THE EFFECT OF OIL PRICE VOLATILITY ON ECONOMIC ACTIVITY: NEW EVIDENCE FROM IRAQ

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Abstract: Global oil markets witnessed intense price volatility in the recent years. Volatility of crude oil price is perceived as a significant source of economic fluctuation. It could likely affect levels of economic growth whether in oil exporting or in oil importing countries. In addition, Iraq is one of the leading oil exporting countries in the world. In general, the national income of the country is depending on crude oil. Oil revenues in Iraq cover above % 90 of the Iraqi government's budget every year since the collapse of the Saddam's regime in 2003, and the rising of crude oil price recently affects the economic growth in Iraq. Moreover, the main purpose of this study is to examine the effects of oil price volatility on economic activity in Iraq. For this purpose, this study employs an ARDL time series model over the period of 1986–2022. In addition, the time series datasets employed in the study are tested for both stationarity and co-integration model by using the augmented Dickey-Fuller (ADF) unit root and Johansen test for co-integration test respectively. According to our results we have found that there is a significant and negative relationship between oil price volatility and economic activity in Iraq for that period.

Keywords: Oil price volatility, economic activity, ARDL Model, Iraq.

1. Introduction

For the last few decades, levels of crude oil consumption and export are both used as indicators to measure economic growth whether in oil importing or in oil exporting economies. The kind of energy that crude oil generates, and the derivative products it provides affect almost every aspect of our modern life. As one of the most easily extracted source of energy, crude oil's favorable characteristics entitles it to stand globally as the most highly valued energy source. The importance of crude oil as a strategic commodity that affects global economic and national security stems from the fact that its availability and volatile prices influence the health, welfare, and security of billions of people and their nations.

Oil global supply is not very reliable and it is subject to instability and supply-side shocks. Multiple reasons stand behind this supply's uncertainty. Political instability and wars represent important generators of oil supply and price shocks. Upon the 1973 Arab oil embargo against the countries that supported Israel, Yom Kippur War (October 6, 1973) triggered the media and the economists' concerns about oil price surges. Another enormous supply shock occurred upon a huge drop in the Iranian's production of oil after the overthrow of the Shah regime in 1979. Supply shortages entail oil price increases, meanwhile oversupply of oil drags prices down. Iraq's resumption of oil exportation in 1996 upon the United Nations Oil-For-Food program flooded the market causing a remarkable reduction in its price (Alnasrawi, 2002 & Banana, M.Z.(2023). Besides, it coincided with the Asian financial crisis that decreased the Asian demand over oil. A recent reduction of crude oil price in the global market is also attributed to the oversupply of crude oil after the announced potential domestic reserves of United States that are expected to flood the global markets. Yet, increased demand on energy sources also triggers price surges, particularly when the supply does not confront the demand.

Global oil markets witnessed intense price volatility in the recent years. The fluctuations of oil prices in

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the global markets attracted economists' attention to the relationship between economic growth rates and changes in oil price, precisely, the form that it takes, and the extent to which it affects economic performance. From a theoretical perspective, oil price volatility affects levels of macroeconomic indicators through many transmission channels. The supply-side effect of surges in crude oil price on levels of real output is attributed to the impact that they may have on marginal costs of production. This effect is transmitted in its turn to the demand-side through the impact that crude price change may have on consumers' disposable income and investors earnings, thus, on levels of aggregate consumption and investment.

Since 1970s until recently, volatility of crude oil price is perceived as a significant source of economic fluctuation, and likely to affect many economies simultaneously. The consequences of oil price fluctuation on levels of real activities differ between oil importing and oil exporting countries. Positive surges of crude price are expected to boost revenues to finance development projects in oil exporting countries; meanwhile the effect of negative price shocks is expected to have reverse impacts. Empirical evidence proved that crude price increases have a significant negative impact on GDP growth and contributes to higher inflationary pressures in oil importing countries. The implications of oil price fluctuation also differ between developed and developing economies. The increase in oil price leads to energy efficient consumption in developed countries, but it is not necessarily the case in developing countries where it may be reflected in increased human costs, food costs as cooking fuel may become less affordable.

Oil reserves are unevenly distributed as most of the known oil reserves are located in politically or economically unstable areas of the world. More than half of the world's reserves are located in the Middle East. According to the statistics of the Organization of Arab Petroleum Exporting Countries (OAPEC), the Middle East with its vast oil reserves represents a global powerful force that holds approximately 56.4% of the world's oil reserves with an increasing trend in its share of the global production. Iraq is one of the five major members of OPEC that holds the reserve of 115 billion barrels, which represents 17.57% of the Arab producing countries' reserves and 9.91 % of the world's oil reserves. Despite its vast oil reserves, Iraq is still a lower middle income developing economy that suffers from tremendous deficiencies in development projects. Iraq's large quantities of oil resources represent the most important source of income to Iraqi economy, yet are unable to support any process of sustained development (Owen & Pamuk, 1998).

The following study proves that the impact of oil price shocks is not exclusive to oil importing economies. Oil exporting economies are also vulnerable to crude price volatility especially in the countries whose economic structure depends largely on crude exports revenue. Iraq's developing economy is highly dependent on oil exports as a main source of revenues. Oil production and exports are the main components of Iraq's economy. The demand over Iraqi oil exports is likely affected by the movement of crude oil prices in the global market. This is reflected in Iraq's real GDP via the impact on Iraq's exports and oil income. This study attempts to ascertain that the correlation exists between the movement of oil prices and Iraq's economic performance. The high dependency of Iraqi economy on oil exportation activities indicates the vulnerability of Iraq's economic stability to crude price shocks. Hypothetically positive surges in oil prices should have a positive impact on Iraq's GDP through its positive impact on revenues. However, these positive surges may decrease the demand on Iraq's oil exports due to other factors like fluctuation of exchange rates and other political and regional factors. Thus, the study employs ARDL model to investigate the impact of crude price volatility on levels of economic activity in Iraq. The times series datasets were tested for stationarity using the augmented Dickey-Fuller (ADF) unit root test. The long run relationships among the variables are traced using the Johansen co-integration test, and finally, ARDL method confirmed the existence of long run relationships among a few of the independent variables.

1. Background Information on Iraq

Iraq is a lower middle income developing Middle Eastern country with a population of almost 40 million. Iraq's large quantities of oil resources

represent the most important source of income to Iraq economy which relies heavily on oil revenues. The oil sector is the only economic sector capable of generating a substantial and regular inflow of external revenue into the country. Most of Iraq's development projects including infrastructure, industrial, and service sectors are financed by oil income. Oil revenues always supported the development of related industries, especially the petroleum refining, chemicals, and fertilizers. In a country where oil exportation is the only economic activity that provides income to the economy, implications of oil global markets' instability on economic activities and its influence on the economic growth are expected to be significant.

In addition, international sources estimated Iraq's proven oil reserves at 112 billion barrels, and they could likely reach 214 billion barrels in the future. Also, the country is endowed with 3,360 billion m^3 of proven gas reserves. The potential production capacity of the currently producing fields is about 3,862.000 Barrel /Day million barrel per day (https://www.ceicdata.com-2021).

Oil production in Iraq has always shown a fluctuating pattern. Positive surges in oil production were always followed by a sharp reduction due to wartimes. The increase in the production of the year 1979 when oil revenues recorded a very large contribution to Iraq's income was followed by a sharp reduction due to the outbreak of Iraqi-Iranian War in 1980. The increase in the production between the years 1989-1990 that followed the recovery of the war alongside the implementation of some economic policies that boosted the private sector was also followed by a capacity reduction due to Iraq's invasion of Kuwait in 1990. Iraq's oil production peaked in 1990 to around 3.5 million barrel per day. Upon Iraq's invasion of Kuwait exports were halted by an economic sanction. After the first Gulf War, oil production was only sufficient for domestic consumption as it declined to about 500,000 barrels per day. Then with the start of the UN Oil-for-Food program, oil exports increased, and oil production averaged to 2.5 million barrel per day during 1991-2001. Yet, this increase was followed by a decline in the production due to the 2003 US invasion of Iraq (Kumins, 2005).

2. METHODOLOGY

Data and Unit Root Test

The five variables are used in this study such as, Exchange rate, general government expenditure, inflation rate, interest rate, and oil price, using time-series data for over the period 1986–2022. The data are collected from World Development Indicator (WID).

Moreover, we begin the empirical analysis with an investigation of the unit root test for the variables. We assumed that, the data have used in this estimation are stationary. If the results of stationarity are violated, this might lead to spurious results. In examining the time-series data properties, there are several models to test the stationarity, but the most important one is the Augmented Dickey–Fuller (ADF) (Dickey and Fuller, 1979, 1981) and the Phillips–Peron (PP) (Phillips and Peron, 1988) unit root tests.

Autoregressive Distributed Lag (ARDL) Model and Co-integration Analysis

To analyze time series data with different order I(1) and I(0) together, Pesaran et al. (2001) suggested that, the Autoregressive distributed lag approach (ARDL) to test for co-integration as an alternative to co-integration model for Engle-Granger (1989). The study uses ARDL model to investigate the long run and short run relationship between variables. The ARDL bond testing approach for co-integration can be written:

$$\begin{aligned}\Delta GDP_t = \alpha_0 &+ \sum_{i=1}^{p} \alpha_i \, \Delta GDP_{t-i} + \sum_{i=1}^{p} \alpha_i \, \Delta EXCH/_{\cdot t-i} \\ &+ \sum_{i=0}^{p} b_i \, \Delta GE_{t-i} + \sum_{i=0}^{p} c_i \, \Delta INF_{t-i} \\ &+ \sum_{i=0}^{p} d_i \, \Delta IR_{t-i} + \sum_{i=0}^{p} d_i \, \Delta OIL_{t-i} \\ &+ \delta_1 GDP_{t-1} + \delta_2 EXCH_{t-1} \\ &+ \delta_3 GE_{t-1} + \delta_4 INF_{t-1} + \delta_5 IR_{t-1} \\ &+ \delta_6 OIL_{t-1} + \mu_t \qquad (1)\end{aligned}$$

Here Δ is the first difference operator, ΔGDP_t stands the natural log of real GDP, ΔGE stands the natural log of real government expenditure, ΔINF stands the natural log of inflation rate, R stands the natural log of real interest rate, ΔOIL stands the natural log of oil price, and μ_t stands the error correction term.
The *F* test is used to determine whether the long-run relationship exists between the variables through testing the significance of the lagged levels of the variables. When the long-run relationship exists, the *F* test shows which variable should be normalized.

The null hypothesis of no co-integration amongst the variables in equation (1) is
H0= δ 1= δ 2= δ 3= δ 4= δ 5 = δ 6=0 against the alternative hypothesis
H1≠ δ 1≠ δ 2≠ δ 3≠ δ 4≠ δ 5 ≠ δ 6 ≠0.

The *F* test has not a standard distribution which depends on; (1) whether the variables are included in the ARDL model are I (0) or I (1); (2) the number of independent variables; (3) whether the ARDL model contains an intercept and a trend; and (4) the sample size of the variables. The rejection of the null depends on F-test and the critical bound tabulated value for small sample size according to Narayan (2005).

The long run relationship among the variables exists if the calculated value of F - statistic is greater than the upper critical bound, and if the calculated value of F- statistic is smaller than the lower critical bound, the long run relationship does not exist, if calculated value of F-statistic comes in between the range of LCB and UCB then the long run relationship is inconclusive.{Mintz, 1990} Hassan & Kalim, (2012). The optimal lag can be selected using the model selection criteria like Akaike Information Criterion (AIC). According to Narayan (2005) the maximum lags for small sample size is two lags.

Moreover, the results of the Johansen test of co-integration among the variables time series indicates the co-integration of the time series and existence of long-run relationships among the variables of the levels of GDP, growth rate of oil export revenue, and the change in the annual exchange rate of ID to US dollar. The test indicates a co-integrated vector and the existence of one co-integrating equation. Therefore, upon predicting the ARDL model, the co-integrating equation integrates the change in the annual exchange rate of ID to US dollar and the crude oil ETF volatility index, while other variables co-integration is not significant.

3. EMPIRICAL RESULTS

Table 1 shows the result of stationary test for ADF-test and PP test respectively for the oil price change in Iraq. Both tests revealed that GDP has unit root at level, but it becomes stationary at first difference, which implies that GDP is I (1). Nevertheless, all other variables were found to be significant at first difference and thus it indicates the variables are I (1). As the results point out, the variables are either I (0) or I (1), therefore implying that we can confidently apply ARDL approach to this model as using ARDL requires the data to be stationary at level I(0) and first difference I(1) (Narayan, 2005).

Table 1: Augmented Dickey-Fuller and Phillip-Perron unit root test results Iraq.

	ADF		**Philip-Perron**	
	Level			
	intercept	**Intercept and trend**	**intercept**	**Intercept and trend**
$GDPC_t$	-8.639535*	-11.65283*	-10.60387*	-10.60387*
$EXCH_t$	-3.646342*	-4.262735*	-3.646342*	-4.262735*
$GOVT_t$	-3.646342*	-4.262735*	-3.646342*	-4.462738*
INF_t	-3.653730*	-4.273277*	-3.646342*	-3.646342*
IR_t	-3.646342*	-4.262735*	-3.646342	-4.262735
OIL_t	-3.646342*	-4.374307	-3.646342	-4.262735

First Difference				
$GDPC_t$	-11.46210	-4.313172	-29.98491*	-30.11625*
$EXCH_t$	-3.653730	-4.273277	-3.653730	-4.273277
$GOVT_t$	-3.653730	-4.284580	-3.653730	-4.273277
INF_t	-3.661661	-4.394309	-3.653730	-4.273277
IR_t	-3.661661	-4.323979	-3.653730	-4.273277
OIL_t	-3.653730	-4.273277	-3.653730	-4.273277
*, ***Denotes*** *significant at 1% level.*				

Table 2 represents the long run co-integration test analysis, and existence of long run relationship which has been found among the model's variables. Results illustrate that the computed F-statistics are 8.6781. The relevant critical value bounds at ten percent level (with unrestricted intercept and no trend) are 5.1744 and for the lower and upper bounds respectively. Subsequently, the computed F-statistics is higher than the critical value of the upper bound, the null hypothesis of no long run co-integration relationship among the variables can be simply rejected. Having established the existence of the long run associated between GDP per capita, general government expenditure, military expenditure, exchange rate, inflation rate, and interest rate and oil price. The model can be used to estimate long run and short run parameters.

Table 2: Testing for existence of a level relationship among the variables in the ARDL model				
Lag structure:				1,1,3,3,0,0
F-statistics	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
8.6781	3.7773	5.1744	3.1266	4.3657
W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
52.0687	22.6640	31.0466	18.7596	26.1941
If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.				

Table 3 demonstrates the selected long and short run ARDL model, based on Akaike Information Criterion (AIC). The results show negative and significant relationship between general exchange rate ($exch_t$), government expenditure and gross domestic product (GDP) in the short run. While the rest of others are negatively related to the GDPC in the short run. In addition, in the long run the correlation between our variables are not statistically significant, while other variables such as exchange rate, government expenditure and oil price are negatively influenced GDPC, in contrast both variables namely inflation and interest rate positively impact GDPC. Our results in lined with Adam (2019) & Rasheed, S. A. (2023).

Table 3: Short and Long run Estimation Results.

Dependent variable is dGDPG

33 observations used for estimation from 1986 to 2022

ARDL (1,1,3,3,0,0) selected based on Akaike Information Criterion

	Short Run		**Long Run**	
variables	*Coefficient*	*T-Ratio [Prob]*	*Coefficient*	*T-Ratio [Prob]*
Constant	-1.5837	-1.0322[.315]	1.1812	-1.0553 [.307]
$EXCH_t$	**-.16024***	**-3.1836[.005]**	-.033999	-1.1114 [.283]
$GOVT_t$	**-2.1773**	**-1.9527[.055]**	-.97593	-1.4868 [.157]
INF_t	-.10273	-1.7702[.093]	.036020	.51308 [.615]
IR_t	.26421	.61627[.545]	.20794	.58986 [.564]
OIL_t	-.017083	-.050621[.960]	.26495	-.050747[.960]
ECT_{t-1}	**-1.2706**	**-5.9917[.000]**	n/a	
R-Squared	.87252	n/a		

*, ***Denotes*** *significant at 1% level.*

4. Conclusion

Crude price volatility is a major source of economic instability in exporting countries whose economy depends largely on crude export revenue. Iraqi economy that is endowed with massive reserves of crude oil and an extensive level of crude export is expected to be vulnerable to a large extent to oil price shocks in global markets. To investigate the impact of crude price volatility on levels of economic activities in Iraq, this study estimates an ARDL model that predicts Iraq GDP in terms of a set of independent variables that measure crude price volatility in global markets and levels of Iraq macroeconomic aggregates. The time series datasets employed in the study are tested for stationarity and co-integration using the augmented Dickey-Fuller (ADF) unit root test and Johansen test for co-integration respectively. According to our results we have found that there is a significant and negative relationship between oil price volatility and economic activity in Iraq for that period. So, this result is similar with Khaleel, Z. K. (2021) and Asaad, Z. (2021).

References:

Adam, P., Rahim, M., & Rosnawintang, R. (2019). The Effect of crude oil prices on economic growth in South East Sulawesi, Indonesia: An application of autoregressive distributed lag model. *International Journal of Energy Economics and Policy*, *9*(2), 194.

Alnasrawi, A. (2002) *Iraq's Burden: Oil, sanctions, and underdevelopment*, Greenwood Press.

Asaad, Z. (2021). Oil price, gold price, exchange rate and stock market in Iraq pre-during COVID-19 outbreak: An ARDL approach. *Asaad, ZA (2021). Oil Price, Gold Price, Exchange Rate and Stock Market in Iraq Pre-During COVID19 Outbreak: An ARDL Approach. International Journal of Energy Economics and Policy*, *11*(5), 562-671.

Banana, M.Z.H., Hoshmand, M. and Behname, M.(2023), " ANALYZING THE IMPACT OF CRUDE OIL PRICES ON ECONOMIC ACTIVITY IN SELECTED OPEC MEMBER COUNTRIES. International Journal of Studies in Business Management, Economics and Strategies. Volume 02, Issue 06, June, 2023

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica: journal of the Econometric Society*, 1057-1072.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American statistical association*, *74*(366a), 427-431.

Engle, R. F., Granger, C. W., & Hallman, J. J. (1989). Merging short-and long-run forecasts: An application of seasonal cointegration to monthly electricity sales forecasting. *Journal of econometrics*, *40*(1), 45-62.

Hassan, M. S., & Kalim, R. (2012). The triangular causality among education, health and economic growth: A time series analysis of Pakistan.

Khaleel, Z. K. (2021). IMPACT OF OIL PRICE FLUCTUATIONS ON IRAQ'S SUSTAINABLE DEVELOPMENT. *Academy of Strategic Management Journal*, *20*, 1-8.

Kumins, L. (2005). Iraq oil: Reserves, production and potential revenues. Congressional Research Service CRS, RS21626

Mintz, A., & Huang, C. (1990). Defense Expenditures, Economic Growth, and The" Peace Dividend". *The American Political Science Review*, 1283-1293.

Narayan, P. K. (2005). The saving and investment nexus for China: evidence from co-integration tests. *Applied Economics*, *37*(17), 1979-1990.

Owen, R., & Pamuk, S. (1998). *A history of Middle East economies in the twentieth century*. LB Tauris & Co. Ltd.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335-346.

Rasheed, S. A. (2023). The Impact of Oil Price Volatility on Economic Growth and Stability in Iraq through the Public Expenditure for the Period (2003-2020). *International Journal of Professional Business Review: Int. J. Prof. Bus. Rev.*, *8*(6), 17.

www.ceicdata.com-2021