag	LogL	LR	FPE	AIC	SC	HQ
0	302.5972	NA	1.84E-13	-15.1367	-14.4903	-14.90671
1	534.0998	365.5303	3.61E-18	-26.0053	-24.28148*	-25.39195*
2	565.3655	41.13905*	2.90e-18*	-26.33502*	-23.5339	-25.3384

*indicates significant lag at 5% level.

In the model we include the unrestricted trend and intercept in the model. Both data and cointegration contain trend, as discussed in the Johansen (1991, 1995) and Johansen and Juselius (1990) five different choices of intercept and trend. Cointegrating relationship between the variables has been examined through Maximum Likelihood Method of Johansen (1988). Johansen proposed two test statistics that is, Trace Test and Maximum Eigenvalue test to check order of cointegrating vectors. These results are given in the Table 5.3. According to the Trace test statistics the null hypotheses r = 0 is rejected at 5% against the alternative hypotheses r ≥ 1. Through the Maximum Eigenvalue test statistics the null hypotheses r = 0 is rejected at 5% against the alternative hypotheses r = 1. Both test statistics indicates one cointegrating relationships in the variables.

Table 5.3: Trace and Maximum Eigenvalue Tests of Cointegration for TOC and Growth (VAR order = 02)

Hypothesis		test statistics	Critical values
H_o	H_a		5%
(λ_{trace})			
r=0	r≥1	112.0755*	88.8038
r≤1	r≥2	63.44853	63.8761
r≤2	r≥3	32.61129	42.91525
r≤3	r≥4	17.78000	25.87211
r≤4	r≥5	6.985741	12.51798

(λ_{max})			
r=0	r=1	48.627*	38.33101
r≤1	r=2	30.83724	32.11832
r≤2	r=3	14.83129	25.82321
r≤3	r=4	10.79426	19.38704
r≤4	r=5	6.985741	12.51798

*indicates significant at 5 %.

Now we estimate the cointegrating relationship by using Maximum Likelihood Method. The normalized long run coefficients are given in equation (5.1). (Chi square values are in parentheses.)

$$LY_t = 0.01\ \text{trend} + 0.05\ LL_t - 0.27\ LP_t + 0.13\ LTOC_t + 0.63\ LK_t \quad \ldots\ldots\ldots (5.1)$$

(20.52) (0.03) (17.97) (4.12) (75.16)

Examining the above cointegrating equation (5.1), it is noticed that capital has positive impact on the GDP as expected. But the labor force has not significant impact on the GDP, as labor force is not efficient in the Pakistan and it's not able to influence the GDP significantly. The oil consumption shows positive relationship with GDP, as there is 1% raise in the oil consumption so it can be seen that 0.13% significant enhancement in the GDP. As oil consumption is playing roll in the economic growth. Oil is needed in different sector of economy like transport, industrial etc. So in long run consumption of oil enhance the economic growth by utilizing it in different major sectors. If there would be less oil use so the economic growth could be effected badly in long run. The oil prices variable shows significant negative relationship with GDP in long run as expected. Pakistan's imports mostly comprising on the petroleum or petroleum products. So the oil is the costly input product and impacted the economic growth. So the overall oil prices have negative impact on the GDP of Pakistan about 0.27% examined through the long run equation.

5.2 Short Run Dynamic Results

Once the variables are cointegrated we can move forward to estimate the short run dynamic relationship between variables. For the analysis Error Correction model is estimated in first differenced form for short run estimates and error correction term is added in this model to confirm the long run relationship. Through general to specific approach (David Hendry, 2004) through this the model is misspecification and the over fitting problems can be managed by remove insignificant variables; the parsimonious short run equations (5.2) are given below, estimated at second lag selected on the basis of diagnostics tests given below. (t-statistics given in parenthesis)

$$\Delta LY_t = 0.56 + 0.08\Delta LK_t + 0.13\Delta LK_{t-2} + 0.10\Delta LP_t + 0.13\Delta LP_{t-2} - 0.34\Delta LL_{t-1} +$$
$$(3.94) \quad (2.11) \quad (2.43) \quad (2.87) \quad (3.49) \quad (-2.51)$$

$$0.56\Delta LL_{t-2} - 0.01D_{1979} - 0.04D_{2008} - 0.01D_{2005} - 0.18ECM_{t-1}$$
$$(4.01) \quad (-2.96) \quad (-5.94) \quad (-2.86) \quad (-3.87) \quad \ldots\ldots\ldots\ldots\ldots (5.2)$$

Diagnostic Tests

$R^2 = 0.75$ $\quad \overline{R}^2 = 0.63$

Breusch Godfrey LM test of Autocorrelation $F_{(1,23)} = 1.95$ (0.17)

Jarque Bera test of Normality $\chi^2_{(2)} = 0.52$ (0.76)

Breusch Pagan Godfrey Hetroscadasticity test, $F_{(12,24)} = 1.03$ (0.47)

The dynamic model (5.2) is diagnosed through testing the residual of the model, first by checking the serial correlation by LM test. The value of F statistics is 1.95 so we cannot reject the null hypotheses of no serial correlation. The chi square χ^2 value of Jarque Bera Test is 0.52 tells that residual follow the normal distribution as we cannot reject the null of hypothesis and also the residual have equal spread of variance by examining the F statistics value of hetroscadasticity test that is 1.03. R^2 and adjusted R^2 values shows 75 % and 63% goodness of fit respectively, and it can be said that independent variables are explained by dependent variables by the percentage of 63. For testing the stability of the parameters of dynamic model, CUSUM and CUSUM of squared (Brown, et al 1975) are plotted. Through figures 5.1 and 5.2 it can be noted that calculated lines are within the significance bounds of 5%. So model shows parameters or mean stability by CUSUM and variance stability by CUSUM of square test.

Figure 5.1: CUSUM

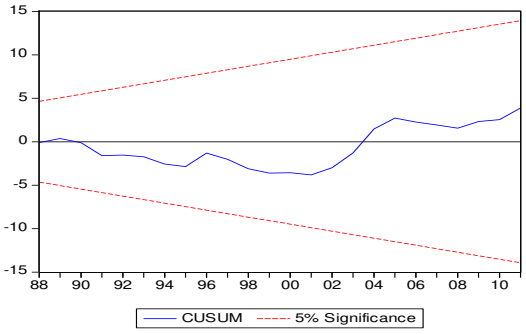
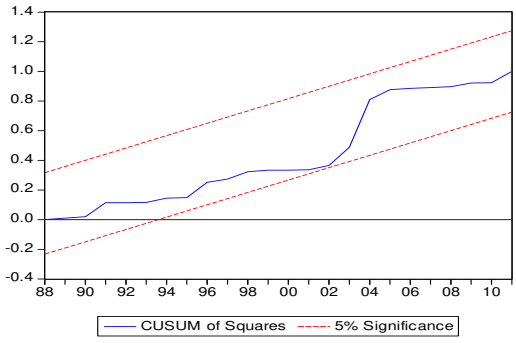


Figure 5.2: CUSUM of Square



Here is the interpretation of dynamic relationship. In equation (5.2) the magnitude of ECM_{t-1} is negative and significant according to theory. As (Π) error correction term comprises of alpha (speed of adjustment) and beta (long run coefficient) as explained in the methodology, so the value of ECM_{t-1} shows that error is correcting with the speed of 0.18% in the one year. The significance of error correction term also approves the long run relationship between variables.

The coefficient of current and lagged variables of capital stock is positively impacting on the economic growth as expected and many previous studies gave same relationship. So increase in the investment in different sector of economy boost up the economic growth in short run. The magnitude of oil prices in current and lagged period shows positive impact on economic growth in short run. According to Rasmussen and Roitman (2011), 125 importing countries including Pakistan shows positive impact of oil prices on the GDP. If there is one percent increase in the change of current and lagged oil price there will be 0.10 and 0.13 percent increase in the economic growth. So increase in the prices some time takes as good time in the economy, as increase in oil prices generally appears to be demand driven Rasmussen and Roitman (2011). Also study of Akram (2011) shows positive significant relation between oil price increase and growth in case of Pakistan. Labor force is impacting the economic growth greater than the other variables in the model. There is negative impact of change in lagged labor force on economic growth as labor force is not so efficient; very few labors are available to impact the economy positively. In 1979 Pakistan economy faces difference ups and downs. Natural as well as political problems have faced by Pakistan economy. The second big oil price shock in 1979 due to Iranian revolution has impacted negatively to Pakistan economy. In 2005 oil prices hikes all over the world due to decline of oil supply from Iraq, as Iraq has major oil reserves also due to the great earth quack in Pakistan negatively impacted on all sectors of economy. In 2007-2008 there was financial crisis globally and rise in oil prices internationally and nationally, causes the bad impact on the economy.

Finally it can be concluded that total oil consumption has positive relationship with GDP and oil price negatively related with GDP in long run, but in short run total oil consumption has no significant impact on growth and oil prices related positively with the growth and the oil shock impacting negatively but have very little influence on the economic growth of Pakistan.

6. CONCLUSIONS

Pakistan is facing oil related problems since many years, specifically oil prices and its increasing demand in every sector of economy. So keeping this point of view in this study impact of oil price and shocks on economic growth has been checked and causal relationship between them. Time series approach has been used in this study to

test the long run and short run dynamics through Johansen approach of cointegration and Granger causality test for detecting the causal relationship and initially ADF test for finding order of integration I (d). Annual data has used since 1972-2011 for analysis. Model of Cobb-Douglas production function has constructed for total oil consumption including oil prices depending on GDP. Shocks dummies are also included in the model as previous studies had not concern about the oil shocks in data. In Pakistan only one or two paper are hardly found related to causal relationship between oil consumption and GDP, in these papers authors has ignored the sectoral use of oil and impact of oil price and shocks specifically Pakistan's oil prices were not taken in any paper for this context, So oil price variable and shock dummies have been added in the analysis. From the analysis finally it can be concluded that oil consumption has positive impact on economy in long run and also shows the long run causal relationship from oil consumption variable to GDP also oil price variable shows negative impact as expected. In short run oil consumption variable shows very little impact on economic growth of Pakistan however, shocks dummies also influencing negatively to the growth in short run but with low percentage. In short run consumption as well oil price variables also show causal relation toward growth. So we can say oil consumption is important to enhance the economic growth of Pakistan specifically in long run scenario but less contribution toward economic growth in short run.

If we examine the previous study of Bedi-uz-Zaman et. al., (2011), that was first study in Pakistan that had investigated the relationship between oil consumption in sectors of Pakistan and economic growth and compare the results of our study it can be seen that by estimating individual dynamic model for each sector give different results up to some context. In previous study oil price variable and shock dummies were not included that have significant impact on the economy. Oil consumption variables are positively cointegrated with economic growth as concluded in previous study. Results of our study are also supports the results of the study of Akram (2011) shows positive significant relationship of increase in oil prices for Pakistan. The results are also consistent with the findings of Khan and Qayyum (2007) that capital and labor variables have greater impact on economic growth then other variables.

Additionally, the policy implications could be for this study are, firstly; investing on the labor and capital, we can get fruitful results as these variables shows greater impact on economic growth of Pakistan both in long run and short run. oil consumption are very important part of any economy that could boost up to growth but need too much planning in prices controlling and developing the safe guards for oil shocks, so that oil consumption could take part in up grating the economy of Pakistan.

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