The impact of Oil Price and Oil Price Fluctuation on Growth Exports and Inflation in Pakistan

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3 November 2013

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Abstract: *In this study we employed the ARDL bound test in order to detect cointegration relation of oil price and oil price fluctuation with GDP, exports and inflation in Pakistan. Our results confirmed cointegration among the variables when GDP was considered as dependent variable, while in case of inflation as responding variable, the long run relation among the variables are confirm only when oil price was replaced with oil price fluctuations as an explanatory variable. Applying VECM technique, we confirmed that causal link is running from oil price and oil price fluctuation to GDP and inflation. We could not detect causality running from oil prices and oil price fluctuation to exports or vice versa. Finally the augmented granger causality verified our findings of causal relation running from oil price and oil price fluctuation to GDP and Inflation both in combination with other variables as well as individually. We found that oil price fluctuation compared to oil prices drastically and asymmetrically affect the macro-economy of Pakistan.*

JEL Classification: Q43, O40

Key Words: Oil Price, Co-integration, Growth, Exports, Inflation, Granger Causality.

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1. Introduction

It is considered that industrialization is the prima facie for overall material development since the first industrial revolution a century ago. Industrialization helped many countries to escape poverty traps and achieve high standard of livings besides paving way for enhancing human creativity. However, industrialization without smooth and steady supply of raw material, trained human capital and access to energy resources, foremost to oil, seems impossible. Thus the path of development (or underdevelopment) depends on access to energy corridors of which oil pre-occupies a dominant position.

Theoretically, the impact of rise in oil price transfer to real economy via increase in cost of production and decrease in disposable income. Increase in cost of production squeeze aggregate supply and push the prices of intermediate goods up that ultimately erodes profits and overall competitiveness of domestic producers while increase in oil prices raises the general level of prices that erodes the purchasing power of the consumers which reduce aggregate demand and thus bring the aggregate output few notches down. However, the impact of oil price on an economy varies and depends on a number of other variables including internal situation, size and status of an economy, domestic production of oil and the level and mix of energy consumption of a country. Similarly, the effect of oil price in short and long run is not the same. In short run oil prices influence the cost of production while in the long run changes in oil price reallocate resources across the board that influence every aspect of an economy i.e. distribution and consumption, cost and price, trade and investment etc. On the contrary, theory assumes that decrease in oil prices bring the cost of production and level of prices down that increase the overall economic activities. But empirical studies rarely confirm the linear impact of increase or decrease in oil prices on macro-economic variables.

Pakistan, an oil importing country, always feels the brunt when the price of oil rises. In Pakistan, oil constitutes 29 percent of total energy mix and almost every walk of life depends directly or indirectly on oil consumption. Pakistan spends almost two times of her remittances and more than 80 percent of her foreign exchange reserves on oil imports every year. Pakistan reliance on oil for energy consumption is predictably going to increase as there is no short run alternate nor long run planning to tackle the issue of sever energy crisis with in the country that have presumably affected not only growth and development prospects but have also adversely influenced social and political threads in Pakistan. Therefore, in this paper we want to measure the impact of international oil price on Pakistan economy. As we mentioned earlier, oil price has widespread impact, but we contain our research only to three main points i.e. the impact and causal link of international oil prices on growth, inflation and exports of Pakistan.

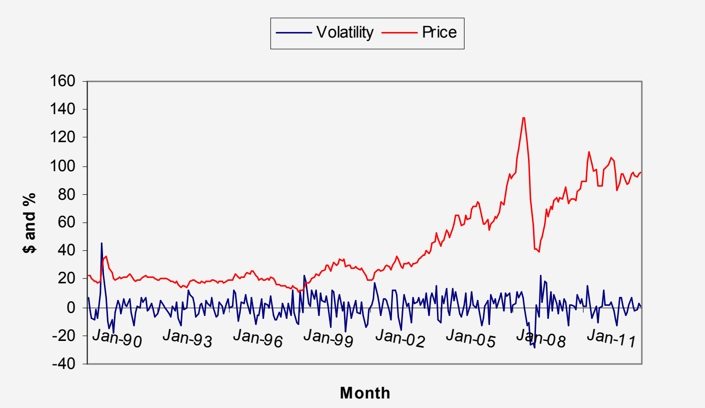
The paper is organized as follows. We begin by discussing the global and domestic perspectives of rising oil prices in section 2. Section 3 discusses literature review while section 4 consists of data and methodology. Section 5 reports discussion and results while section 6 concludes the paper.

2. Global and Domestic Perspective on Rising Oil Prices

2.1 Global Perspective

Though global economy showed considerable resilience to third oil price shock but oil price fluctuations in the last two decades were more severe compared to any other period in oil history. Since 2004, international crude oil prices have exhibited dramatic volatility, where the prices broke every record until 2008 and touched almost $150 per barrel by July, 2008. Though global financial crisis caped the unabated rise in oil prices at the cost of world economic growth but oil price volatility remained invincible (Fig 1).

Fig 1: International Oil Price and Price Volatility

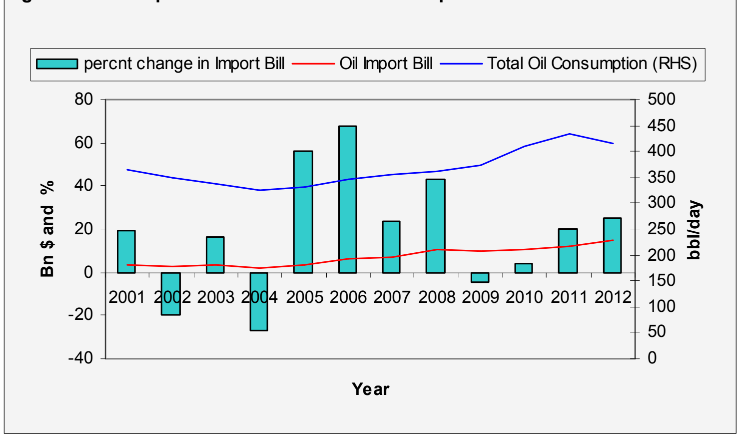


Kilian (2009) considers that the main reasons of international oil price volatility are oil supply shocks; world aggregate demand of oil and the shifts in the precautionary demand for oil due to uncertainties about future oil supply. The decrease in oil prices after 2008 was a temporary relief for oil importing developing countries combined with a grief of loss on external sector. Today oil prices are more unpredictable at the face of global economic recovery, particularly that of increase in oil demand from emerging economies and prevailing political uncertainties in the Middle East. Some studies project that the world oil demand is going to increase to 98 millions barrels/ day by 2015 and 118 millions barrels / day by 2030. But the available oil resources of nearly 1.5 to 2 trillion barrels are depleting very rapidly. Therefore, estimates by Nick et al. (2010) shows that predicted oil demand will surpass oil supply by 2015. This is not good news for developing countries that have yet to escape the vicious cycle of low growth.

2.2 Domestic Perspective:

In Pakistan indigenous resources and domestic production of Oil are not sufficient to satisfy energy thirst of the growing economy. Domestic production of oil is constant (59000 to 64000 bbl/day) in face of increasing energy demand. As a result Pakistan has to import large quantity of oil and other petroleum products. Thus the net import gap of oil is ever increasing. The cash starved Pakistani government spent huge amount of $15.697 billion on oil imports in financial year of 2012-13 that further deteriorate already stressed external balances of Pakistan put huge pressure on indigenous development. Fig 2 shows that oil import bill is on rise and year on year percent change in oil import registered wild fluctuations.

Fig 2: Value of Imports and Volume of Oil Consumption in Pakistan



3. Literature Review

Neoclassical theory explains oil price shocks by finding a linear negative relationship between oil prices and real activity in oil importing countries. Among them included Rasche and Tatom (1981), Darby (1982), Hamilton (1983), Burbidge and Harrison (1984), and Gisser and Goodwin (1986). Hamilton (1983) recognized a strong relationship between oil price rise and subsequent reduction in economic activities. Many scholars second Hamilton's conclusion, but they disagree on the channels of impact ranging from labor market dispersion (Loungani, 1986; Finn, 2000; Davis and Haltiwanger, 2001), investment uncertainty (Bernanke, 1983; Dixit and Pindyck, 1994), consumption smoothing in durable goods (Hamilton 1988; Lee and Ni, 2002) to the consequences for inflation (Pierce and Enzler, 1974; Mork, 1981). The crux of these studies is that, indirect transmission mechanisms are the crucial means of oil price macroeconomic consequences.

Brown and Yücel (1999) used the vector auto-regressive (VAR) model to study the impact of oil price on the developed economies. They concluded that the rise in oil price and oil price shock have caused the real GDP to decline and increase the general price level and policy rate, both in long and short term. Razi et al (2010) examined the effect of high speed diesel oil prices on food sector prices in Pakistan. Their result supported the hypothesis of positive effect of oil prices on food inflation and concluded that oil prices significantly contribute to food inflation in Pakistan.

Sanchez (2011) used dynamic computable general equilibrium model (CGE) on six oil-importing (Bangladesh, El Salvador, Kenya, Nicaragua, Tanzania, and Thailand), developing countries to see the welfare effects of rising oil prices during 1990 to 2008. A significant negative effect of oil price on GDP and positive effect on inflation was detected. A study conducted by IMF (2000) on impact of oil price shows that increase in oil price reduced GDP of Pakistan and India by 0.4 percent in the first round and by 0.1 percent in the second round. Similarly, the rise in oil price induced inflation in Pakistan was 0.4 while in India it was 1.3 percent. The report also showed that the average annual loss of real GDP is not the same and varies from country to country e.g in case of Tanzania it is 0.1 percent of GDP while in case of Kenya the loss is 0.9 percent of GDP.

For small oil importing countries, the causal impact of oil price is always running from oil prices to macro-economic variables as the countries do not wield the power to influence international oil prices (Lescaroux and Mignon, 2008; Du, He and Wei, 2010; Cunado and Gracia, 2005; and Jalles, 2009) while others did not confirm causality between oil price and macro varailbes, such as in Bartleet and Gounder (2007) for New Zealand, and Li et al. (2010) for Hong Kong. In many oil importing countries the impact of oil price shock on GDP is known to be a classic supply-side effect, where high cost of oil can hinder productivity and can reduce output growth that eventually lead to fall in GDP. However, the impact varies across the countries depending on the intensity of oil consumption and availability of alternative resources.

4 Data and Methodology:

4.1 Data

In this study the data on gross domestic product (y), exports (ex) and inflation rate (In) have been collected from WDI (world development Indicators) of World Bank, while quarterly oil price data (OP) is collected from the EIA (Energy Information Administration). The range of the data is from 1990 to 2010. We selected value of Brent crude as it is used to price two-thirds of the world's internationally traded crude oil supplies, and is a benchmark for oil production from regions such as Europe, Africa and Middle East. As the annual data will not serve our purpose, particularly of oil prices;

therefore, we convert annual data into quarterly using AM technique. We also introduced dummies for increase (D1) and decrease (D2) in oil prices in order to segregate the impact of increase and decrease in oil prices. Finally we have prepared an index of oil price fluctuation (SD) by taking standard deviation of oil prices.

4.2 Methodology

We apply cointegration and causality approaches along with impulse response function to specify the impact and causal relation of international oil price and oil price fluctuation on growth, exports and inflation in Pakistan.

4.2.1 Stationarity Check

The empirical analysis of time series data usually starts from stationarity checks. In our study we employ Augmented Dickey-Fuller and Phillips-Perron test for stationarity. The ADF test exhibit low power in small sample, thus, along with ADF we also apply the Pillip-Perron test for the robustness of estimation results. The quality of Philips-Perron (PP) is that it determines the maximum order of integration of each series and can control for structural breaks. It also deals affectively with any correlation and heteroskedasticity in error terms. Therefore, we base our final decision on Phillips-Perron.

4.2.2 ARDL (Autoregressive Distributed Lag) Model

ARDL (Autoregressive Distributed Lag) Model has a number of advantages over other traditional cointegration tests. First, usually it does not require stationarity tests as it is indifferent to I (0) and I (1), however, we must be cautious if the variables are I(2). Second, this test is equally effective for small as well as for large size data.

In ARDL, F-statistics is used to test the long-run relationship between the variables under consideration; however, the final acceptability of the ARDL method and results is based on a number of diagnostics tests. Based on the approach in equations 1 to 3, we run regressions to determine the long relationship between GDP, exports, Inflation and oil prices as

$$\Delta \ln Y_t = \alpha + \beta_1 \ln Y_{t-1} + \beta_2 \ln Ex_{t-1} + \beta_3 lfn_{t-1} + \beta_4 \ln OP_{t-1} + \sum_{j=1}^{k} \theta_{1j} \Delta \ln Y_{t-j} + \sum_{j=0}^{k} \theta_{2j} \Delta \ln Ex_{t-j}$$
$$+ \sum_{j=0}^{k} \theta_{3j} \Delta lfn_{t-j} + \sum_{j=0}^{k} \theta_{4j} \Delta \ln OP_{t-j} + \zeta_{1t} \quad (1)$$

$$\Delta \ln Ex_t = \alpha + \beta_1 \ln Ex_{t-1} + \beta_2 \ln Y_{t-1} + \beta_3 lfn_{t-1} + \beta_4 \ln OP_{t-1} + \sum_{j=1}^{k} \theta_{1j} \Delta \ln Ex_{t-j} + \sum_{j=0}^{k} \theta_{2j} \Delta \ln Y_{t-j}$$
$$+ \sum_{j=0}^{k} \theta_{3j} \Delta lfn_{t-j} + \sum_{j=0}^{k} \theta_{4j} \Delta \ln OP_{t-j} + \zeta_{2t} \quad (2)$$

$$\Delta lfn_t = \alpha + \beta_1 lfn_{t-1} + \beta_2 \ln Y_{t-1} + \beta_3 Ex_{t-1} + \beta_4 lfn_{t-1} + \sum_{j=1}^{k} \theta_{1j} \Delta lfn_{t-j} + \sum_{j=0}^{k} \theta_{2j} \Delta \ln Y_{t-j}$$
$$+ \sum_{j=0}^{k} \theta_{3j} \Delta \ln Ex_{t-j} + \sum_{j=0}^{k} \theta_{4j} \Delta \ln OP_{t-j} + \zeta_{3t} \quad (3)$$

Δ and ln stands for first difference operator and natural logarithm, respectively, while k represents the selected lag order of regressors determined by Akaike's Information

Criterion (AIC). We use F- value, as suggested by Pesaran et al. (2001), in order to test the following hypothesis in equations (1 to 3).

Ho: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

To decide the significance of our null hypothesis, we compare our computed F statistic with asymptotic critical upper $I(1)$ and lower bound $I(0)$ values tabulated in Pesaran et al. (2001). If the calculated F-statistics exceeds the upper bound critical value, we conclude in favor of a long-run relationship regardless of the order of integration while in case the F-statistics falls below the lower critical values, we cannot reject the null hypothesis of no cointegration. However, if the calculated F-statistic falls between the two critical bounds, inference would be inconclusive. We will replace OP in equations (1 to 3) with SD and dummies in order to measure the impact of oil price fluctuation and increase and decrease in oil prices.

4.2.3 VECM (Vector Error Correction Model) Granger Causality

Once the cointegration is detected, the next step of our interest will be to measure the direction of causality among the variables in co-integrating vectors based on the following approach

$$\Delta \ln Y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{p} \lambda_i \Delta \ln Ex_{t-i} + \sum_{i=1}^{p} \delta_i \Delta \ln Ifn_{t-i} + \sum_{i=1}^{p} \psi_i \Delta \ln OP_{t-i} + \vartheta_t ECT_{t-1} + \nu_{1t} \quad (4)$$

$$\Delta \ln Ex_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{p} \lambda_i \Delta \ln Ex_{t-i} + \sum_{i=1}^{p} \delta_i \Delta \ln Ifn_{t-i} + \sum_{i=1}^{p} \varpi_i \Delta \ln \mathrm{OP}_{t-i} + \vartheta_2 EC + \nu_{2t} \quad (5)$$

$$\Delta \ln_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{p} \lambda_i \Delta \ln Ex_{t-i} + \sum_{i=1}^{p} \delta_i \Delta \ln Ifn_{t-i} + \sum_{i=1}^{p} \Omega_i \Delta \ln \mathrm{OP}_{t-i} + \vartheta_2 EC + \nu_{2t} \quad (6)$$

Equation 4 to 6 captures the causal impact of right hand side variables on Growth, inflation and exports, respectively. ECT_{t-1} is the one period lagged error-correction term calculated and applied for those models that observed long run relation. Our null hypotheses for causal relation in the VECM based equations are given below,

Ho: $\Psi_1=\Psi_2=$ ----$=\Psi_p=0$, implying that oil price does not cause GDP

Ho: $\omega_1=\omega_2=$-----$=\omega_p= 0$, implying that oil price does not cause exports

Ho: $\Omega_1= \Omega_2=$----$=\Omega_p=0$, implying that oil price does not cause inflation

where the final decision is based on Likelihood Ratio (LR) statistics. Similarly, the causal impact of oil price fluctuation on Growth, inflation and exports can be measured by replacing OP with SD in the above equations.

Though the VECM clearly differentiate between long-term and short term impact between the variables in co-integrating vectors; however, VECM does not measure the causal relation beyond that, nor VECM address an important issue of timing in causal analysis. In this backdrop, application of VAR will allow us to address the issue of e simultaneous determinations of the variables.

4.2.4 Toda and Yamamoto Augmented Granger Causality Test

It is generally observed that the F-test is ineffective when the variables display an integrated or cointegrated structure and the test statistics lack a standard distribution (Zapata and Rambaldi, 1997). In such condition, when the data is integrated or cointegrated, the general tests applied for exact linear restrictions on the parameters (e.g. the Wald test) do not exhibit usual asymptotic distributions. To deal with this problem and avoid stationarity and cointegration that we can face in running the granger causality test, we can use the procedure proposed by Toda and Yamamoto (1995) of augmented granger causality. This procedure modified Wald test (MWald) for restrictions on the parameters of $VAR(k)$. This test displays asymptotic chi-square distribution and considers the selection procedure valid by $k \geq d_{\max}$ (where k is the lag length in the system and $d_{\max}$ is the maximal order of integration to occur in the system). The augmented granger causality test in our case suggested by Toda and Yamamoto (1995) is

$$\ln Y_t = \alpha + \sum_{i=1}^{K} \beta_i \ln Y_{t-i} + \sum_{j=K+1}^{d_{\max}} \beta_j \ln Y_{t-j} + \sum_{i=1}^{K} \lambda_i \ln Ex_{t-i} + \sum_{j=K+1}^{d_{\max}} \lambda_j \ln Ex_{t-j}$$
$$\sum_{i=1}^{K} \delta_i \ln OP_{t-i} + \sum_{j=K+1}^{d_{\max}} \delta_j \ln OP_{t-j} + \sum_{i=1}^{K} \psi_i lfn_{t-i} + \sum_{j=K+1}^{d_{\max}} \psi_j lfn_{t-j} + \varepsilon_{1t} \quad (7)$$

$$\ln Ex_t = \gamma + \sum_{i=1}^{K} \varphi_i \ln Ex_{t-i} + \sum_{j=K+1}^{d_{\max}} \varphi_j \ln Ex_{t-j} + \sum_{i=1}^{K} \mu_i \ln Y_{t-i} + \sum_{j=K+1}^{d_{\max}} \mu_j \ln Y_{t-j}$$

$$\sum_{i=1}^{K}\theta_i \ln OP_{t-i} + \sum_{j=K+1}^{d_{\max}}\theta_j \ln OP_{t-j} + \sum_{i=1}^{K}\pi_i lfn_{t-i} + \sum_{j=K+1}^{d_{\max}}\pi_j lfn_{t-j} + \varepsilon_{2t} \quad (8)$$

$$lfn_t = \sigma + \sum_{i=1}^{K}\Gamma_i lfn_{t-i} + \sum_{j=K+1}^{d_{\max}}\Gamma_j lfn_{t-j} + \sum_{i=1}^{K}\tau_i \ln Y_{t-i} + \sum_{j=K+1}^{d_{\max}}\tau_j \ln Y_{t-j}$$

$$\sum_{i=1}^{K}\Pi_i \ln Ex_{t-i} + \sum_{j=K+1}^{d_{\max}}\Pi_j \ln Ex_{t-j} + \sum_{i=1}^{K}\varpi_i \ln OP_{t-i} + \sum_{j=K+1}^{d_{\max}}\varpi_j \ln OP_{t-j} + \varepsilon_{3t} \quad (9)$$

$$\ln OP_t = \phi + \sum_{i=1}^{K}\mu_i \ln OP_{t-i} + \sum_{j=K+1}^{d_{\max}}\mu_j \ln OP_{t-j} + \sum_{i=1}^{K}\rho_i \ln Y_{t-i} + \sum_{j=K+1}^{d_{\max}}\rho_j \ln Y_{t-j}$$

$$\sum_{i=1}^{K}\vartheta_i \ln Ex_{t-i} + \sum_{j=K+1}^{d_{\max}}\vartheta_j \ln Ex_{t-j} + \sum_{i=1}^{K}\Omega_i lfn_{t-i} + \sum_{j=K+1}^{d_{\max}}\Omega_j lfn_{t-j} + \varepsilon_{4t} \quad (10)$$

The error terms $\varepsilon_{1t}, \varepsilon_{2t}$, ε_{3t} and ε_4 in the above equation (7-10) are white noise with zero mean, constant variance and no autocorrelation. In augmented granger causality, unlike ARDL approach, we will avoid the causal impact of dummies and will replace OP only by SD in order to observe the combined as well as individual causality among th variables. We will use Joint Fisher approach for testing our null of no causality.

5. Discussion and Results

5.1 Stationarity Check

Since the core of our empirical methodology varies from augmented to ARDL test, therefore, it is imperative to first discuss the stationary properties of all the variables. The

ADF and PP unit root tests are applied to the level (original) series and first differences. The results of the ADF and PP tests are given in table 2:

Table 2: ADF and PP Stationary Tests					
Variables	ADF Test		PP Test		Decision
	Level	1^{st} difference	Level	1^{st} difference	
Ly	0.9950	0.0068*	0.9969	0.0071*	I(1)
Lop	0.9331	0.0045*	0.9500	0.0080*	I(1)
Lex	0.9186	0.0045*	0.9173	0.0046*	I(1)
In	0.2166	0.0010*	0.5186	0.0050*	I(1)
SD	0.083***	0.0070*	0.2003	0.0000*	I(1)

*Significant at 1 percent level, *** level stationary at 10 percent with trend and intercept

The ADF test Results in table 2 suggest that all the variables are stationary at first difference except SD. However, PP exhibit that all variables, including SD, are stationary at first difference and are integrated of order one i.e. I(1). Our sample size is small and therefore, we rely on PP test for final decision and conclude that all the variables are I(1).

5.2 Autoregressive Distributed Lag Model

Given that all the variables are I(1), we proceed with a 'bounds testing' approach to cointegration in order to examine whether growth, exports, inflation, oil prices and oil price fluctuation are cointegrated. Considering that an appropriate lag length is an important issue in applying 'bounds testing' approach, we assigned the lag length at 5 for quarterly data based on SC statistic. In addition, a set of diagnostic tests e.g Durbin Watson test, are conducted on the selected ARDL models that are given along with the Cointegration results in table 3.

Table 3: The Results of ARDL Co-integration Tests					
Bound Testing to Co-integration				Diagnostic Tests	
	Optimal lag lengths	F-Statistics	Critical Value Lower Bound/ Upper Bound	Adj R^2	D.W test
With Oil Prices					
$Ly_t = f(lex_t, in_t, lop_t)$	(1,1,1,0)	8.0820*	3.3658 4.5444	0.9995	32.3281
$Lex_t = f(ly_t, in_t, lop_t)$	(1,1,1,0)	0.67935	3.3658 4.5444	0.9984	2.7174
$In_t = f(ly_t, lex_t, lop_t)$	(1,1,1,1	0.81351	3.3658 4.5444	0.9578	3.2540
With dummies for increase and decrease in oil price					
$Ly_t = f(lex_t, in_t, D1, D2)$	(1,1,1,0,0)	6.9985*	3.0325 4.2312	0.9995	34.9924
$Lex_t = f(ly_t, in_t, D1, D2)$	(1,1,1,0,0)	0.8516	3.0325 4.2312	0.9985	4.4258
$In_t = f(ly_t, lex_t, D1, D2)$	(1,1,1,1,0)	0.0287	3.0325 4.2312	0.9583	3.5144
With oil price fluctuation					
$Ly_t = f(lex_t, in_t, SD)$	(1,1,1,0)	6.4715*	3.3658 4.5444	0.9994	25.8862
$Lex_t = f(ly_t, in_t, SD)$	(1,1,1,0)	1.9370	3.3658 4.5444	099984	7.7479
$In_t = f(ly_t, lex_t, SD)$	(1,1,0,0)	8.4999*	3.3658 4.5444	0.97468	33.9995

* significan and cointegrated

On the basis of values of F statistic in table 3, we reject the null of no cointegration for exports, inflation and oil price, when we take GDP as dependent variable. Similarly, export and inflation along with dummies for increase and decrease in oil price and oil price fluctuation shows cointegration when we use GDP as dependent. However, inflation as dependent variables produces long run relation among export and inflation only in combination with oil price on right hand side. Overall we find four co-integrating vectors once GDP and inflation are used as dependent actors, implying that a long-run equilibrium relationship exists among the variables.

Table 4: Long Run Results				
Explanatory Variables	Dependent Variables			
	Ly	Ly	Ly	IN
ly	-	-	-	-6.3203 (.535)
lex	1.0972 (0.0001)*	1.0245 (0.0005)*	1.4175 (0.0001)*	-0.91705 (0.9945)
In	-0.0014 (0.5420)	-0.00117 (0.6090)	-0.00346 (0.2120)	-
lOP	0.1679 - (0.1700)		-	-
D1	-	-0.0267 (0.1079)***	-	-
D2	-	0.0092 (0.1314)	-	-
SD	-	-	-0.0083 (0.7054)	3.3464 (0.0417)**
INPT (constant)	-0.3314 (0.8008)	0.35165 (0.8005)	-3.2812 (0.0056)*	92.959 (0.2352)

P values in parenthesis , *, **, *** significant at 1, 5 and 10 percent level, respectively.

The long term marginal impact of the explanatory variables in cointegrated vectors is presented in table 4. The results shows that the overall impact of oil price on growth is insignificant, however, when we separate the rise in oil price from decline in oil prices by introducing a dummy, the impact of rise in oil price is negative. We found that 10 percent increase in oil prices decrease GDP by 2.6 percent. On the other hand the dummy for decrease in oil price is insignificant and reflects that the impact of increase and decrease in oil price on growth in Pakistan is non-linear and asymmetric. The impact of oil price fluctuation is negative and significant on growth and significantly positive in inflation. This suggests that that oil prices fluctuation is one of the causes of inflation in Pakistan.

5.3 The VECM Granger Causality Test

After detecting cointegration and long run affect of oil price and oil price variation, it is interesting to check the direction of causality. For this we use VECM granger causality technique. The direction of causality can be divided into short- and long-run causation. The significance of the one period lagged error-correction term ECT_{t-1}, represents the long-run causality, while the joint significance LR tests of the lagged explanatory variables represents the short-run causal relation. In table 5, negative significant values of ECM_{t-1} for growth (ly) and inflation (In) once again confirm our assertion of long run relation among the variables. The coefficient of significant ECM_{t-1} ranges from -0.036 to -0.076 in case of oil prices and -0.035 to 0.075 in case of oil price fluctuation, which shows that changes in economic growth, reverts to equilibrium by 7.6 percent in case of oil price and by 4.4 percent in case of oil prices fluctuation per quarter. Similarly, in case of inflation the disequilibrium is adjusted by e 3.6 percent in case of oil prices and by 3.5 percent in case of oil price fluctuation. From this we can assert that disequilibrium in growth and inflation takes quite long time to revert back to equilibrium in case of oil price fluctuation compared to oil prices.

Contrary to long-run impact, we find that the short-run causality vary among VECMs. The result in table 5 shows that Exports, inflation and oil price Granger cause GDP at 1 percent level of significance. Similarly, export, and inflation along with oil price fluctuation significantly affect GDP. Though GDP and inflation cause exports in short run, however, oil price and price fluctuation do not show causal relation with exports. Short run results also confirm that inflation is granger caused by all other variables including oil price and oil price fluctuation.

Table 5: The VECM Granger Causality Result

Dependent variables	Direction of causality				
	Short run				Long run
(Analysis for Oil Price)					
	$\Sigma\Delta$ ln y_{t-1}	$\Sigma\Delta$ ln lex_{t-1}	$\Sigma\Delta$ ln_{t-1}	$\Sigma\Delta$ $lnOP_{t-1}$	ECM_{t-1}
D ln y	----	3.8959 (0.0000)*	-0.2133 (0.0083)*	14.0930 (0.0000)*	-0.0766 (0.0074)
Dln lex	35.1120 (0.0000)*	----	1.4252 (0.2466)	0.6975 (0.5009)	-0.0709 (0.1510)
Din	0.4944 (0.0118)	1.5821 (0.0121)	----	15.0818 (0.0000)*	-0.0364 (0.0381)**
D ln op	0.0912 (0.1118)	-0.92882 (0.456)	3.1122 (0.1232)	----	0.0554 (0.1381)
(Analysis of Oil Price Fluctuations)					
	$\Sigma\Delta$ ln y_{t-1}	$\Sigma\Delta$ ln lex_{t-1}	$\Sigma\Delta$ ln_{t-1}	$\Sigma\Delta$ $lnSD_{t-1}$	ECM_{t-1}
D ln y	----	39.2652 (0.0000)*	-0.07367 (0.0114)**	0.0456 (0.0554)**	-0.0446 (0.0113)**
Dln lex	4.2645 (0.0000)*	----	4.0409 (0.0214)*	0.6426 (0.5289)	0.0701 (0.1025)
Din	4.0607 (0.0210)**	2.3310 (0.1021)***	----	29.0004 (0.0000)*	-0.0358 (0.0361)**
D SD	1.2134 (0.1220)	1.1323 (0.4731)	2.1210 (0.1123)	----	0.1251 (0.2012)

P values in parenthesis , *, **, *** significant at 1, 5 and 10 percent, respectively.

The results in table 5 also show that the role of Pakistani macro economic variables is insignificant in determining international oil prices and oil prices fluctuations. Given that, we can conclude that the direction of causality in our study runs one way from oil price and price fluctuation to growth and inflation in case of Pakistan.

5.4 Augmented Granger Causality Test

Augmented granger causality test is indifferent to I(0) and I(1), however, the order of integration is important for selection of lags length ($k+d_{max}$). From table 2 we assume the maximum order of integration (d_{max}) as 1 while we select lag length in the system (k) as 2 depending on Shwarz and Akaike Information Criteria given in table 6.

Table 6: Selection of Lag Length

Lag	Log L	LR	FPE	AIC	SC
0	90.84011	NA	1.49e-06	-2.067622	-1.951869
1	757.0000	1253.015	2.82e-13	-17.54762	-16.96885
2	876.1641	212.7930*	2.42e-14*	-20.00391*	-18.96213*
3	879.8612	6.249912	3.27e-14	-19.71098	-18.20619

The results in table 7 show that the combined causality of exports, inflation and oil price on GDP and the combined causality of GDP, exports and oil price on inflation is significant, while the combined causal impact of other variables on exports is insignificant. Similarly, the causal affect of GDP, export, and inflation as a group on oil price can not be detected. Oil price not only causes GDP and inflation in combination with other variables but have also significantly causes growth prospects of Pakistan economy individually.

Table 7: Augmented Granger Causality Test Results for Oil Price (OP)	
Null Hypothesis:	p values
Combined causality of OP, Inflation and Exports on GDP	0.0025*
Exports does not Granger Cause GDP	0.0521***
Inflation does not Granger Cause GDP	0.0621**
OP does not Granger Cause GDP	0.0012*
Combined causality of OP, Inflation and GDP on Exports	0.0056**
GDP does not Granger Cause Exports	0.0254**
Inflation does not Granger Cause Exports	0.0841***
OP does not Granger Cause Exports	0.2214
Combined causality of OP, Exports and GDP on inflation	0.0123**
GDP does not Granger Cause Inflation	0.1014
Exports does not Granger Cause Inflation	0.0562***
OP does not Granger Cause inflation	0.0501**
Combined causality of Exports, GDP and inflation on OP	0.1552
GDP does not Granger Cause OP	0.4512
Exports does not Granger Cause OP	0.1222
inflation does not Granger Cause OP	0.2325

*,**and *** are significant at 1, 5 and 10 percent, respectively

The results in table 7 are not unexpected, showing that neither the growth prospects of Pakistan nor the macroeconomic variables influence international oil price. The granger causality results for oil price fluctuation are given in table 8[4] which shows that oil price fluctuation granger cause GDP, exports and inflation in combination as well as individually, while the other variables, as expected, failed to cause oil price fluctuation.

[4] The lag selection remained 2 when oil price was replaced with oil prices fluctuation.

This shows that in case of Pakistan oil price fluctuation compared to oil price has huge economic impact.

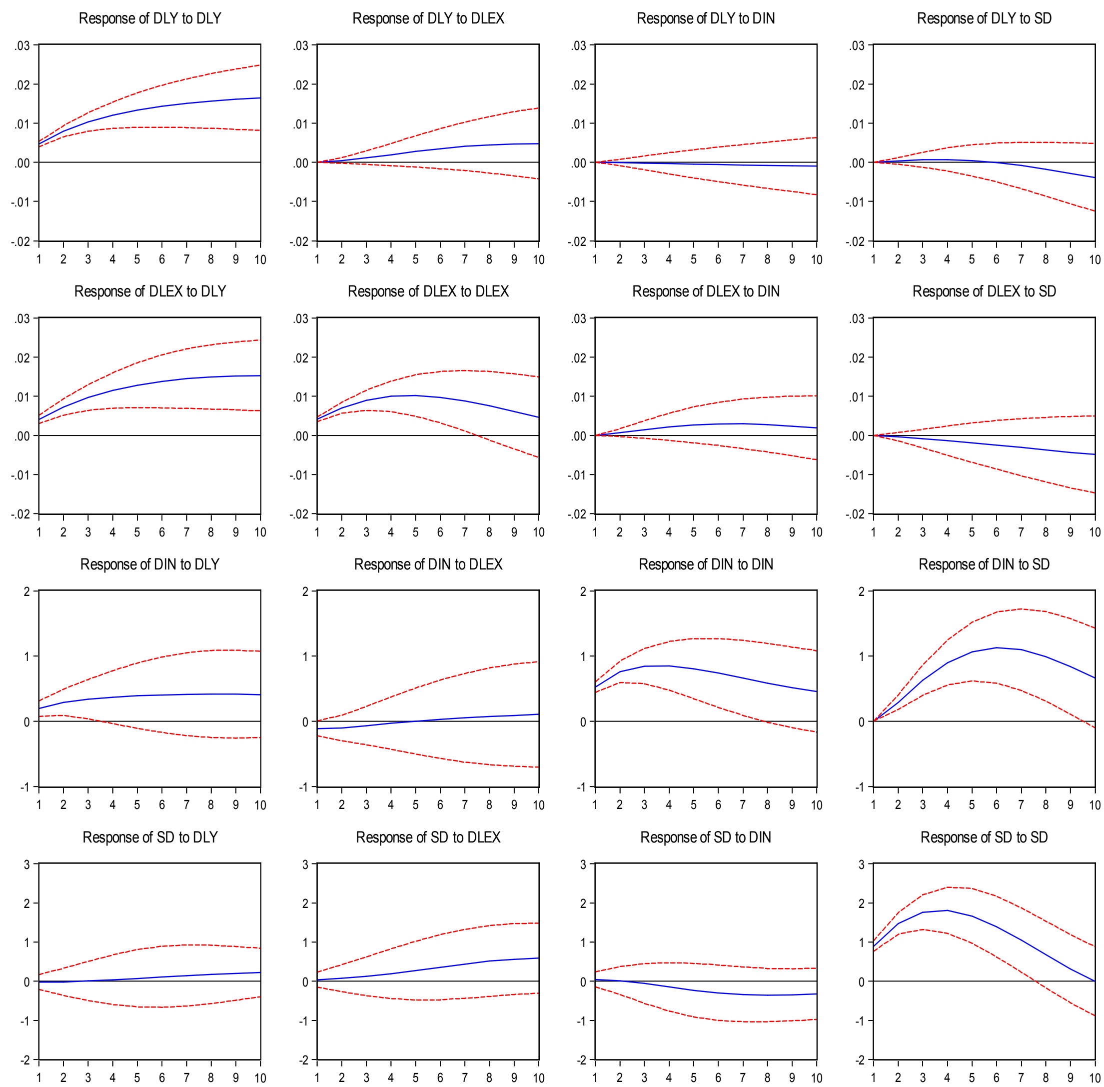
Table 8: Augmented Granger Causality Test Results for Oil Price Fluctuations (SD)	
Null Hypothesis:	p values
Combined causality of SD, Inflation and Exports on GDP	0.0115**
Exports does not Granger Cause GDP	0.0343**
Inflation does not Granger Cause GDP	0.1329
SD does not Granger Cause GDP	0.0001*
Combined causality of SD, Inflation and GDP on Exports	0.0236**
GDP does not Granger Cause Exports	0.1444
Inflation does not Granger Cause Exports	0.0342**
SD does not Granger Cause Exports	0.1141
Combined causality of SD, Exports and GDP on inflation	0.0223**
GDP does not Granger Cause Inflation	0.1494
Exports does not Granger Cause Inflation	0.0212**
SD does not Granger Cause inflation	0.0551***
Combined causality of Exports, GDP and inflation on SD	0.4453
GDP does not Granger Cause SD	0.5443
Exports does not Granger Cause SD	0.1298
inflation does not Granger Cause SD	0.2780

*,** and *** are significance at 1, 5 and 10 percent level, respectively

5.5 Impulse Response Function

Considering that oil price fluctuation severely affect the growth and inflation variables, we present the impulse response of the GDP, Exports and Inflation in combination with SD (fluctuation in oil prices) in Fig 1. The Fig 1, indicates negative response in GDP (Ly) due to standard shock stemming from SD (oil price fluctuation) which drag GDP down. Similarly, shock from SD drastically reduce exports while response of inflation to SD is positive but inverted U shaped which means that SD contribute positively to inflation, however, the impact of SD on inflation start dying down after 4th time horizon

Fig 1: Response to Cholesky One S.D. Innovations ± 2 S.E.



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6. Conclusion

This paper, based on ARDL bound testing approach, corroborates the existence of cointegration relationship between the variables. The long run results shows that the impact of oil prices on real output are negative, which confirm the Hamilton's (2003) findings that oil price adversely affect economic activities. However, the affect of oil price fluctuations compared to oil prices are more severe that not only affected real out but have also contributed to Pakistan's inflation. This finding is interesting because like oil price shocks, price fluctuations is unexpected and therefore impose huge cost on Pakistan economy.

The VECM and augmented granger causality results confirmed that oil price and oil price fluctuation along with the rise in oil prices granger cause GDP. The causal impact of oil price fluctuation running to inflation can also be detected both individually as well as in combination with other variables. Our finding shows that Pakistan needs to address the issue of oil price and oil price fluctuation by incorporating it in macro models and responding to it by prudent fiscal and monetary policies. Considering oil price as an external shock without proper backup plan will always surprise and panic the fragile economy of Pakistan while in time policy response will mitigate the adverse impact of oil price and prices fluctuation to some extent.

The insignificant impact of oil price on export give us a hint that though the rising energy price is one of the cog in the under development of Pakistan but not the whole.

International energy prices always provide an excuse for Pakistan to hide domestic inefficiencies, lack of competitiveness and less than comprehensive approach to vital issues. Cheap energy alone can not boost Pakistan exports but efficient human resource and advanced capital can. Therefore, besides revitalizing and securing energy, Pakistan needs to invest in human capital, physical infrastructure, ensuring law and order and energy efficient labor intensive industries to pave way for long run economic development.

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