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Macroeconomic Impacts of Oil Price Shocks: Evidence from Iraq by Using Vector Autoregressive Model

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ABSTRACT

Based on a VAR framework, Granger Causality Tests, Impulse Response Function and Variance Decomposition analysis on the annual data from 1970 to 2021. This study aims to demonstrate the effect of oil price fluctuations on GDP, imports, international reserves, and exports in Iraq. The Granger causality results demonstrated a unidirectional connection moving from oil price to imports, exports, international reserves, and GDP, this is an inevitable result because oil prices are determined in the international markets according to specific factors that do not include local economic variables. The variance decomposition result indicated that oil price changes are an important source of variation in the studied variables. Finally, the results of the impulse response function indicated that fluctuations in oil prices significantly impact GDP, exports, imports, and international reserves in Iraq. Therefore, we suggest that economic policymakers work seriously to develop practical plans to diversify the Iraqi economy instead of relying too heavily on oil revenues, which are characterized by sharp and continuous volatility, to avoid the negative effects of these fluctuations on the main macroeconomic variables in Iraq.

Keywords: Macroeconomic Variables, VAR Model, Oil Price Shocks, Iraq
JEL Classifications: Q41, F62, C32

1. INTRODUCTION

Since the 20th century, the importance of crude oil and oil products has expanded enormously. Since the 1950s, crude oil has dominated global energy consumption. In 2020, crude oil represented more than 30% of global energy consumption (Figure 1). Its consumption will increase by 44% in 2050, according to the expectations of the US Energy Information Administration. It will constitute 27% of global energy consumption (IEO, 2021). Extreme fluctuations and instability characterize oil prices in global markets. Over the past five decades, the oil markets have seen significant fluctuations. During the 1970s, oil prices rose dramatically due to the decline in supplies from the Middle East.

Oil prices rose from $2.48 a barrel in 1972 to $36.83 in 1981 (BP, 2011). This means prices have multiplied by nearly 15 times during these 10 years. Since 1981, prices have declined gradually and rapidly until they reached $11 per barrel in July 1986 (EIA, 2023). Prices continued to fluctuate at their low level until 1999. This continuous decline can be attributed to a decrease in demand and an increase in supply at the same time. The decrease in demand came as a result of the economic slowdown that occurred in most industrialized countries, in addition to the use of modern technologies that led to raising the efficiency of energy use. At the same time, the oil supply expanded because of the discovery of promising oil fields in many parts of the world (Brini et al., 2016).

In early 1999, Iraq increased its oil production and the Asian financial crisis accompanied this, which pushed oil prices to lower levels. However, the market began to adjust gradually and the price reached nearly $34 in November 2000. During 2003-2007, oil prices steadily increased due to various events such as

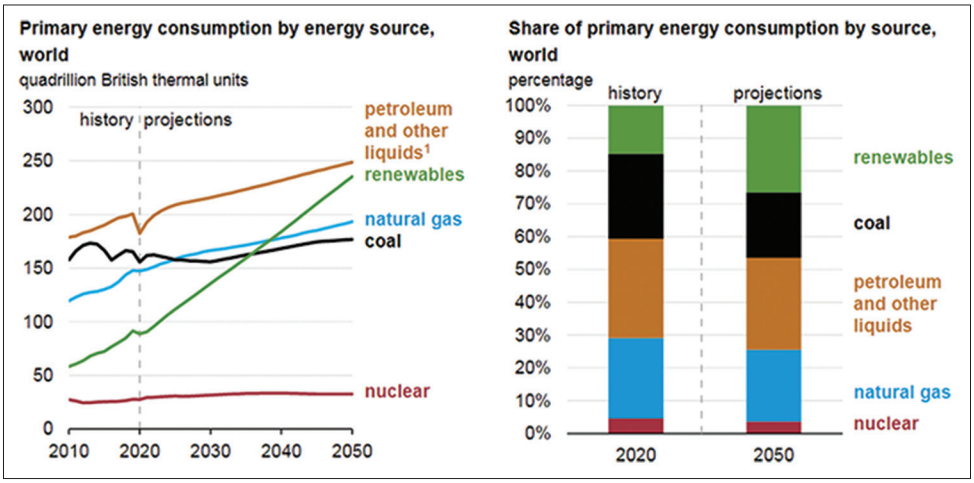
the invasion of Iraq in 2003 which led to a reduction in Iraq's oil production by 50%, and Hurricane Katrina in the USA in 2005. as well as geopolitical tensions in the Middle East, such as the continued security tensions in Iraq, the war between Lebanon and Israel in 2006 and the decreases in US dollar values. In June 2008, the price of oil reached a historic high of $133.88 (Rodhan and Jaaz, 2022).

In the same year, the housing bubble burst in the United States, and this was followed by a credit crisis that began in the United States and spread to the global economy. Which pushed prices below $40.With the recovery from the 2008 crisis, prices gradually improved until they exceeded $100 in 2014. But that did not last long, as with the increase in oil supply, resulting mainly from increased production of American shale oil, prices fell to $30 in 2016. Due to COVID-19, prices reached $16.55 in 2020, their lowest level in 20 years. Prices rose rapidly with the disappearance of Covid-19 and the emergence of the Ukrainian crisis until they reached $130 in February 2022. Figure 1 shows the historical development of crude oil prices (Rodhan, 2023). Figure 2 shows oil price fluctuations during the period 1960-2022.

The first oil price shocks in 1973 and the second in 1979 highlighted the importance of the influence of volatility in oil prices on macroeconomic variables. Since then, studying the impact of oil price fluctuations on the economic performance of countries has become one of the most important areas in the field of economics. Many economic studies have emerged that focus on examining the relationship between macroeconomic fundamentals and oil price fluctuations. This trend was greatly stimulated by the uncertainty in oil prices and their continuing fluctuations (Alekhina and Yoshino, 2018). The importance of studying the relationship between oil price fluctuations and the macroeconomy has increased significantly since the end of 2000 due to significant rises in crude oil prices and sharp and continuous fluctuations, as happened in 2008, 2014, 2016, 2020, and 2022.

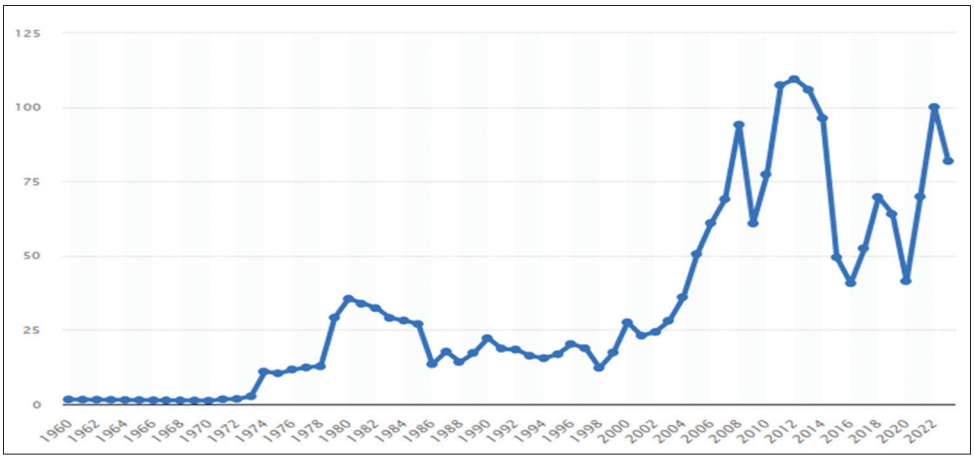
Iraq is the third largest oil exporter after Saudi Arabia and Russia, with 3.44 Mb/d, which represents more than 8% of total oil exports in the world in 2020 (OPEC, 2022). After Saudi Arabia, Iraq is the second largest crude oil in OPEC and the fourth largest in the world after the USA, Saudi Arabia, and Russia in 2020. As production reached 4.6 Mb/d in 2020. With 145 billion barrels, it

Figure 1: Primary energy consumption by energy source.



Source: EIO, 2021

Figure 2: OPEC crude oil prices (1960–2022) (USD/barrels).



Source: Statista, 2023

has the fifth-largest crude oil reserves in the world, accounting for 8% of the reserves in the global reserves and 17% of the Middle East (EIA, 2023b).

Currently, oil revenues play an important role in the Iraqi economy, representing about 98% of total exports, 90% of government budget revenues and 35.5% of GDP (OPEC, 2022). Therefore, a slight fluctuation in oil prices will have a major impact on the Iraqi economy, for example, when oil prices drop by $5, the state budget will lose more than $6 billion. This is a constant occurrence, and prices may fall much more. Therefore, studying the impact of oil price changes on the Iraqi economy is considered extremely important to achieve economic stability by trying to avoid the negative effects of these fluctuations. In general, there is an urgent need for greater knowledge of the complex relationship between oil price shocks and macroeconomic variables in Iraq. This study seeks to shed more light on this relationship, and to this end, the goal was to study the effect of oil price shocks on Iraqi macroeconomics for the period 1970-2021. This study answers the following question: What is the effect of oil price changes on GDP, imports, international reserves, and exports? This study showed the negative effect of oil price fluctuations on macroeconomic variables. Therefore, there is a need to restructure and diversify the economy.

This study is organised as follows: In the next section, we present a brief overview of oil revenues in Iraq. The review of literature is shown in the third section; in the fourth section, we show a data description and VAR methodology. In the fifth section, we provide empirical results including unit root tests, determination of lags, VAR model checking, variance decomposition analysis and impulse response functions (IRF). In the last section, we present the conclusions of the study.

2. OVERVIEW OF IRAQI OIL REVENUES

Iraqi oil revenues during the period (1970-2021) witnessed significant fluctuations, the main reason for which is due to fluctuations in oil prices in global oil markets and, to a lesser extent, fluctuations in oil exports due to regional geopolitical events and the internal security conditions that Iraq has faced at times.

During the period (1970-1979), the oil price nearly quintupled (Figure 2). The amount of oil exports also increased from 1.49 Mb/d in 1970 to 3.25 Mb/d in 1979. Consequently, oil revenues increased from $ 8 billion in 1970 to $26.1 billion in 1979 (OPEC, 2005). Iraq's total oil revenues during the period (1970-1979) amounted to $96.7 billion. While total revenues for the period (1980-1989) amounted to $93.9 billion. Iraqi oil revenues declined significantly during the period 1990-1996, as the United Nations did not allow Iraq to export crude oil after the events in Kuwait in 1990. In 1997, the embargo was partially lifted, and oil prices gradually rose, which raised oil revenues slightly. Total oil revenues from 1990 to 1999 amounted to $47.4 billion.

Due to the increases in oil prices to historical levels witnessed during the period 2000-2021, oil revenues increased significantly, as oil revenues during the period 2000-2009 amounted to $297.5 billion. And $902.6 billion during the period 2010-2021, while it amounted to $1199.1 billion for the period 2000-2021 and $1437.5 billion for the period 1971-2021 (Table 1). Figure 3 shows the relationship between fluctuations in oil prices and Iraqi oil revenues for the period 1970-2021.

3. LITERATURE REVIEW

Oil is the source that has the most impact on economic activities among the various energy sources. Therefore, oil price fluctuations have attracted much attention over many decades. A deep understanding of the relationship between oil price fluctuations and macroeconomic performance is crucial for oil exporting and importing countries to develop economic policies to avoid the adverse consequences of continued volatility in oil prices. Therefore, the literature dealing with oil price instability has expanded significantly. Hamilton's study (1983) is one of the most important studies that examined the impact of oil shocks on economic performance. He studied the influence of oil shocks on the economic performance of the United States during the period extending from World War II until 1982 using the VAR model. He found that seven of the eight recessions were preceded by increases in oil prices. Eltony and Al-Awadi (2001) investigated the impact of oil price changes on the Kuwaiti economy using the (VAR) and (VECM) models on seven economic variables for the period 1984-1998 using quarterly data. The estimated results indicate a strong link between economic variables and oil prices, as well as that the causal relationship goes from oil prices to other variables. The variance analysis showed that 45% of variations in government spending and oil revenues are caused by oil prices. Rautava (2003) examined the effect of oil price shocks on the Russian GDP for the period from 1995 to 2002 using the cointegration techniques (VAR) model. The results show that the Russian economy still relies heavily on oil revenues, as a 10% increase in oil prices increased the gross domestic product by 22%. Ito (2010) applied the VAR approach to study the influence of oil price shocks on macroeconomic performance in Russia for the period from Q1 1994 to Q3 2009. He concludes that in the long run, an increase in crude oil prices of 1% will be offset by the rise in economic growth, which increases by 0.46% and the exchange rate, which increases by 0.17%, with a slight rise in inflation.

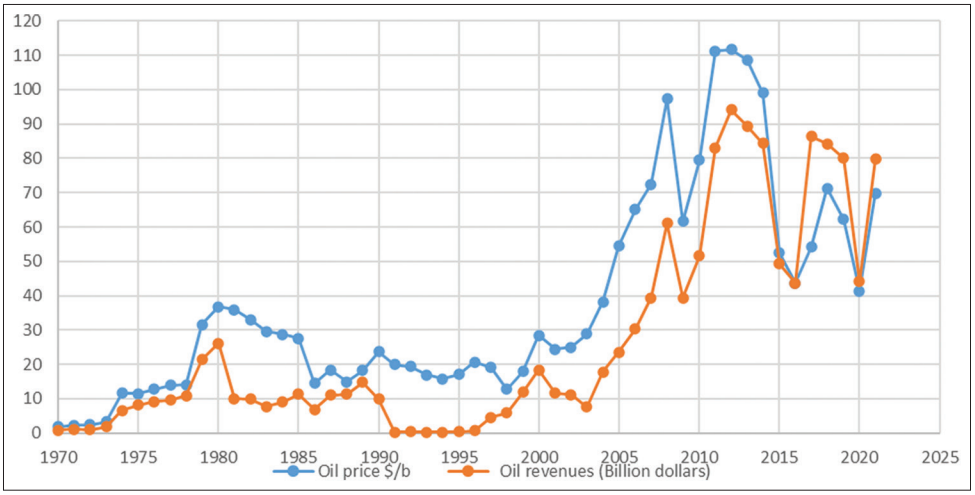
Moshiri (2015) used the VAR model to demonstrate the impact of oil price shocks on economic growth, inflation rate, and exchange rate for the period 1970-2010 in nine oil exporting countries, three of which were advanced, namely Canada, the United Kingdom, and Norway, and six were developing. The study concluded that volatility in oil prices does not significantly impact economic

Table 1: Iraqi oil revenues (1970-2021)

Years	Oil revenues (Billion $/years)	Annual average (Billion $/year)
1970-1979	96.7	9.67
1980-1989	93.9	9.39
1990-1999	47.4	4.74
2000-2009	297.5	29.75
2010-2021	902.6	75.22

Source: Authors' computation, based on OPEC, 2023, 2011, 2005

Figure 3: The relationships between oil prices and oil revenue in Iraq (1970-2021).



Source: Authors' computation, based on OPEC, 2021

performance in developed countries, unlike developing countries, and the reason for this is the development in the economic structure of developed countries. Nusair (2016) studied the impacts of oil price shocks on the GDP of the Gulf Cooperation Council countries using the (NARDL) model. The results indicate that the GDP of the GCC countries is significantly positively affected by the increase in oil prices. However, the decline in oil prices did not significantly affect GDP, except in the case of Kuwait and Qatar. The results generally show that higher oil prices have a more important positive impact on GDP than the negative impact of lower oil prices. Yildirim and Arifli (2021) used the VAR model to explain the impact of oil price shocks on inflation, trade balance, and economic growth in Azerbaijan during 2006-2018. They concluded that lower oil prices resulted in a decline in economic activity, an increase in inflation, and a decrease in trade balance.

Related to the Iraqi economy, there are relatively few studies about the significance of oil revenues in the Iraqi economy and the influence of fluctuations in oil markets on the performance of the Iraqi economy. The publication of the United Nations Development Programme in Iraq in 2020 (UNDP Iraq, 2020) entitled the impact of COVID-19 on the Iraqi economy was practically interesting. It showed that macroeconomic and financial conditions in Iraq in the short and medium term are closely related to volatility in oil prices, and long-term stagnation in oil prices due to COVID-19 will represent a much more significant challenge in Iraq's economy.

Al-Zanganee (2017) studied the influence of oil price volatility on Iraq's economy from 2003 to 2015 by using the VAR model. The OPEC basket price and the oil volatility index were used to indicate the changes in crude oil. Oil revenues and the Iraqi dinar exchange rate were used to indicate the level of Iraqi economic activity. He concluded that fluctuations in oil prices impact Iraq's GDP and economic activity in Iraq very significantly. This effect can be explained by the negative impact of oil price changes on the state's general budget. AL-Bayati and Obeida (2022) explained the impact of oil price fluctuations on the gross domestic product and the state budget in Iraq during the period 2010-2020 using the ARDL model and concluded that changes in crude oil prices negatively affect the GDP and the general budget, as oil revenues constitute 90-95% of public budget revenues. They explained that the heavy dependence of GDP on oil revenues distorts the Iraqi economy. In addition, it deepens structural imbalances due to fluctuating crude oil prices.

Al-Jubouri and Abdul Hamid (2020) examined the relationship between oil prices and Iraq's economic growth from 2003 to 2017 using the ARDL model. They pointed out that there is a positive short- and long-term relationship between oil revenues and economic growth and that the Iraqi economy is characterised by suffering from structural imbalances in the structure of the Iraqi economy. Oil revenues were not used rationally to address structural imbalances but were directed chiefly to consumer expenditure at the expense of investment expenditure to address imbalances. Kadhim (2023) studied the impact of fluctuations in oil prices on the public budget in Iraq based on inflation, the price of a barrel of oil, the exchange rate, the GDP and oil revenues for the period 2001-2019 using a multiple regression model. The study concluded that fluctuations in oil prices greatly impact the general budget and that lower oil prices lead to more budget deficits. A decrease of one dollar in the price of a barrel of oil leads to a loss of more than one billion dollars for the Iraqi economy.

From a review of the literature, we find that studies on the Iraqi economy are still limited, although Iraq is the second-largest producer in OPEC and the fourth-largest globally. This study attempts to enrich the literature related to the Iraqi economy by examining the influence of oil price shocks on Iraqi macroeconomics from 1970 to 2021, using the VAR model and tries to provide further clarification and evidence of the extent to which Iraqi economies are exposed to the adverse effects of fluctuations in crude oil prices, which helps to design future scenarios to deal with these effects. This study is distinguished from previous studies by the following:

1. The period covered by this study began in 1970 when Iraqi oil revenues increased significantly. The study extends to 2021, meaning it will cover a period that is more than 50 years. This

gives a more precise understanding and a deeper analysis of the influence of fluctuations in international oil markets on the Iraqi economy. It is a period that has not previously been studied as a continuous time series.

2. This study investigates the influence of oil price volatility on GDP, export, import, and international reserves in Iraq using annual data from 1970 to 2021 and using vector autoregressive model, Granger Causality Tests, Variance Decomposition analysis and Impulse Response Function as empirical methods. Therefore, considering the above reasons, our study will be regarded as a new contribution to research in this field.

4. DATA AND METHODOLOGY

This study examines the effect of oil price fluctuations on Iraqi macroeconomic variables such as GDP, imports, international reserves, and exports. To empirically test the influence of international oil price volatility on these variables annual data from 1970 to 2021 are used, which gives us 52 observations for each variable, this is a statistically appropriate period to achieve the purpose of this study. Data obtained from OPEC and World Bank. Logs were taken for all variables. because the variables in log form contain a unit root. Therefore, we converted them to the first differences. Figure 4 shows the time series of each variable, and the description of the variables is shown in Table 2.

4.1. Methodology

This study used the VAR model to investigate the impact of oil prices on GDP, exports, imports, and international reserves in Iraq. The VAR model is one of the famous models for examining the interrelationships and causality between variables. The reasons for choosing the VAR model in this study are as follows. Firstly: VAR models are constructed on the basis that all variables are endogenous. This makes it an unrestricted model, as the standard VAR model (Sims, 1980) depends on the result of the Granger causality test (Granger, 1969). Second: it is appropriate for handling such time series (Dinh, 2020). Finally: Some empirical literature has used it to examine the relationship between the fluctuation of oil prices and macroeconomic variables. To examine the impact of oil price fluctuation on macroeconomic variables, we consider the VAR structure as the equation below.

$$Y_t = \sigma + \eta_1 Yt_{-1} + \eta_2 Yt_{-2} + \ldots\ldots\ldots + \eta_p Y_{t-p} + \varepsilon_t \quad (1)$$

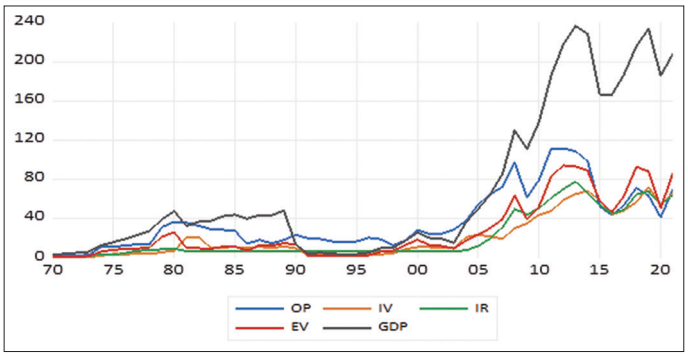
where Y_t is a n × 1 vector of endogenous variables of the model, σ is a n×1 vector of constant, η_i is a n × n matrix of coefficients, ε_t is a n × 1 vector of the white noise process, j represents the maximum number of lags.

In this study, we will analy e an annual structural VAR model to estimate the effect of the oil price shock on four main macroeconomic variables. Therefore, the vector Y_t can be expressed as the following:

$$Y_t = [\Delta\log(OP), \Delta\log(GDP), \Delta\log(EV), \Delta\log(IR), \Delta\log(IV)] \quad (2)$$

where OP is the price of Brent oil (current $/barrel), GDP (Billion -current USD$), EV is the export value (Billion -current USD$), IR is the international reserve (includes gold) (Billion-current USD$), IV is the import value (Billion -current US$). Figure 5 illustrates the steps for analysing the model, according to which the rest of this study will be organised.

Figure 4: Time series of data (1970-2021) (Billion US$).



Source: Authors' computation, based on OPEC, 2022; World Bank, 2023

Table 2: Variables description

Variable	Variable	Log Form	F.D Form
OP	Price of Brent crude oil_ (current US$ per barrel)	LOP	DLOP
GDP	Gross domestic product (Billion -current USD$)	LGDP	DLGDP
EV	Export value (Billion -current USD$)	LEV	DLEV
IR	International reserve_(includes gold)_(Billion-current USD$)	LIR	DLIR
IV	Import value_ (Billion -current US$)	LIV	DLIV

5. EMPIRICAL RESULTS

5.1. Unit Root Test

To run the VAR model, all-time series variables should be stationary and should not possess a unit root. Therefore, we need to test the unit root and Stationary features of the data. The results of the unit root test based on the augmented Dickey-Fuller (ADF) are presented below in Table 3. The ADF test has the null hypothesis of unit roots. The P-value of those tests at the level at a 5% error level is more than 0.05 for all variables and the absolute t-statistics is less than the critical value. Therefore, we cannot reject the null hypothesis at the 5% level. The ADF test indicates that all variables exhibit unit root at the level. However, all the variables become stationary at the first difference. Therefore, the first differences of the variables will be used in this study. With this conclusion, we can run the VAR model.

5.2. Determination of Lags

The VAR requires an appropriate lag for further tests. The number of lags is chosen by selecting the lag with the lowest value. Therefore, in this study, information criteria are used to choose the best lag length for our model. Table 4 shows the lag order selection statistics. The result reports lag order at one by the selection criteria of the HQ, FPE, AIC and SC. Therefore, in this study, one lag will be used.

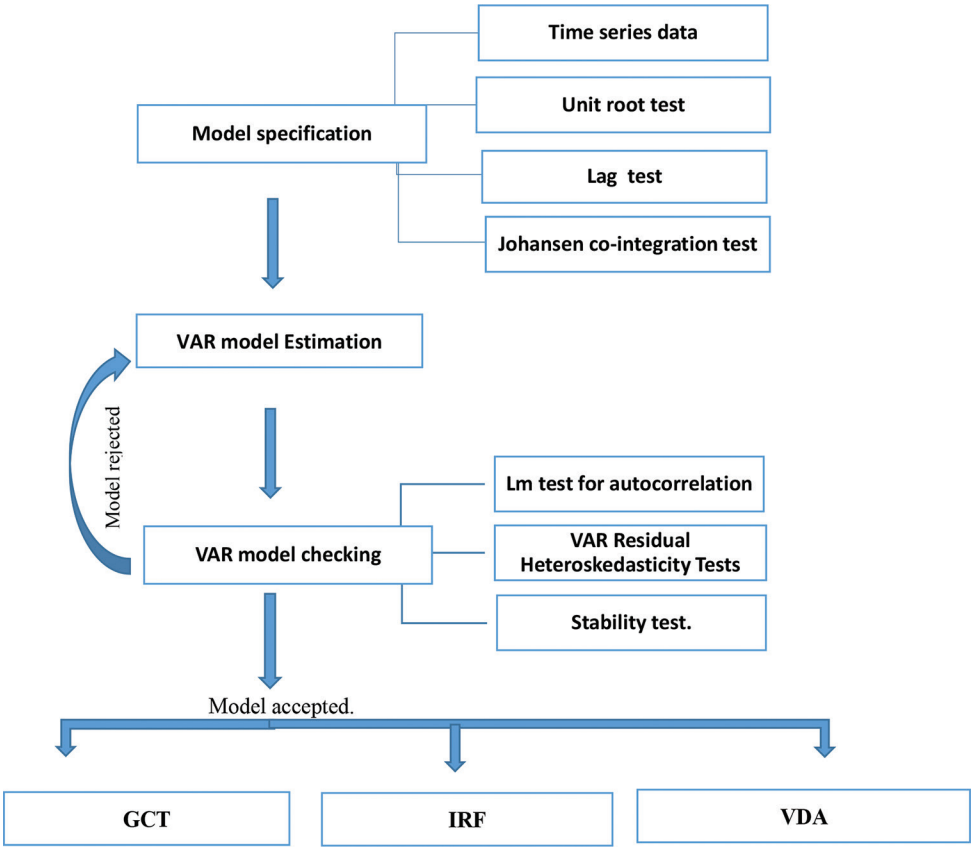
Table 3: ADF unit root test result (1970-2021)

Series	Level			First difference		
	ADF statistics	5% critical level	Prob	ADF statistics	5% critical level	Prob
LOP	−2.80365	−2.91995	0.0648	−6.54575	−2.92117	0.0000
LGDP	−1.21681	−2.91995	0.6604	−5.13093	−2.92117	0.0001
LEV	0.36293	−2.91995	0.4220	−6.60891	−2.92117	0.0000
LIV	−1.96500	−2.91995	0.3010	−6.11144	−2.92117	0.0000
LIR	−1.96613	−2.91995	0.3004	−4.32698	−2.92117	0.0011

Table 4: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−143.6697	NA	0.000385	6.326372	6.523196	6.400438
1	26.38860	296.6975	8.08e-07*	0.143676*	1.334622*	0.598074*
2	51.64041	38.68362*	8.30e-07	0.152961	2.308027	0.957690
3	69.89217	24.07678	1.22e-06	0.430120	3.579308	1.615181
4	91.42857	23.82751	1.72e-06	0.577508	4.710816	2.132899

Figure 5: VAR analysis procedures.



Source: Authors' computation, based on Lütkepohl, 2007

5.3. Cointegration Test

The results of the Johansen co-integration test both maximum eigenvalue and trace Statistics shown in Table 5, indicate that the variables do not pose co-integrating equations. This means that the variables have no long-run relationship since the variables are not co-integrated, the authors then exclude the VECM model and use the VAR model in modelling the variables.

5.4. VAR Model Checking

The following different tests are applied to ensure that the VAR model is free of econometric problems. Table 6 shows the result of the LM test for autocorrelation, this result indicates that with 1 lag length, there is no serial autocorrelation since the significance values of 5% are less than the P-values. The VAR residual heteroskedasticity test shows that the model is free from heteroskedasticity. Finally, to examine the dynamic stability condition, the model is tested by roots of characteristic polynomials; the result shows that all inverse roots of the model lie inside the unit circle, which means that the model satisfies the stability condition with 1 lag length. Therefore, given that the model does not exhibit any econometric problems. which indicates that Granger Causality, impulse response functions and Variance Decomposition generated from the model are valid and stable.

Table 5: Johansen co-integration test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE (s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None	0.434131	64.73568	69.82889	0.1190
At most 1	0.284929	36.26606	47.86613	0.3832
At most 2	0.218526	19.49740	29.78707	0.4576
At most 3	0.093489	7.168738	15.59471	0.5581
At most 4	0.044216	2.261148	3.841465	0.1327
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE (s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None	0.434131	28.46962	33.97687	0.1927
At most 1	0.284929	16.76866	27.68434	0.5999
At most 2	0.218526	12.32866	21.23162	0.5156
At most 3	0.093489	4.907591	14.26460	0.7535
At most 4	0.044216	2.261148	3.841465	0.1327

Table 6: Residual diagnostic tests

VAR residual serial correlation LM tests			
Lag	**LRE stat**	**df**	**Prob.**
1	27.80670	25	0.3202
VAR residual heteroskedasticity tests			
Chi-sq	**df**		**Prob.**
163.4414	150		0.2141
Inverse roots of characteristic polynomial			
Root		**Modulus**	
0.496195		0.496195	
−0.017127−0.156392i		0.157327	
−0.017127+0.156392i		0.157327	
−0.127403		0.127403	
0.123808		0.123808	

Table 7: Granger causality tests

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
DLOP→DLGDP	50	0.82832	0.3674
DLGDP→DLOP		0.39573	0.5323
DLOP→DLIR	50	1.94690	0.1695
DLIR→DLOP		0.0616	3.6666
DLOP→DLIV	50	0.66978	0.4173
DLIV→DLOP		0.00891	0.9252
DLOP→DLTEV	50	1.94690	0.1695
DLTEV→DLOP		0.03778	0.8467

5.5. The Granger Causality Test

This test shows whether a change in one variable is a result of a change in another variable. In the VAR model, all the variables are regressed based on their past value and the value of other present variables. We will study the causality between crude oil prices and macroeconomic variables in Iraq because it represents the main objective of the study. Table 7 shows that the null hypothesis of DOLP that does not cause DLIR, DLGDP DLIV, and DLTEV is rejected, while that of DLIR, DLGDP DLIV, and DLTEV that do not cause DOLP is accepted. The Granger causality results demonstrated a unidirectional connection heading from oil prices to imports, exports, international reserves, and GDP. This means that the oil price granger causes imports, exports, international reserves, and GDP in Iraq. On the other hand, imports, exports, international reserves, and GDP do not Granger cause oil price; this is because the price of oil is determined by factors such as supply, geopolitical, demand, and other factors, there is no influence of local factors in determining oil prices. Granger causality analysis from Table 7 answers the research question of this study, which aims to determine whether oil prices cause changes in macroeconomic variables in Iraq, and what is the causal direction between them. The analysis showed both a causal relationship and a direction.

5.6. Impulse Response Functions

To examine the effect of changes in oil prices on macroeconomic variables, we used the impulse response test. This test investigates the responsiveness of the variables to shocks in all other variables. Specifically, it shows the impact of one standard deviation shock on a variable on the endogenous variables. The impulse responses of macroeconomic variables to changes in crude oil prices are shown in Figure 6 below and illustrate the clear dependence of macroeconomic variables on oil prices. Figure 6 reported the results of Impulse Response Functions. The response of variables to a unit oil price shock demonstrates the dependence of macroeconomic variables on oil price changes. The immediate response of the DLGDP is positive. However, it begins to decrease after the 1st year and becomes negative in the 2nd year, returns to being positive in the 4th year, and the effect diminishes after about 8 years. The immediate response of the DLIR is positive. After 6 years, the effect decreases significantly. The response of the DLIV creates strong fluctuations. The immediate response is positive. and becomes negative in the 4th year, and returns to positive in the 6th year, The effect decreases after about 8 years. The immediate response of the DLTEV is positive and becomes negative in the 2nd year, returns to positive in the 4th year, and the effect diminishes after about 7 years.

5.7. Variance Decomposition Analysis

The variance decomposition test suggests that forces related to one variable have an impact on the valuation of another. It provides details on the significance of each stochastic innovation that affects the variables. We have carried out a variance decomposition analysis to evaluate the range of the variation in variables because of the positive shock in oil prices. The variance decomposition analysis will provide a better understanding of the impacts of oil price shocks on the VAR model. In this study, we will decompose the variance of exports, GDP, international reserves, and imports with respect to oil prices. Table 8 reported the variation decompositions of GDP, exports, international

Figure 6: Impulse response analysis

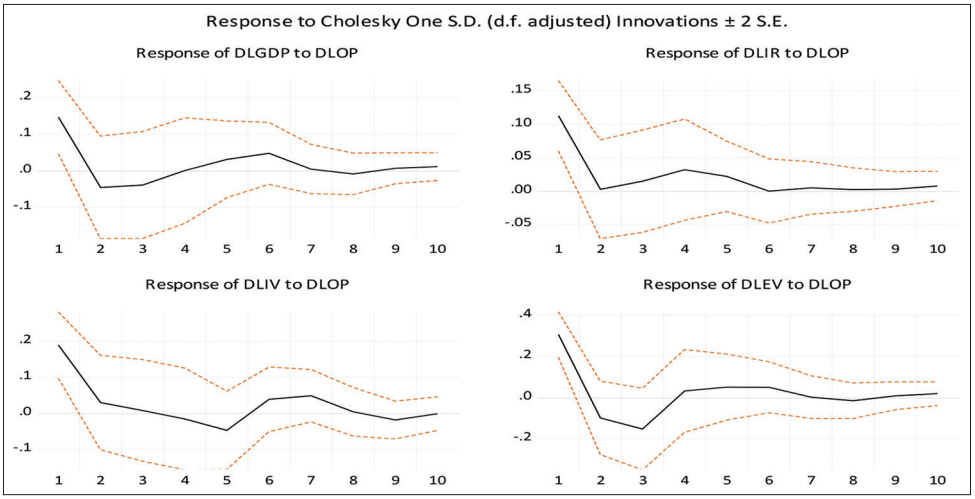


Table 8: Variance decomposition of variables explain by oil price shock

Period	DLGDP	DLIR	DLEV	DLIV
1	16.35918	32.05779	48.62684	30.06418
2	13.02718	26.27183	34.04305	23.56340
3	13.67432	25.43517	37.32760	21.84786
4	13.35504	25.81864	37.27448	21.57311
5	13.60260	26.04228	37.25724	21.81404
6	14.57587	25.37596	37.58019	22.42813
7	14.56210	25.26914	37.53941	23.34125
8	14.55239	25.23399	37.48913	23.29510
9	14.55740	25.16711	37.44601	23.39767
10	14.59344	25.22537	37.48800	23.37858

reserves, and imports because of the oil price shock. In the case of DLGDP, the oil price shock explains 16.35% of the variation in the 1st year and 14.59% in the 10th year. For the DLRI oil price shock explained 32.05% of the variation in the 1st year and 25.22% in the 10th year. In addition, 48.62% in the 1st year and 37.48% in the 10th year of DLTEV variations are explained by oil price shock. Finally, more than 30% in the 1st year and 23.37% in the 10th year of variations in DLIV are accountable to oil price shock Evidence obtained from the above analysis indicates that fluctuations in oil prices contribute significantly to the disruption of macroeconomic indicators. It emphasizes the significance of oil revenues to the Iraqi economy and explains the risks of volatile crude oil prices on the Iraqi economy. In general, the obtained results indicate that the Iraqi economy is very sensitive to volatility in oil prices in international markets because oil revenues play a major role in the Iraqi economy.

6. CONCLUSIONS

In this study, we analyse the effect of oil price fluctuations on GDP, imports, exports, and international reserves in Iraq using annual data from 1970 to 2021 and a structural VAR model. Granger causality tests, impulse response functions, and variance decomposition tools are also used. The augmented Dickey-Fuller test indicates that the variables have unit roots at the level and become stationary at the first difference. The Granger causality results showed a unidirectional connection moving from oil price to Imports, exports, international reserves, and GDP. This indicates that fluctuations in oil prices could be used to forecast fluctuations in these variables. The Impulse Response function results show that a unit shock of oil price to Imports, exports, international reserves and GDP creates strong fluctuations. Furthermore, the variance decomposition test showed that oil price volatility is the main cause of variance in studded variables after self-shock.

Findings, the study concludes that oil price fluctuation has a huge effect on Imports, exports, international reserves, and GDP in Iraq. This study focused only on the economic influence of oil price instability; it would be intriguing to discuss the proposed scenarios to deal with fluctuations in crude oil prices in future research.

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