Journal of AL-Rafidain University College for Sciences (2024); Issue 56; pp. 515-533

AL- Rafidain University College

PISSN: (1681-6870); EISSN: (2790-2293)

Journal of AL-Rafidain University College for Sciences

Available online at: https://www.jrucs.iq

JRUCS

Journal of AL-Rafidain University College for Sciences

Heterogeneity of Iraqi Oil Effect on the Global and Local Interest in Wars and Pandemics Crises

Abbas G. Beg Murad	Ghiath H. Majeed
abbas.beg@univsul.edu.iq	gayath.edbs@uomustansiriyah.edu.iq
Department of statistics & Informatic, College of Administration and Economics, University of Sulaimaniyah, Sulaimaniyah, Iraq	Department of Mathematics, College of Basic Education, Mustansiriyah University, Baghdad,Iraq

Suhad A. Ahmed

suhad.a.a@ihcoedu.uobaghdad.edu.iq

Department of Computer Science, College of Education Ibn Al Haitham, University of Baghdad, Baghdad, Iraq

Article Information

Article History:

Received: February, 20, 2024
Accepted: April, 12, 2024
Available Online: December, 31, 2024

Keywords:

Corona Virus, Russia-Ukraine Conflict, GDP, Forecasting Techniques, ARIMA model, fpp2 forecast package.

Correspondence:

Ghiath H. Majeed
gayath.edbs@uomustansiriyah.edu.iq

Abstract

Iraq is considered one of the countries that depend mainly on oil production, so the revenues from these resources are assigned in various sectors and fields within the country is the biggest problem. The importance of this research comes from the importance of this sector in terms of production and profits (in wars and epidemics Crises) and its impact on the global oil market and the international economy, this paper examines the effect of changes in oil production and values on Iraq's economic growth to assess its reliance on the crude oil sector. as well as on the local Iraqi economy to shed light on both cases (Corona epidemic in 2020 and the Russian-Ukrainian war in 2022), By analyzing the time series of Iraqi oil (production and prices) separately, and prices and production lines for (Basra and Ceyhan separately and totally) for the extended period (from January-2019 to April-2022) and on a monthly basis using different statistical forecasting methods in terms of stability in production and prices as well as seasonality and forecasting oil prices in the next 2 years where (R) programming language with multi Packages and functions have been used to find best fitted for the selected Box Jenkins (ARIMA) model and studying the homogeneity or heterogeneity of Iraqi oil influence locally by (GDP) and globally on international oil prices, and what are the proposed solutions and decision making to reduce Risks (or losses) and maximize profits as much as and stability in the Iraqi oil policy compared to neighboring countries or the world.

DOI: https://doi.org/10.55562/jrucs.v56i1.46

1. Introduction

Overlapping crises, from conflict to the COVID-19 pandemic to climate change even the Russo-Ukrainian war have created unprecedented challenges for developing countries. Debt-related vulnerabilities, rising inflation, rising energy prices, and food insecurity threaten to reverse development gains. These growing challenges require decisive political action and continued international cooperation on many fronts to ensure better economic conditions in all countries, particularly the poorest.

The year 2020 was unprecedented in living history. Not since the 'Spanish Flu' pandemic 100 years ago has such a crisis hit our planet. COVID-19 was undoubtedly the defining feature of the year. The pandemic hit China hard at the beginning of the first quarter, leading to widespread lockdowns and negatively impacting the economy, as well as the oil market. During the World Economic Forum Meeting in Davos, experts expressed optimism for the global economy in 2020. During the World Economic Forum Meeting in Davos, experts expressed optimism for the global economy in 2020.. However, this positive sentiment was swiftly shattered in February as the virus began to spread worldwide. Hotspots such as Iran and Italy came into focus, and the devastating impact on healthcare systems and human life became clear. Measures such as city-wide lockdowns were implemented to slow the virus's spread. In March, the outbreak reached critical levels in other European countries and the US, while other parts of the world were just beginning to feel the devastation. [1]

In 2013, Ukraine's then-leader put a stop to finalizing a major trade deal with the European Union. This move sparked protests by Ukrainians who favored closer ties with the EU. The result was a change in Ukraine's government in February 2014. Tensions in Ukraine continued to rise with Russia's annexation of Crimea, which led to sanctions by the EU and US. Sadly, the conflict remains unresolved. Military conflicts have economic consequences that impact not just governments, but also families, businesses, and investors around the world. [2]

This paper also addresses the possibility of conflict causing damage to oil-consuming countries or benefiting oil-producing countries in the medium term to economies where stock prices can be used for economic forecasting in the future.

Statistical decision theory is a branch of mathematics that deals with problems that involve uncertainty. It is useful for oil and gas operators who want to make informed exploration decisions that will help achieve their objectives, such as maximizing the expected net present value of Iraqi oil sales. Statistical decision theory guides decision-makers by unpacking the assumptions and judgments underlying each choice. Imagine you're exploring oil production – this theory helps you identify key variables like wars or epidemics, and how they might affect oil prices. These variables and their relationships form the core of your exploration challenges. However, it's crucial to remember that models don't make decisions, people do. Statistical decision theory is a powerful tool to support, not replace, human judgment.

We rely on the statistical analysis of the Iraqi oil sector to give a future vision about optimizing the distribution of revenues in light of the presence of these restrictions as well as political and macroeconomic instability.

This paper shifts focus from the specifics of how statistical decision theory impacts problem analysis. Instead, we'll delve into how statistical methods are used to construct the probabilistic foundation of mathematical models, specifically Box-Jenkins models, for crucial exploration decision problems. [3]

It is essential to have a functional form that can describe the problem of Iraqi oil production and its financial returns. This form is crucial for decision-makers who analyze production and development decisions in the oil sector and plan for future development. The ideal model should be flexible enough to fit a variety of empirical graphs for analyzing and forecasting oil production time series and prices in the next biennium. We can use ARIMA models in Iraqi oil production areas, such as the Basrah oil fields, and export it through the Turkish Ceyhan oil pipelines. By doing this, we can estimate the total sale of Iraqi oil.

2. The topic of discussion is the macroeconomic impact of oil shocks.

It is possible that inflation rates may rise and supply chains may be disrupted in 2022 due to Russia's attack on Ukraine. Additionally, Saudi Arabia's choice not to increase its oil supply to make up for Russia's exports could have a significant impact on the global price of crude oil. [20]

The economic consequences of oil supply, such as a price shock, differ significantly from the shock of oil demand driven by changes in the world.

There are significant differences in economic activity between countries that import oil and those that export energy. Our research reveals that when oil prices rise due to supply issues, oil-importing countries tend to experience a prolonged decline in economic activity. On the other hand, countries that export energy, and have significant oil and gas reserves, tend to benefit from higher oil prices. However, when there is a drop in oil demand, the situation can change. [4]

Many countries are experiencing unrest and long-term instability, despite a rise in real output. Additionally, due to an interest rate shock in the oil market, stock values are declining in all oil-importing nations. The time series below shows the fluctuation in oil prices, including periodic crises from 1970 to 2012.

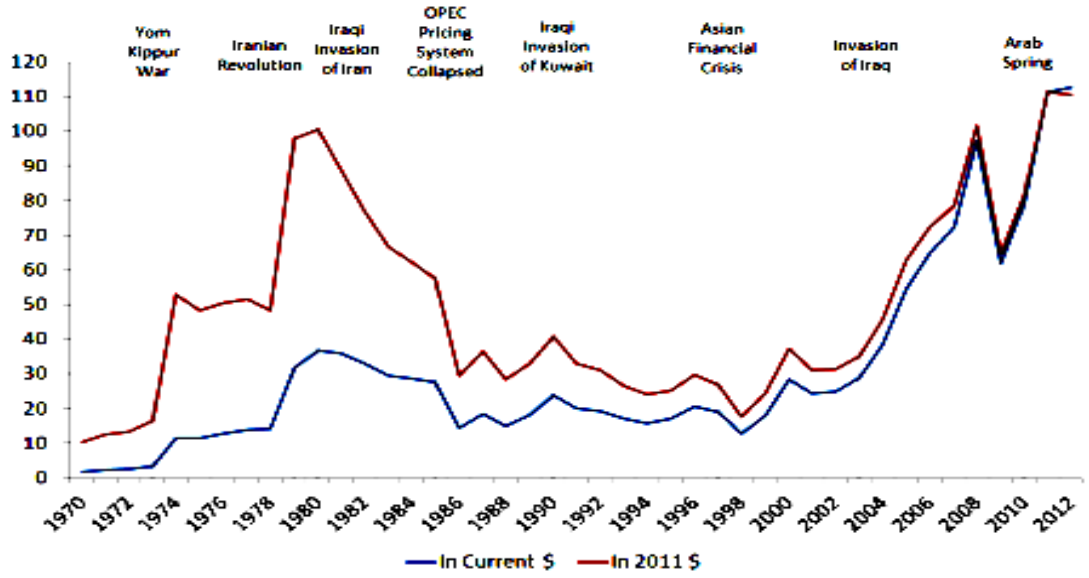

Fig. (1): BP Statistical Review of World Energy and the International Monetary Fund International Financial Statistics collected and analyzed the price of crude oil per barrel from 1970 to 2012.

Table (1): From 1979 to 2010, oil importers had an average consumption rate. The data was sourced from the British Petroleum Statistical Review of World Energy and is organized by country.

Major Importers	Million Barrels/day	Percent of World	Other Oil Importers	Million Barrels/day	Percent of World
China	3.1	4.8	Latin America	2.1	3.3
Euro Area	9.3	14.5	Emerging Asia	2.6	4.0
Japan	4.7	7.4	Rest of the World	3.5	5.5
United States	17.3	26.9	World	64.1	100.0

Saudi Arabia holds the title of being the largest oil producer and exporter globally, with an excess capacity that is also the largest. This gives it a significant position in the global economy as a

swing producer. In the year 1985, Saudi Arabia augmented its oil production from 2 million to 4.7 million barrels per day. Consequently, there was a significant drop in oil prices from $57.61 to $29.62 in today's money terms. To comprehend the broader economic impact of oil shocks on the world economy, it is vital to analyze both the nominal oil prices (in US dollars) and the total volume of oil produced worldwide.

Between 1979 and 2010, the United States consumed an average of about 27% of the world's total oil. This consumption rate is much higher than that of the other three major oil importers, such as China, the Eurozone, and Japan. The combined oil consumption rate of these three major importers is only 26.6%, which is still lower than that of the US.

To differentiate between disruptions in oil supply and shifts in oil demand, we depend on the boundary of impact determined by the elasticity of oil supply prices, which necessitates the occurrence of negative oil supply shocks.

The GDP level of Iraq, the Gulf Cooperation Council countries, and other oil-exporting countries has been negatively impacted due to the increasing oil prices and decreasing global oil production. This has led to a reduction in the real GDP of all oil-importing nations. In order to account for slow responses to quantitative measures like oil production and real GDP, limitations have been imposed for one year following the shock.

It is important to note that the oil supply shock cannot move oil prices or oil production levels and real value and GDP in two opposite directions. However, in the case of oil demand shocks, we need to see an increase in both oil prices and oil production levels. [5]

Table (2) The following table displays the production of crude oil by OPEC based on secondary sources, covering the years 2016 to 2020. You can find the source at https://somooil.gov.iq/exports.

	2016	2017	2018	2019	1Q20	2Q20	3Q20	4Q20	2020	Change 2020/19
Algeria	1,105	1,047	1,042	1,022	1,016	878	840	857	897	-125
Angola	1,718	1,634	1,505	1,401	1,373	1,260	1,211	1,171	1,253	-148
Congo	216	252	317	324	295	296	286	273	287	-37
Equatorial Guinea	160	133	125	117	122	110	112	110	114	-4
Gabon	221	200	187	208	195	201	186	182	191	-18
IR Iran	3,515	3,813	3,553	2,356	2,052	1,949	1,948	1,993	1,985	-371
Iraq	4,392	4,446	4,550	4,678	4,560	4,127	3,697	3,817	4,049	-630
Kuwait	2,853	2,708	2,745	2,687	2,741	2,460	2,245	2,293	2,434	-253
Libya	389	811	951	1,097	348	84	121	916	368	-728
Nigeria	1,556	1,658	1,718	1,786	1,808	1,624	1,468	1,450	1,587	-199
Saudi Arabia	10,406	9,954	10,311	9,771	9,796	9,212	8,766	8,962	9,182	-588
UAE	2,979	2,916	2,986	3,094	3,202	2,880	2,617	2,515	2,802	-292
Venezuela	2,154	1,911	1,354	796	730	501	362	408	500	-297
Total OPEC	31,663	31,484	31,344	29,337	28,238	25,582	23,858	24,946	25,649	-3,688

3. The Impact of Oil Price Heterogeneity on (GDP) in Political Conflict

In 2014, many politicians believed that imposing sanctions would be an effective way to stop the Russian-military conflict. These sanctions put significant economic pressure on Russia. However, the prices of natural resources, including oil, have fallen globally since the fall of 2014 due to slower growth in major industrialized countries, lower growth prospects in key emerging markets such as China and Brazil, and OPEC's decision to maintain a high level. The consistent rise in oil production, notably from non-OPEC nations like the United States driven by technological progress, has shifted the focus toward the interplay of political and economic dynamics in the depreciation of the ruble exchange rate. This downward trend correlates closely with Russia's economic performance.

The stability of the political situation is essential for maintaining a stable economic environment, and drawing a balanced foreign policy helps to create a more inclusive internal

environment that is less prone to tensions and attacks. Other countries' experiences have shown that a stable political situation is closely linked to a stable economic situation. [7]

Gas and oil combined make up more than two thirds of Russia's exports and more than 50% of its government revenue, making it one of the world's major providers of both resources. But the nation hasn't done a great job of diversifying its economy, and because of its strong reliance on oil exports, it is extremely susceptible to changes in oil prices across the world. Prior to the financial crisis, the country's GDP grew at a rate of more than 7% during the years of high oil prices; however, the subsequent expansion has been slow because of the decline in the price of natural resources and the difficulty in luring foreign direct investment. The government has seen a drop in revenue and has been obliged to cut spending as a result of the ruble's depreciation.

This has led to an increase in inflation due to higher import prices. Unfortunately, the manufacturing sector remains uncompetitive in the international market, and non-oil exports have not been able to mitigate the situation. Additionally, Russian banks have faced limitations in refinancing foreign debt, which has further impacted the country's economic stability. To mitigate the situation, the Russian state has started to rely on the reserve funds accumulated during periods of resource price booms.. [9]

Since the end of the Cold War, Ukraine has been facing a range of economic challenges. These include inadequate and prolonged reforms, high levels of corruption, unclear economic policies, an oligarchic industrial structure that favors rent-seeking, and an unfavorable geographical position between Russia and the European Union. Ukraine's heavy dependence on Russia, especially for energy imports, has worsened these problems. Moreover, the country's political elites have shown reluctance to implement policies that would benefit the entire population.

Trade restrictions, for instance, might hurt the penalizing countries as well as raise prices for the destination country. From the standpoint of poor growth, countries with close economic relations have been particularly severely hit. This is the situation at the moment with the US and European sanctions imposed on Russia, and Europe is suffering from rising gas and oil costs. [10]

Crude Oil Price Fluctuations Effect on World Economy in 2021 (Demand and Supply). Since March 2020, crude oil markets have undergone structural changes due to the COVID-19 pandemic. The spread of the virus led to confinement measures that reduced outdoor activities and severely impacted tourism, airlines, and shipping... [16]

The year 2021 witnessed a significant rebound in the global economy after the outbreak of the COVID-19 pandemic. However, the pandemic remained a major challenge throughout the year, particularly with the emergence of new variants such as Delta in the second quarter and Omicron in the fourth quarter of the same year. Where the global economy has gone through a turbulent period since the beginning of the epidemic, while the main uncertainties remained to confirm the recovery during the year, but this came at the expense of the rise in debt globally with the continued global economic recovery supported largely by unprecedented monetary and fiscal stimulus, and most importantly, the recovery remained uneven between economies and within countries throughout the year.

The crude oil markets are currently experiencing turmoil due to war-like situations between Russia, Saudi Arabia and their OPEC allies. In an effort to stabilize the markets, a proposal was made to reduce production. However, Russia, a non-OPEC oil giant, has challenged this proposal by increasing its production and supply. In response to a disagreement over oil production, Saudi Arabia and Russia engaged in an oil price war by increasing their oil output. However, this led to a drastic drop in oil prices, which was further exacerbated by the COVID-19 pandemic. The situation was eventually resolved with the help of international mediation and political intervention. In April 2020, Saudi Arabia and Russia reached an agreement to reduce their oil output, but the oil price war and pandemic have already caused significant damage to the crude oil market. [17]

Economies that have been able to control the epidemic through successful vaccination campaigns and effective containment strategies have the financial potential to recover quickly

through economic stimulus measures. In contrast, economies with limited access to vaccines, unsuccessful containment strategies, and limited financial resources for public funds and monetary stimulus may face more difficulties. In 2021, the US and China were at the forefront of the global recovery, with other OECD economies also recovering well, albeit at a slower pace. This includes the euro zone and Japan, which implemented significant lockdown measures throughout the year. Iraq has faced a serious challenge in terms of health and economy due to the drop in oil prices, which has put great pressure, especially on the private sector. Additionally, the high death rate compared to the number of injuries has had a significant impact on Iraq's recovery, in contrast to the countries of the Arab Gulf. These countries saw a weak impact on their recovery throughout the year. Low-income economies in Latin America, Africa, and Asia were among the lagging economies in the global recovery. [15]

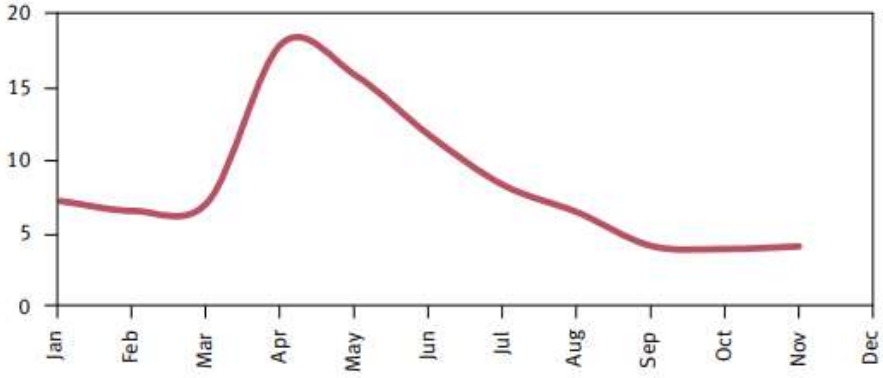

Fig. (2): Global industrial production in 2021(source: Netherlands Bureau for Economic Policy Analysis and Haver Analytics)

Recently, there has been a rise in crude oil spot prices due to geopolitical tensions in Eastern Europe and concerns about potential shortages of oil supply amidst trade turbulence. OPEC's record basket price has gone up by $19.53, a 20.8% increase, leading to a closing price of $113.48 per barrel. This uncertainty surrounding oil supply and demand has resulted in high volatility in oil futures prices. The first month of 2022 saw Brent ice increasing by $18.36, a 19.5% increase, with an average price of $112.46 per barrel, while West Texas Intermediate crude in New York rose by $16.63, an 18.1% increase, with an average price of $108.26 per barrel. This has widened Brent/WTI crude futures by $1.73 to $4.20 per barrel. It's worth noting that the market structure of the three major crude oil benchmarks (ICE Brent, NYMEX WTI, and DME Oman) has remained in steep decline..

According to the latest assessment, the world economic growth rate for 2022 has been revised downwards from 4.2% to 3.9%. This revision takes into account the impact of the ongoing pandemic and the conflict in Eastern Europe. The assessment also indicates that the risks associated with these factors are skewed towards the downside.

In the previous month's assessment, the world economic growth rate for 2021 was predicted to be 5.8% but there has been a slight revision to this number. The US GDP growth rate for 2022 has been revised downwards to 3.8% from 4%, after recording a growth rate of 5.7% for 2021.

The growth rates of the Eurozone, China, and India's GDP have been revised recently. The Eurozone's growth rate for 2022 has been lowered from 3.9% to 3.5%, while China's growth rate for 2022 has been adjusted from 5.6% to 5.3%. However, China has recorded an 8.1% growth in 2021. On the other hand, India's GDP growth rate for 2021 is reported at 8.1%, and the forecasted growth rate for 2022 remains at 7.2%.

Russian growth rate in 2022 has been revised downwards to show a contraction of 2%, after the reported 4.7% growth in 2021.

Global oil demand growth in 2021 was revised slightly down by 0.04 million barrels per day, reflecting actual data across the United States.

The global demand for oil is currently at 5.7 million barrels per day. There is a need for a downward review of this figure, while the 2020 boundary should be upwardly reviewed. In 2021, there was a growth of 2.6 million barrels per day in oil demand in OECD countries, and a growth of 3.1 million barrels per day in non-OECD countries. However, for 2022, the global oil demand growth has been revised downward by 0.5 million barrels per day to 3.7 million barrels per day. This is mainly due to a downward revision in the global economic growth. It is expected that oil demand growth will reach 1.9 million barrels per day in OECD countries.

In non-OECD countries, the daily consumption of oil is estimated to be around 0.8MB. In 2021, the global production of oil increased by 0.1 million barrels per day compared to the previous year, with Canada, Russia, and China experiencing the largest growth. However, the production is believed to have reduced in the UK, Brazil, Colombia, and Indonesia during the same period. The United States, Russia, and Brazil are expected to be the primary contributors to the liquid supply growth in 2022, with an average of 5.1 million barrels per day and 5.3 million barrels per day, respectively. In March, OPEC 13 crude oil production increased by 57 TB/day, month on month, with an average of 28.56 MB/day. [18]

- **The Impact of the 2022 Russia-Ukraine Conflict on Global Economics**

The 2022 conflict between Russia and Ukraine had a negative impact on global stock indices, but the effects were mixed. Economic globalization, as measured by GDP, showed a negative correlation with returns from this conflict. However, markets in NATO countries displayed higher returns due to expected economic stimulation for military readiness. These results suggest that more globalized economies are more susceptible to international conflict, although there is significant variation..

Global statistics were significantly impacted negatively by the conflict, although the Russian economy and the ruble's value relative to the dollar were positively affected. On the other hand, the overall impact was primarily detrimental to the US, the Middle East, and global capital markets. NATO member states benefited from the post-conflict era since there were hopes for economic stimulus from the military buildup. Investors realised that conflict would impact the overall prosperity of nations, driving up the cost of commodities used in manufacturing, such as wheat and iron. UN economic sanctions are to blame for this effect, and the economies of some European nations will be impacted differently than those of Russia and the rest of the globe.. [6]

The price of oil has risen in the past year, reaching its highest level in eight years. This is due to the ongoing tension between Russia and Ukraine. If the tension escalates, the price of oil may increase even further, which could cause shock waves throughout the United States. Analysts predict that US stock indices will remain unpredictable during this conflict, while economists fear that rising commodity prices will reduce the amount of money available for discretionary spending. If the price of oil were to reach $110, the annual inflation rate could rise above 10%. This has not happened since 1981, when inflation reached 10%. Inflation is currently the biggest problem facing the US economy. The rise in the prices of metals like niobium and palladium is also causing fears of inflation in the United States. [21]

- **The Impact of Crises on Global Gross Domestic Product (GDP) and its Relation to the Oil Sector**

Despite ongoing COVID-19 challenges in 2021, the global economy showed resilience with a 5.6% GDP growth. This was driven by strong performances in several regions: the US (5.7%), the eurozone (5.2%), China (8.1%), and India (8.8%). Russia and Brazil saw more modest growth at 4% and 4.7%, respectively.

The global oil market mirrored this positive trend, experiencing an impressive recovery. Increased global mobility due to relaxed lockdowns fueled a strong demand for oil, resulting in a daily growth of 5.7 million barrels.In response to the unprecedented events and the terrible impact of COVID-19, crude oil production underwent significant and lasting adjustments in 2020. The participating countries have agreed to meet regularly throughout 2021 to respond quickly to any

changes during the recovery period. It has been decided that 2 million barrels per day will be gradually returned to the market, with the speed of this process being determined by market conditions. Saudi Arabia has also agreed to a major additional voluntary supply adjustment of 1 million barrels per day, starting from February 1, which has been extended for three months. This decision has helped in supporting market stability. Several countries have made up for the compensation deficit throughout the year. [8]

Iraq's economy is bouncing back after a rough patch caused by COVID-19. The overall economy (GDP) grew by 1.3% in 2021, recovering from a steep 11.3% decline in 2020. This rebound is driven by a surge in non-oil sectors like transportation, hotels, and shops, which expanded by 6% in the first nine months of 2021. However, agriculture and construction took a hit, shrinking by 17.5% and 36.8% respectively. This was due to a combination of factors like droughts, power cuts, and rising global costs for materials. Meanwhile, oil production followed OPEC+ agreements, leading to a 4% contraction in oil GDP during the first three quarters of 2021. Inflation also rose in 2021, averaging 6% for overall prices and 6.6% for core prices. This increase came after a currency devaluation in December 2020 and a pick-up in domestic spending.

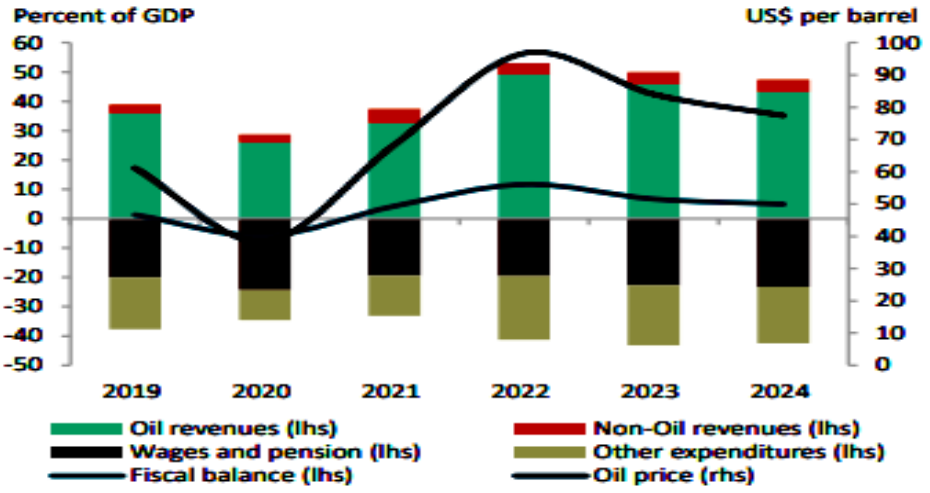

Fig. (3): Shows Iraqi Fiscal account outlook (source: The World Bank Group, 2022, "Iraq Economic Monitor", World Bank Group- Macroeconomics, Trade & Investment)

The improvement in the oil market has significantly boosted Iraq's economic outlook for the future. The projected growth for 2022 is 8.9%, and it is expected to continue as OPEC+ quotas end and Iraq's oil production surpasses the pre-pandemic level of 4.6 million barrels per day. However, growth in the outer years is expected to be modest, averaging at 3.7%, as oil production moderates. Non-oil GDP growth is expected to align to its long-term potential growth trend, mainly due to increased investments that will be financed by the oil windfall. However, the economic growth is projected to continue to be limited by the country's limited absorptive capacity and other inefficiencies. [18]

Global changes such as the outbreak of wars and the increase in man-made disasters are the primary threats to sustainable development. These changes are embodied in the energy crisis which is linked to changes in the balance of supply and demand of energy resources. Due to the advancements in the development of oil and gas production technologies, these crises result in significant changes in industry indicators, which in turn affects the system of state regulation. This also affects the level of state support for individual sectors of the economy. [19]

There is some relationship between oil prices and industry, but there is a need for integrated policies to limit the consequences of low oil prices on Iraq. New integration and modeling methods must be created to help us forecast Iraqi oil prices in the future.

4. The media Effect on the Iraqi oil economy

To assess the impact of oil price sanctions on the development of the economy, in addition to static data, we use evidence based on information from the media, since this data corresponds to the

daily frequencies of exchange rates and oil prices, the analysis can be carried out over fairly short periods of time without facing Degrees of freedom problems. Information from the media also makes it possible to separate the expected and unexpected outcomes of policies, that is, whether the sanctions actually implemented are more or less severe than initially anticipated. Due to the constantly growing number of Iraqi news and news channels, such as blogs, tweets and newsletters, which unfortunately, the majority publish misleading or incorrect information that reflects on the Iraqi reality, many of these channels and social networking pages rely on unreliable automated searches and this is applied Methods are widely used to predict oil prices or the impact of disasters, wars and epidemics, on business cycles and financial markets. The most important thing is that since 1992 The Economist has published the R Word indicator for early detection of a turning point in economic cycles. The index counts the number of times the word "recession" appears in the New York Times and the Washington Post, for example. [14]

5. Statistical applications in the fields of energy, production

The issue of production, which is a major part of this research, needs the political will and government commitments necessary to advance projects and programs to improve energy use, and these plans are usually long-term and work to establish solid infrastructure to establish integrated industrial cities through foreign relations, openness to the world and curbing corruption. This has stifled the economy and all its branches and left significant negative effects, especially on the limited income. [3]

The basic condition for statistical forecasting is the condition of stationary. Without this condition, the results are incorrect at most (inaccurate). For example, using of prediction method to forecast electricity consumption in Sulaimani province, we noticed that the time series of electricity consumption witnessed a decline in an orderly manner, but it started to recover in recent months. Therefore, fluctuations in electricity consumption generate inconsistency in electricity consumption discrepancies; the government must expect these occasional or irregular impacts on electricity consumption, depending on statistical methods. Appropriate methods of forecasting anticipate these prices before they occur, allowing the government to formulate its policies before such crises arise and to develop appropriate solutions without resorting to temporary solutions.

The statistical prediction gives a future vision in addition to the possibility of controlling the problem and developing solutions to it through modeling the problem.

- **Data Analysis and methodology**

In this study, we evaluate the effects of pandemics and wars on oil prices on both the crude oil futures and spot markets. The time series data in this study were Iraqi oil production and prices both separately from January 2019 to April 2022, the data analysis was performed using ARIMA (Automatic Regression Moving Average) by using three packages in R programming language (fpp2, t-series and forecast package) codes, The appropriate forecast technique and the most appropriate prediction interval were chosen by taking into account the smallest value of AIC, The result of the study showed that the ARIMA model was the best model for finding the most appropriate monthly forecast period, The forecasts for the ARIMA time series models will be useful for the of the Energy and production systems so that the system (R) programming language has been used to find coefficients that are best fitted for the selected ARIMA model with multi Packages and functions.

The general ARIMA equation is given by:

$$\hat{y}t = \mu + \phi 1\, yt\text{-}1 + \ldots + \phi p\, yt\text{-}p - \theta 1 et\text{-}1 - \ldots - \theta q et\text{-}q \quad (1)$$

The moving average parameters (θ) are defined with negative signs in the equation, as per the convention introduced by Box and Jenkins. However, some authors and software, including the R programming language, define them with plus signs instead. When actual numbers are used in the equation, there is no ambiguity. However, it's essential to know which convention your software

uses when reading the output. Often, the parameters are denoted as AR(1), AR(2), ... and MA(1), MA(2), ... etc..

ARIMA models are commonly used in time series forecasting to identify and analyze the autocorrelations in the data. The acronym "ARIMA" itself is descriptive and captures the key aspects of the model. In brief, the model has three components:

- AR: Auto regression, which uses the dependent relationship between an observation and some number of lagged observations.

The ARIMA model consists of three components: Integrated (I), Moving Average (MA), and Autoregressive (AR). In order to make the time series stationary, differencing of raw observations is used in the Integrated component. The Moving Average component uses the dependency between an observation and a residual error from a moving average model applied to lagged observations. Each of these components are explicitly specified as parameters in the model. The standard notation used for ARIMA is (p,d,q), where p, d, and q are substituted with integer values to indicate the specific ARIMA model being used.

The ARIMA model's parameters have specific definitions which are as follows:

- p: The number of lag observations included in the model, also known as the lag order.
- d: The number of times the raw observations are differenced.
- q: The size of the moving average window, also known as the order of moving average.

To choose the appropriate values for p, d, and q, the algorithm minimizes AICc. The algorithm uses a stepwise search to traverse the model space to select the best model with the smallest AICc.. [12]

To develop a Box-Jenkins model, we need to follow a set of steps. The first step is Model Identification. This involves using plots and summary statistics to identify trends, seasonality, and autoregression elements. Based on this analysis, we can get an idea of the amount of differencing and the size of the lag that will be required.

It's important to note that the first step in this process is to determine whether the data is stationary or not. If non-stationarity exists, we can model it by differencing it to an appropriate level of difference.

1. To determine the parameters p and q of the ARMA (p, q) model for a non-stationary time series, the next step is to use two diagnostic plots: the autocorrelation function (ACF) and partial autocorrelation function (PACF). These plots help with identifying the values of p and q.
2. Model checking is an essential step in statistical modeling. It involves using plots and statistical tests to assess the accuracy of the model and identify any temporal structures that the model may have missed. During this process, several assumptions of the model are tested, such as whether the model parameters achieve statistical significance or multi-collinearity, and whether the residual term white noise is present. The adequacy of the model is tested using Ljung-Box tests, and the residuals are plotted to examine the autocorrelation. These steps are repeated until the required level of adequacy is achieved. [13]

- **Assumptions of ARIMA Model**

1. Prior to ARIMA (Autoregressive Integrated Moving Average) analysis, it's essential for the data to be stationary. Stationary data refers to a series where statistical characteristics like mean, variance, and correlation remain constant regardless of when the data is observed. Stationary series can encompass white noise series as well as those exhibiting cyclic behavior.
2. It's worth emphasizing that ARIMA analysis operates on a single variable since it relies on auto-regression, a regression technique utilizing past values of the same variable.. [11]

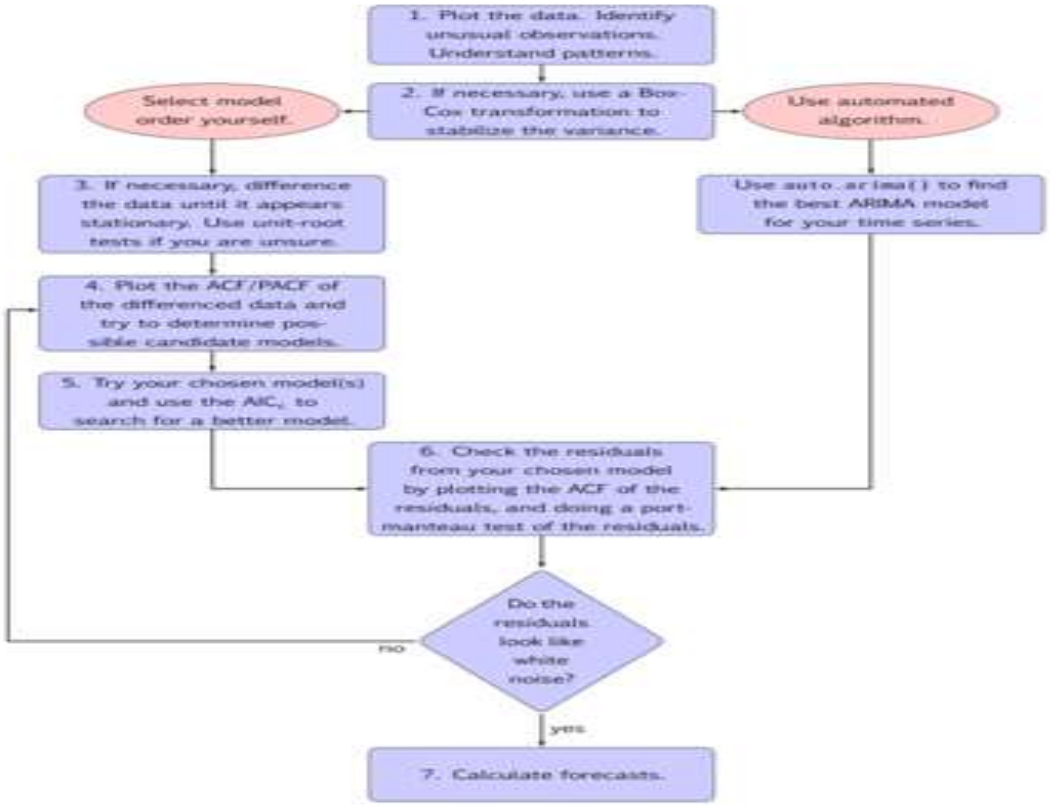

Fig. (4): Represent the flow chart of Box-Jenkins Model

The first step in analyzing the time series is to draw it to know its behavior and the fluctuations that it suffers from, in order to get a preliminary idea of the nature of the time series of oil prices.

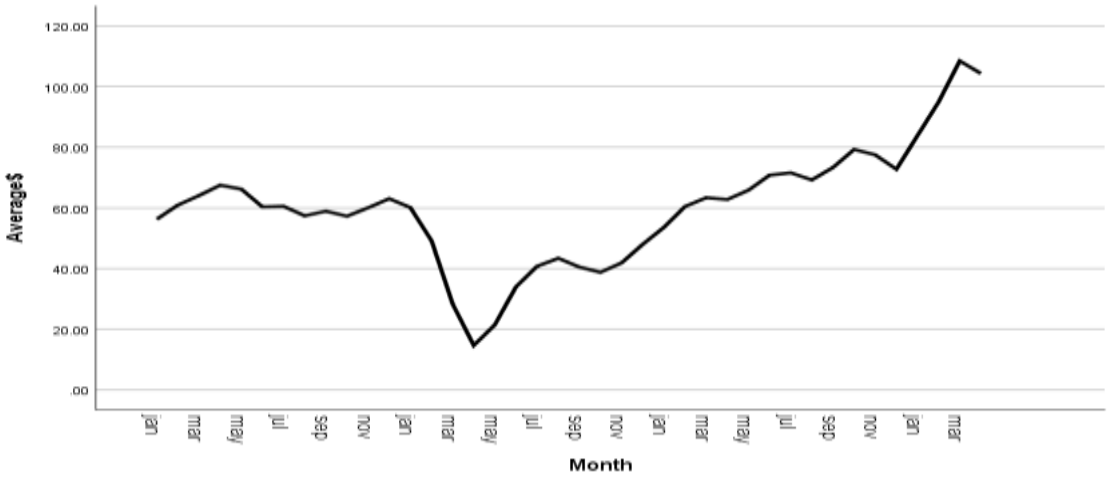

Fig. (5): shows the Average Iraqi oil prices for the period (Jan-2019 to Apr-2022) on a monthly basis

From the above figure, we note that the price of Iraqi oil suffers from large fluctuations as a result of the Corona pandemic, with a sharp decline, especially in the third and fourth month of the year 2020, as well as the Russian-Ukrainian war at the end of the second month of the year 2022, where oil prices were on a continuous rise.

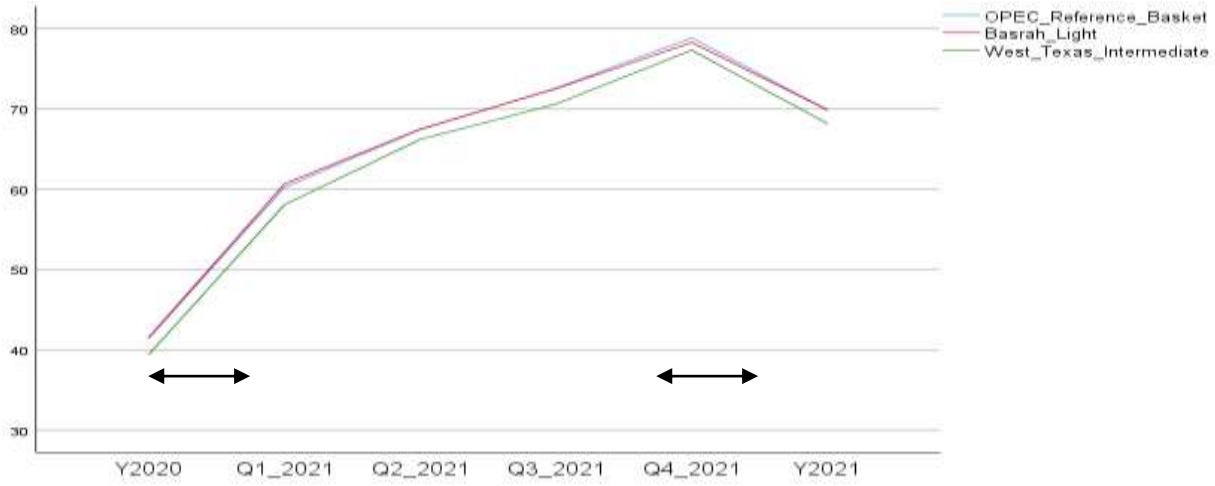

Fig. (6): Shows Basra light, OPEC basket and West Texas Oil Prices by (2020-2021) quarter-year

Through the above figure, we notice that there are no significant differences between the price of Basra Light oil with the OPEC basket and slightly higher than West Texas oil. To test this, we can use the F-test to test the following hypothesis:

H0: There are no significant differences between Basra light, OPEC basket and West Texas Oil Prices

H1: There are significant differences between Basra light, OPEC basket and West Texas Oil Prices

Table (6): shows the ANOVA table of Basra light, OPEC basket and West Texas Oil Prices

S.O.V.	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.579	2	6.290	.037	.964
Within Groups	2564.945	15	170.996		
Total	2577.524	17			

From the above table and the value of significance (0.964) of F test, the null hypothesis (H0) is the accepted one, that is, there are no significant differences between Basra light, OPEC basket and West Texas Oil Prices in (2020-2021) quarter-year duration.

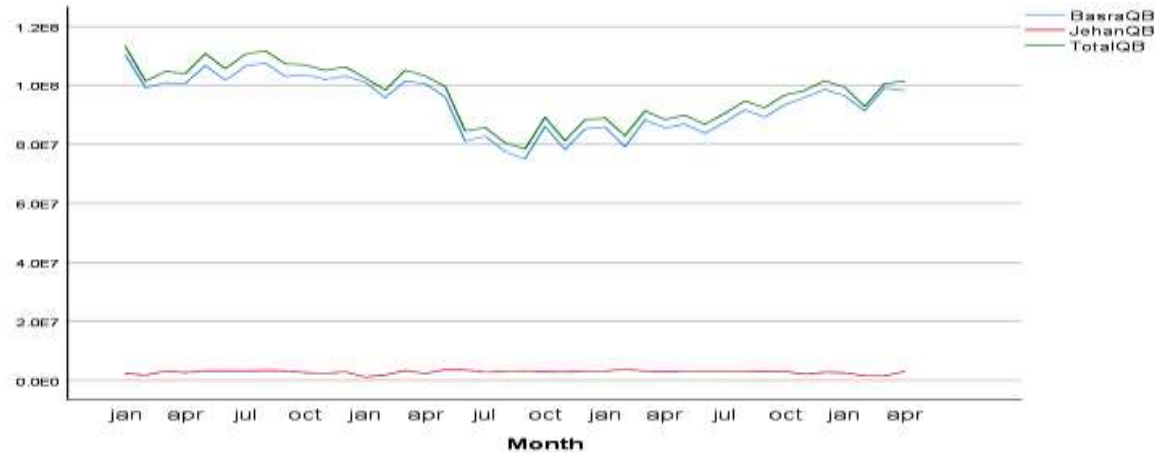

Fig. (7): shows the Iraqi oil production from the Basra, Ceyhan and total oil fields for the period (Jan-2019 to Apr-2022) on a monthly basis

From the above figure, we note that Iraqi oil production depends mainly on the Basra fields and to a very small extent on the Ceyhan pipeline.

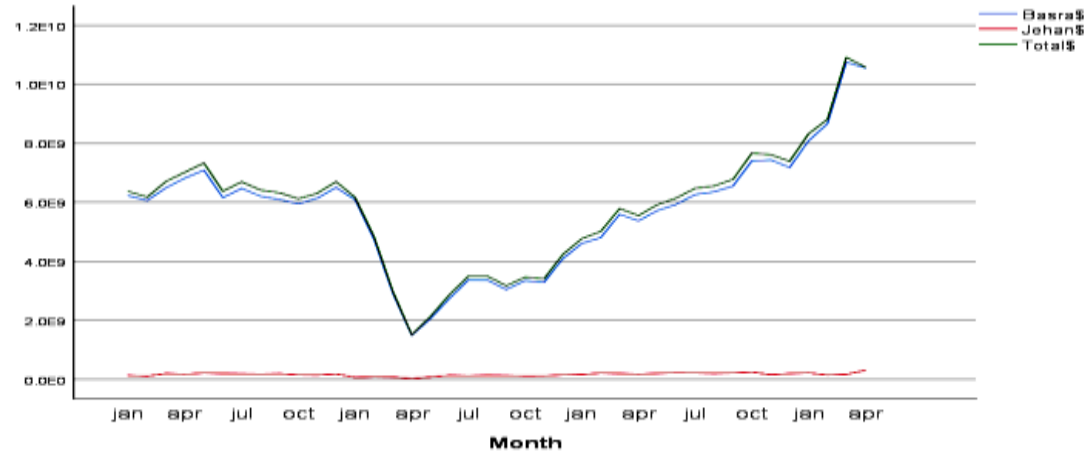

Fig. (8): shows the Total Iraqi oil prices from the Basra, Ceyhan and total oil fields for the period (Jan-2019 to Apr-2022) on a monthly basis

Through the above figure, we notice that the price of Iraqi oil suffers from high fluctuations, which appears on the production of Basra oil, because Iraq produces large quantities of those wells that are close to the total production, and this appears from the convergence in the behavior of the Basra oil production chain with Iraq's total production, while this does not appear in The production of the Ceyhan pipeline due to the weak production in it compared to Basra oil as a result of the Corona pandemic, a sharp decline, especially in the third and fourth month of the year, as well as the Russian-Ukrainian war at the end of the second month of a year, when oil prices were constantly rising.

- **Exploratory analysis**

A time series is a collection of historical values for the variable under prediction. This approach, which is often referred to as naïve approaches, is made up of four parts: This is the real data plot, observed; trend, which shows how the data points have generally moved upward or downward; Seasonal data refers to any monthly trend in the data points, whereas Random data indicates the portion of the data figure that cannot be explained.

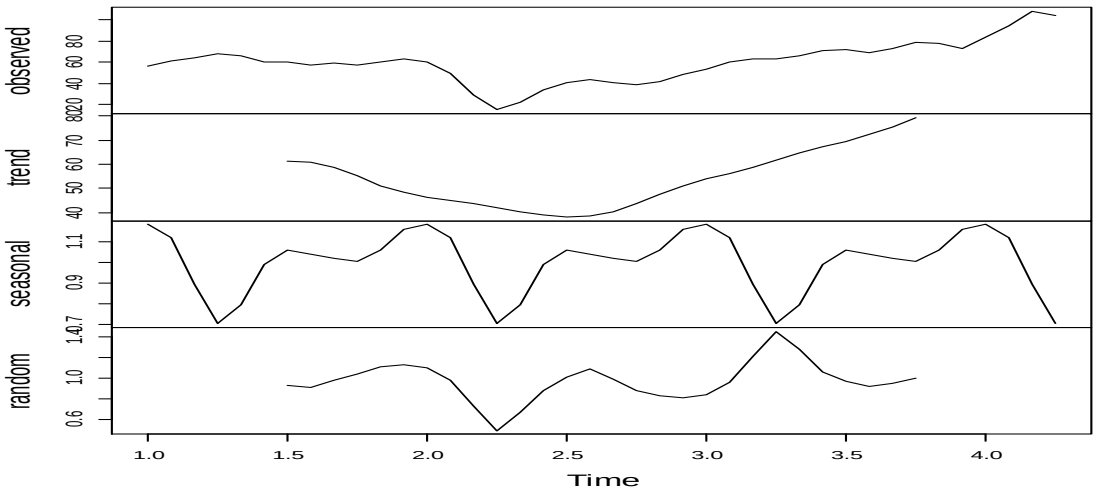

Fig. (9): displays the time series analysis of the average monthly price of Iraqi oil into the four components for the period (Jan. 2019 to Apr. 2022).

- **Choosing the best model**

In R software, the estimation of ARIMA models relies on Maximum Likelihood Estimation (MLE). This approach aims to maximize the log-likelihood given values for p, d, and q, enhancing the likelihood of reproducing the observed data. Akaike's Information Criterion (AIC) is employed to compare models, with preference given to those exhibiting the lowest AIC values. Similarly, Schwarz Bayesian Information Criterion (BIC) aids in model selection by favoring lower BIC

values. MLE may lead to overfitting as additional parameters can inflate likelihood, yet BIC addresses this by penalizing model complexity. Besides AIC and BIC, it is imperative to scrutinize coefficient significance when deciding whether to incorporate specific components into the model.

We need three variables: p, d, and q. These are non-negative integers that correspond to the autoregressive, integrated, and moving average components of the model, respectively, once it has been confirmed that the data satisfies all modelling assumptions. An ARIMA (0,1,2) model was determined to be appropriate for the dataset ranging from January 2019 to May 2022 through examination against Akaike's Information Criterion criteria and Bayesian Information Criteria (BIC) criteria...

Coefficients:

	ma1	*ma2*
	0.8444	*0.5028*
s.e.	*0.1408*	*0.1830*

sigma^2 estimated as 28.72: log likelihood=-120.27

AIC=247.22 BIC=251.53

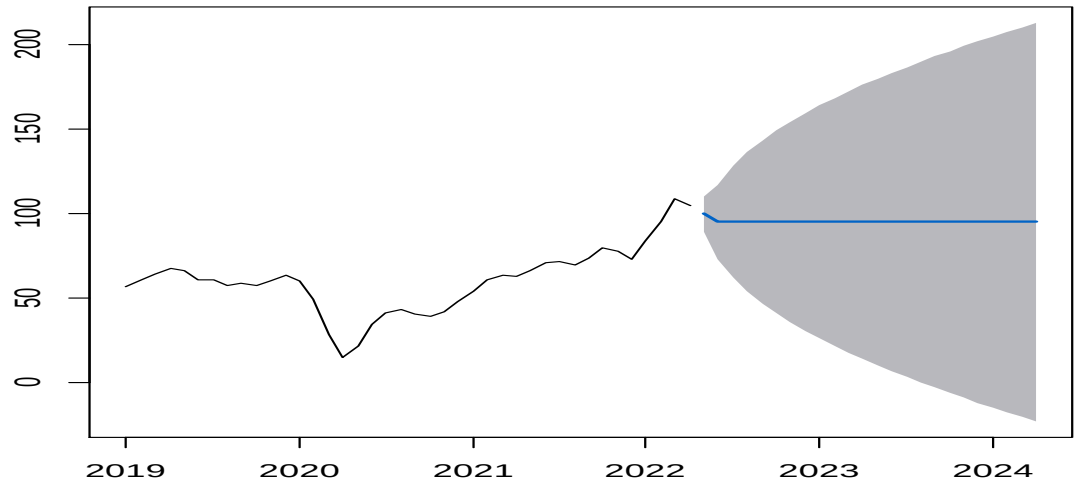

Fig. (10): This depicts the observed and predicted time series data of the monthly average Iraqi oil prices up to the year 2024, employing an ARIMA model.

The chart illustrates forecasts displayed as a blue line, accompanied by 80% and 95% prediction intervals delineated by dark and light-shaded regions, respectively. While the data points demonstrate a steady trend without abrupt declines, they do exhibit seasonality. To delve deeper into this pattern, an analysis is required to pinpoint the precise stationary and seasonality aspects within the data.

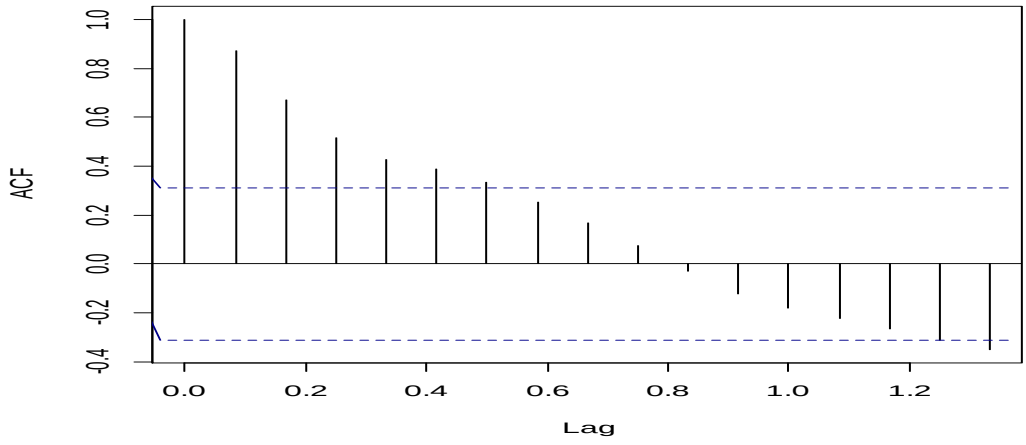

Fig. (11): This presents the autoencoder operate of the monthly average Iraqi oil price spanning from January 2019 to April 2022.

Information on the autocorrelation at all conceivable lags is provided by the autocorrelation function. Since the autocorrelation value indicates the correlation between the data and itself, it is always set to 1. The graph shows that there is no linear relationship between data separated by greater lags, as seen in the picture below, with the autocorrelation decreasing as the lag grows.

From the autocorrelation function figure presented, it's evident that the time series of Iraqi oil sales is non-stationary, as indicated by the presence of a trend. Furthermore, the partial correlation function within the same figure reveals that the first and second lags exceed acceptable limits. This suggests that the parameter for the ARIMA model is (2), which is supported by the figure below..

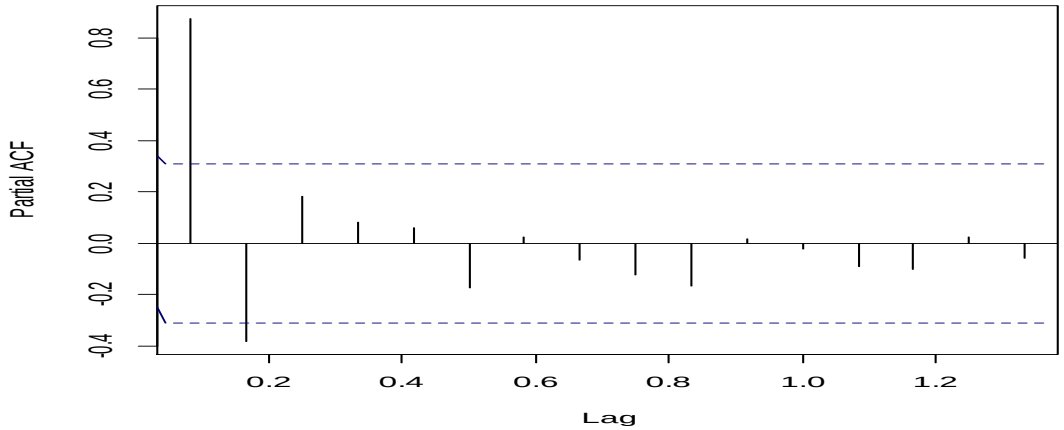

Fig. (12): The graph displays the partial autocorrelation function of the monthly average Iraqi oil price from January 2019 to April 2022.

It is imperative to confirm that the prediction errors are uncorrelated, follow a normal distribution with zero mean, and have a constant variance. Diagnostic tools can help find the best model and guarantee the most accurate predicted results.

Box-Ljung test

p-value = 0.6546, df = 5, and X-squared = 3.2949

.Since the p-value is negligible, there is no autocorrelation in the model

Fig (13): The box plot illustrates the monthly average Iraqi oil price spanning from 2019 to 2022.

Observing the seasonal effects in the figure, it's apparent that the months with the highest volatility in oil prices are the third and fourth months within the study period. Several variables can be attributed to this volatility, such as the rapid decrease in oil prices that followed the start of the COVID-19 pandemic in early 2020. as well as fluctuations resulting from the Russian-Ukrainian conflict, particularly noticeable from the beginning of the third month or slightly earlier. This phenomenon exemplifies the heterogeneity discussed in the research title.

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
14.64	48.93	60.51	60.15	69.63	108.50

From the above table, we note that the lowest price of oil sold by SOMO is (14.64) and the highest sold price is (108.50) and that the average selling price of Iraqi oil is (60.15) during the extended study period (2019-2022).

6. Conclusions

The sustainability of life is affected differently by wars and pandemics, which are episodic effects that can happen unexpectedly. The oil sector is one area where this is especially true, as the nation's heavy reliance on oil exports leaves it extremely sensitive to fluctuations in global oil

prices. Therefore, the Time series of Iraqi oil production and prices (production of Basra and Ceyhan oil fields and Iraq's total production and its prices) were analyzed in cases of wars and epidemics and their impact on the reality of Iraq locally and globally, which suffers from sharp fluctuations as a result of periodic accidental factors. Moreover, through the statistical analysis of the Iraqi oil price series from January 2019 to April 2022 using Box Jenkins models (ARIMA models), through the tables and figures of this paper, it can be noted that it is nonstationary and suffers from seasonality due to its association with episodic variables such as epidemics and wars or supply And demand Oil prices will remain high (Ranging around 100$) in the coming period cause Russia-Ukraine war It transcends a mere conflict between two nations; it's a crisis with ramifications that extend globally., It is experimental. Examining the diversification hypothesis, which proposes that developing a forward-looking vision can foster economic growth in Iraq over the next five or ten years, our research confirms the important role of the oil sector in driving the country's economic expansion. However, our findings also reveal that the relationship between oil and the Iraqi economy is characterized by unstable and nonlinear effects, with the impact of oil prices varying across different systems. The exchange rate of the Iraqi dinar and the political dynamics within the oil market contribute to both homogeneity and heterogeneity within the Iraqi oil sector.

7. Recommendations

Through this paper, we recommend making the following points

1. With our expectations of the Iraqi future vision, we support the transformation of the economy and the opening of the stock market and transforming it from unstable to stable by determining the positive and important impact of foreign investment and the entry of solid companies (especially Chinese companies) to contribute to the development and improvement of the Iraqi economy. Moreover, this diversification path will stimulate a beneficial oil effect on the economy.
2. Iraqi oil policy be balanced and stable, and unstable oil revenues be transferred to stable by establishing a sovereign fund that will keep Iraq away from loans, whether external or internal, and the establishment of integrated industrial cities to be distributed to Iraqi cities, especially those suffering from the problem of unemployment (such as the governorates of Al-Muthanna, Maysan and Dhi Qar)
3. Deducting a percentage of the oil revenues to establish the green belt in central and southern Iraq, especially the areas that suffer from the problem of desertification as well as climate change before it is too late.
4. Urgent attention to Basra Governorate and its infrastructure, as it is the economic lung of Iraq through the establishment of a modern city with an integrated water network, a special medical city for chronic diseases, recreational complexes, and parks, by deducting part of the oil revenues as if they were. The 1 percent reduction in pollution around oil wells and the interest in agriculture and palm replanting was previously the establishment of at least one dam and artificial lakes.
5. The Ministry of Oil and the Iraqi government must have a vision for the next five years of how to develop the oil sector through an optimal production policy by exploring new fields, producing or establishing an internal refinery or intensifying the gas emitted from oil fields and paying more attention to the gas sector with a policy parallel to the oil policy developed over the long term.

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مجلة كلية الرافدين الجامعة للعلوم (2024)؛ العدد 56؛ 515- 533

AL- Rafidain University College

PISSN: (1681-6870); EISSN: (2790-2293)

مجلة كلية الرافدين الجامعة للعلوم

Available online at: https://www.jrucs.iq

JRUCS

Journal of AL-Rafidain University College for Sciences

تباين تأثير النفط العراقي على المصلحة العالمية والمحلية في الحروب والأزمات الوبائية

عباس كلمراد بك مراد	غيث حميد مجيد
abbas.beg@univsul.edu.iq	gayath.edbs@uomustansiriyah.edu.iq
قسم الإحصاء والمعلوماتية، كلية الإدارة والاقتصاد، جامعة السليمانية، السليمانية، العراق	قسم الرياضيات، كلية التربية الأساسية، الجامعة المستنصرية، بغداد، العراق

سهاد احمد احمد

suhad.a.a@ihcoedu.uobaghdad.edu.iq

قسم علوم الحاسوب، كلية التربية ابن الهيثم، جامعة بغداد، بغداد، العراق

المستخلص

يعتبر العراق من الدول التي تعتمد بشكل أساسي على إنتاج النفط، لذا فإن تخصيص إيرادات هذه الموارد في مختلف القطاعات والمجالات داخل البلاد هو المشكلة الأكبر. وتأتي أهمية هذا البحث من أهمية هذا القطاع من حيث الإنتاج والأرباح (في الحروب والأوبئة والأزمات) وتأثيره على سوق النفط العالمي والاقتصاد الدولي، ويبحث هذا البحث في تأثير التغيرات في إنتاج النفط وقيمته. على النمو الاقتصادي في العراق لتقييم مدى اعتماده على قطاع النفط الخام. وكذلك على الاقتصاد العراقي المحلي لتسليط الضوء على الحالتين (وباء كورونا عام 2020 والحرب الروسية الأوكرانية عام 2022)، وذلك من خلال تحليل السلاسل الزمنية للنفط العراقي (الإنتاج والأسعار) على حدة، وأسعار وخطوط الإنتاج لعام 2020. (البصرة وجيهان بشكل منفصل وكلي) للفترة الممتدة (من كانون الثاني-2019 الى نيسان-2022) وبشكل شهري باستخدام طرق التنبؤ الاحصائية المختلفة من حيث استقرار الانتاج والأسعار كذلك كالموسمية والتنبؤ بأسعار النفط خلال السنتين القادمتين حيث تم استخدام لغة البرمجة (R) ذات الحزم والوظائف المتعددة لإيجاد الأنسب لنموذج Box Jenkins (ARIMA)) المختار ودراسة تجانس أو عدم تجانس تأثير النفط العراقي محليا من خلال (الناتج المحلي الإجمالي) وعالميا على أسعار النفط العالمية، وما هي الحلول المقترحة واتخاذ القرارات لتقليل المخاطر (أو الخسائر) وتعظيم الأرباح بقدر واستقرار السياسة النفطية العراقية مقارنة بدول الجوار أو العالم.

معلومات البحث

تواريخ البحث:

تاريخ تقديم البحث:20/2/2024
تاريخ قبول البحث:12/4/2024
تاريخ رفع البحث على الموقع: 31/12/2024

الكلمات المفتاحية:

فيروس كورونا، الصراع الروسي الأوكراني، الناتج المحلي الإجمالي، تقنيات التنبؤ، نموذج ARIMA، حزمة توقعات fpp2.

للمراسلة:

غيث حميد مجيد
gayath.edbs@uomustansiriyah.edu.iq

DOI: https://doi.org/10.55562/jrucs.v56i1.46