Measuring and analyzing the impact of changes in oil prices on monetary variables in Iraq for the period (1990-2020)*

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Abstract

Standard models are a quantitative expression of the theoretical relationships between variables, and this research will deal with the standard quantitative aspect to prove the research hypothesis by measuring changes in oil prices on some monetary variables (exchange rate, money supply in the narrow sense, money supply in the broad sense, inflation rate) in Iraq during the period 1990-2020 by using modern standard and statistical methods and methods, as well as recognizing the characteristics and nature of time series data used by conducting some tests, including static and co-integration tests, and applying models such as the slowdown model, the error correction model, and others.

Keywords: oil prices, monetary variables, Iraq.

Introduction

Crude oil price changes are one of the external economic variables that are affected by the external conditions of the oil-producing or importing countries of the world, as most industrialized countries depend on oil products to liberate energy. The 1973 crisis, then the 1980s and 1990s crisis, the 2008 crisis, the discovery of shale oil, and the Covid-19 crisis. All of these crises contributed to the occurrence of oil shocks, which were reflected in a downturn in the Iraqi economy, and that all the measures taken by the monetary policy makers were poor due to the underdevelopment of the monetary sector in Iraq, and the government controlled all the decisions of the monetary authority even after the independence of the Central Bank in (2004) . Therefore, this research will address the impact of changes in oil prices on some monetary variables in Iraq for the period from 1990-2020. The research was divided into three sections to conclude the research in the sources approved by the official authorities in Iraq or international organizations.

*. The research is extracted from a master's thesis of the first researcher.

Research importance

The importance of the research lies in the extent of the impact of changes in crude oil prices on monetary economic variables, in addition to focusing on a group of political, social and economic circumstances that greatly affect crude oil prices, especially in times of economic crises that generate those shocks.

Research problem

The research problem can be summarized by the following question, which is whether changes in global crude oil prices have a significant impact on monetary policy changes in Iraq

Research Hypothesis

The research stems from the following hypothesis, which is that changes in crude oil prices affect monetary variables in the Iraqi economy.

Research objective

The research aims to identify the changes in crude oil prices and their reflection on the monetary policy variables in Iraq and to explain the reality of the relationship between them and analyze them by economic analysis in order to reach the possible treatments.

Research Methodology

The researcher relied on the standard and analytical approach, as he dealt with research and analysis to reach the most important treatments that can be applied after the occurrence and impact of shocks in oil prices.

first topic

The concept of crude oil, its importance and types of oil shocks

First requirement. The concept and importance of global demand for crude oil

The International Energy Agency defines the global demand for oil as (consists of the obligations of distributors towards consumers of crude oil and represents the quantities of crude oil that a person needs at a certain level and in a specific period of time for the purpose of satisfying basic needs, whether they are consumer, production, oil or petrochemical products), The global demand for crude oil is a demand derived from the global demand for oil derivatives, and therefore it can be said that there is a reciprocal effect between the demand for crude oil and the demand for oil derivatives.

Oil was discovered in the United States of America. This commodity gained importance in the global economy and the demand for it began to increase with the passage of time. The global demand for crude oil began to increase with the rapid development in global growth rates, where the United States, Europe and Japan

constitute more than half of the global consumption of crude oil, where The global demand for crude oil increased from (42.2) million barrels per day in 1970 to (104.1) million barrels per day in 2019 , but the reason for the increase in global demand for crude oil comes from the rapid development in the growth rates of developing countries, industrial policies and the development of productive sectors[1].

Second requirement. The importance of global demand for oil

The global demand for oil comes from its importance, which is derived from the demand for refined petroleum products. whose prices include a large amount of consumption tax in their markets. Hence, the prices of those products would affect the demand in them and thus affect the demand for oil, and the rate of economic growth and other independent variables is added to the price as a basic variable.

The demand for oil is considered inelastic in the short term, due to the lack of alternative energy sources, and this contributes to price sensitivity.

In the medium and long term, oil will remain a major source of energy for reasons related to its properties compared to the available alternatives or that may be available in the future. Therefore, the policies pursued by consuming and producing countries vary in dealing with the nature of demand for oil, searching for energy alternatives, and seeking to benefit from non-conventional oil sources*, as well as following policies aimed at reducing dependence on oil or controlling its consumption through various measures, including the use of tax on Consumption . The global demand for oil may be affected by several factors, including (oil prices and other energy sources, the growth of the world population, growth rates in both developed and developing countries, the discovery of new alternatives, and the climate...) Projections indicate that the world population will increase from about 6.464 billion in 2005. to 8.317 billion people in 2030. Most of the population increase will be concentrated in Asia and Africa, and India will surpass China in terms of population. The following figure reflects part of the world's population expectations. The importance of population growth as a factor affecting the demand for oil comes from the nature of the demand that this growth will create, especially since most of the increase in energy demand will be for domestic consumption. Since the increase in population will be greater in poor countries, especially India, Asian and African countries, it is not expected that these countries will be able to reduce the demand for oil by providing alternatives or adopting policies that can reduce or control demand. OPEC expected the growth of global demand in the reference scenario by about 84.7 million barrels per day from 2006 until 2030 when it will reach 113 million barrels per day). The share of oil in global energy resources will reach 38% by 2030. The following table presents the reference scenario estimates for both OPEC and the US Energy Information Administration[2].

The third requirement. Oil crises.

The oil market has been exposed to many crises, starting from the crisis of 1973, through the crisis of (1997) to the crisis of (2020). From the seventies until (2008) and

the following is a review of some of the oil crises, distributed as follows (). Including the oil crisis of 1973: - It was called the correction of oil prices and the evaluation of oil at its real value, which was very low. As well as the oil crisis in 1979: Oil prices rose at this stage suddenly three times following the outbreak of the first Gulf War (the Iran-Iraq war) from (13-32) dollars per barrel within a few months due to the decline in the export of crude oil by the two countries due to the presence of Oil wells on the two borders, up to the oil crisis of (2004): The year (2004) was marked by a continuous rise in crude oil prices, reaching levels that the nominal prices of crude oil had not witnessed before. The annual rate of the OPEC basket reached (36) dollars / barrel One, which is the highest annual rate of the OPEC basket price since the start of work in the OPEC basket (). And the oil crisis of (2014): the decline in prices this year as a result of the market oversupply of crude oil, which was caused by the production policy in the Kingdom of Saudi Arabia, because the decline in prices harms its competitors (Iran and Russia). And the crisis (2020): - the prices of crude oil in the global markets witnessed a significant decline due to the exacerbation of the new (Covid-19) crisis that affected the world and the deterioration of oil markets due to the disruption of economic life, and the imposition by governments of travel restrictions and quarantine measures and the closure of factories and institutions and others, the matter Which generated a contraction in global demand, as well as a supply shock caused by the end of OPEC and Russia production cuts, as prices fell to their lowest levels since (2002)[3].

The fourth requirement: the evolution of the oil price growth rates for the OPEC basket for the period (1990-2003)

The period (2004-2008) witnessed successive increases in oil prices, and it reached (94.5) dollars / barrel in (2008), which is the highest level during this period, as shown in Table (1), but it decreased in (2009) to (61.1) dollars / barrel, with a negative growth rate of (-35.34)%, and the reason is the occurrence of the mortgage crisis that contributed to the decline in demand for crude oil. However, crude oil prices rose again for the period (2010-2012) and reached its highest level during the research period, reaching (109.7) dollars / barrel, with a positive growth rate of 2.05%, and the reason is the increase in global demand for crude oil. While the period (2013-2016) witnessed successive declines until it stabilized in (2016) at the amount of (40) dollars / barrel. The reason is the discovery of shale oil in the United States of America because it is one of the energy sources, which contributed significantly to the decline in global demand for oil, especially the OPEC basket. Low prices in world markets. In (2017) and (2018), oil prices rose again and amounted to (52.43) and (69.78) dollars / dinars, and the reason is the increase in global demand. But due to the spread of Covid-19, oil prices fell again, until they reached their lowest level during the research period in (2020), reaching 38.41 dollars / barrel, with a negative growth rate of (-8.14) percent[4].

Table (1)
Growth rates of oil prices for the OPEC basket for the period (1990-2020)
dinars / barrel

Years	Crude oil prices e	annual growth rate
1990	22.3	----------
1991	18.6	%-16.59
1992	18.4	%-1.08
1993	16.3	%-11.41
1994	15.5	%-4.91
1995	16.9	%9.03
1996	20.3	%20.12
1997	18.7	%-7.88
1998	12.3	%-34.22
1999	17.5	%42.28
2000	27.6	%57.71
2001	27.2	%-1.45
2002	25.3	%-6.99
2003	28.0	%10.67
2004	36.1	%28.93
2005	50.6	%40.17
2006	61.1	%20.75
2007	69.1	%13.09
2008	94.5	%36.76
2009	61.1	%-35.34
2010	77.5	%26.84
2011	107.5	%38.71
2012	109.7	%2.05
2013	105.9	%-3.46
2014	96.71	%-8.68
2015	50.94	%-47.33
2016	40.76	%- 19.98
2017	52.43	%28.63
2018	69.78	%33.09
2019	64.10	%- 8.14
2020	38.41	%-40.08

Source: International Monetary Fund, various issues OPEC Monthly Oil Market Indicators.

second topic
Standard Model Description

first requirement: the description of the model

Measuring the impact of oil price shocks on some monetary variables. The VAR model is used to study the dynamic relationship between the variables.

This stage is one of the important stages in building the standard model, so these variables were described as follows:

1- Independent Variables

It includes the oil shock variable, which is expressed in world oil prices (OP)).

2- Dependent Variables: Dependent Variables

It includes four variables:

- Narrow cash width M1
- Wide cash offer M2
- exchange rate EXR

Inflation rate INF

3- Random Variables

They are real, coincidental variables that include other factors that did not appear in the model, but affect the dependent variables (symbolized by the symbol Ui. An annual series of (31) observations from 1990-2020 has been adopted based on official data and statistics issued by the Ministry of Planning and OPEC reports on world oil prices[5.]

The second requirement:

the theoretical relationship between the model variables. In order to determine the nature of the relationship between the model variables and to show the effect of the independent variable on some monetary variables in Iraq. Four models have been adopted:

First model:

$$M_1 = \beta_0 + \beta_1 OP + \beta\varphi_i X_{t-p} + U_1 \ldots\ldots\ldots\ldots\ldots (1)$$

Second form:

$$M_2 = \beta_2 + \beta_3 OP + \beta\varphi_i X_{t-p} + U_2 \ldots\ldots\ldots\ldots\ldots (2)$$

Third form:

$$EXR = \beta_4 + \beta_5 OP + \beta\varphi_i X_{t-p} + U_3 \ldots\ldots\ldots\ldots\ldots (3)$$

Fourth form:

$$INF = \beta_6 + \beta_7 OP + \beta\varphi_i X_{t-p} + U_4 \ldots\ldots\ldots\ldots\ldots (4)$$

According to the economic theory and the economic literature, the natural relationship between the independent variable OP is a direct relationship with all the dependent variables, and it is expected that the value of the parameters will be positive when oil prices rise. Inflation[6].

The third topic
Measuring the impact of oil prices on some monetary variables in Iraq for the period (1990-2020)

In this topic, the standard relationship between the independent variable OP and some monetary policy variables will be estimated and analyzed, namely money supply in the narrow sense, money supply in the broad sense, exchange rate and inflation rate, and using the Vector Autoregressive Model to measure the dynamic relationship between the variables. The general form of the VAR model consists of the following equation[7].

$$(Y_t) = (\alpha_0) + ($$

whereas:

Yt: represents the vector of the internal variables studied by the model (M1, M2, EXR, INF, OP

(α0): represents the intersection limit vector (constant term) ∅_(i,): represents the matrix of short-run coefficients

ϑ_i: represents the matrix of long-run coefficients, U_t: represents the vector of the random variable[8].

The first requirement: the matrix of correlation coefficients

The nature and direction of the relationship between the variables can be known through the matrix of correlation coefficients, and the correlation coefficient was calculated between them, as mentioned in Table (2)

Table (2) Matrix of Correlation Coefficients

EXR	INF	M1	M2	OP	
0.093335803637	-0.3959171836472	0.638177268566	0.6640642014076	1	**OP**
0.051988457655	-0.3995481432429	0.961211803777	1	0.6640642014076	**M2**
0.042552757612	-0.3953864082811	1	0.9612118037770	0.6381772685669	**M1**
-0.391128675560	1	-0.395386408281	-0.3995481432429	-0.3959171836472	**INF**
1	-0.391128675560 7	0.042552757612	0.0519884576552	0.0933358036373	**EXR**

Source: From the researcher's work based on the results of the Eveiws12 program

It was noted from the table that there is a positive and negative relationship between the study variables. In addition, there are varying degrees of correlation between them. The relationship was positive between oil prices and money supply in

the broad and narrow sense, and the correlation strength was about 0.66% and 0.64%, respectively. While the relationship of oil prices with inflation was negative and the strength of the correlation between them was weak and amounted to about -0.39%. It was positive and very weak with the exchange rate, reaching about 0.1%. As for the broad money supply, it was associated with a positive relationship with other variables, except for the inflation rate, which was negative, meaning there is an inverse relationship between them. In the same context was the relationship of narrow money supply with other variables. While the relationship of the inflation rate was negative with all variables and weak at the same time, it did not exceed 0.40%. As for the exchange rate, it was associated with a positive relationship with the variables except for the inflation rate, which was a negative relationship as well as a weak relationship.

The second requirement: the unit root test

First: ADF Developer Dickey Fuller Test

Before starting to estimate the standard model, static tests were conducted for the model variables to ensure that the variables were free from the unit root. There are several tests used to detect the unit root problem, including the ADF-developed Dickey-Fuller test and the Phelps-Peron PP test at different orders.

Table (3) shows the results of the silence test for the model variables according to the ADF test at the 1%, 5% and 10% level of significance. Where we note that all independent variables are not static at the level and at all levels of significance because the T-test statistical value of the test was less than the tabular value, in addition, the P-value was greater than 0.05. When taking the first difference, we notice that it stabilized at a significant level of 5%, where the P-value was less than 0.05 in the absence of a secant and a time trend. Which means rejecting the null hypothesis and accepting the alternative hypothesis which states that the variables are still at their first differences, except for the money supply variable in the narrow sense.

Table (3) ADF test results for model variables

Variables	Level		1st Difference			test Equation
	t- test	Prob	t- test	Prob	5%	
OP	1.93350-	0.6124	5.123485-	0.0000	1.9529-	None
M1	2.698955-	0.2457	2.870738-	0.1897	3.6328-	Trend and inter
M2	3.264629-	0.0916	7.697480-	0.0000	1.9529-	None
EXR	1.012741-	0.2602	5.701892-	0.0000	1.9529-	None
INF	3.190495-	0.1066	5.160370-	0.0000	1.9538-	None

Source: From the researcher's work based on the results of the Eveiws12 program

Second: Philips-Peron PP . test

We note from Table (4) the results of the silence test for the model variables according to the PP test at the level of significance 1%, 5% and 10%. Where we note that all independent variables are not static at the level and at all levels of significance because the T-test statistical value of the test was less than the tabular value, in addition, the P-value was greater than 0.05. When taking the first difference, we note that it stabilized at a significant level of 1%, 5% and 10%, where the P-value was less than 0.05 in the absence of a categorical and time trend. This means rejecting the null hypothesis and accepting the alternative hypothesis that states that the variables remain at their first differences.

Table (4) PP test results for model variables

Variables	Level		1st Difference		5%	test Equation
	t- test	Prob	t- test	Prob		
OP	2.021551-	0.566	5.123485-	0.0000	1.9529-	None
M1	1.282849-	0.8729	2.283634-	0.0240	1.9529-	None
M2	3.123044-	0.1193	7.910252-	0.0000	1.9529-	None
EXR	1.894700-	0.6323	5.693423-	0.0000	1.9529-	None
INF	3.147566-	0.1153	7.415775-	0.0000	1.9538-	None

Source: From the researcher's work based on the results of the Eveiws12 program

The third requirement: Estimation of the VAR model (Vector Auto Regressive Model .).

Before starting to build the model, it is necessary to determine the optimal slowdown periods for the model, which represent the number of integration relationships between the variables based on the smallest value of the approved criteria (AIC, SC, HI). The results of Table (5) indicate that the best deceleration of the model was at the second deceleration, that is, at the second year.

Table (5) the optimal deceleration periods for the model

VAR Lag Order Selection Criteria
Endogenous variables: OP M2 M1 INF EXR
Exogenous variables: C
Date: 08/13/22 Time: 00:27
Sample: 1990 2020
Included observations: 27

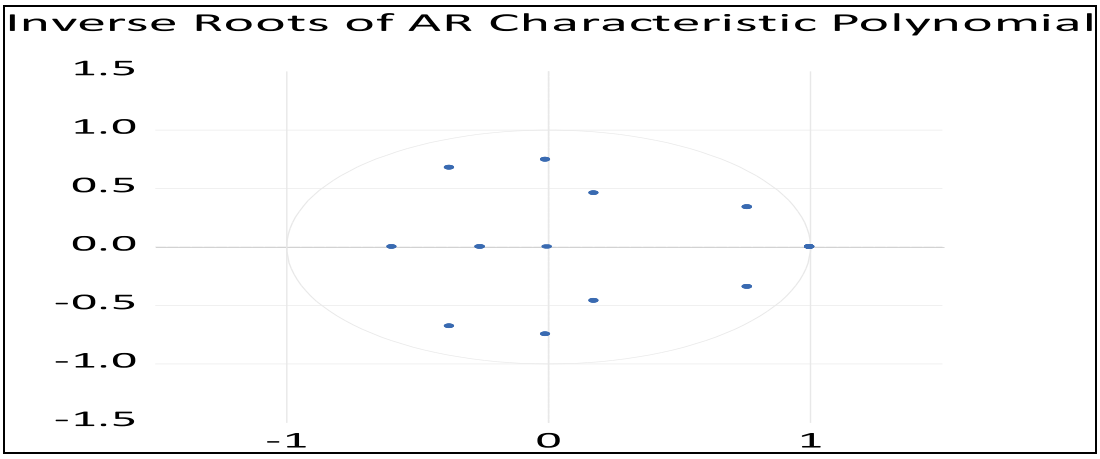
HQ	SC	AIC	FPE	LR	LogL	Lag
81.50822	81.67683	81.43687	1.60e+29	NA	-1094.398	0
76.27232	77.28400*	75.84418	6.20e+26	156.3352	-993.8965	1
76.11498*	77.96974	75.33007*	4.59e+26*	37.85546*	-961.9559	2

Source: From the researcher's work based on the results of the Eveiws12 program

Fourth requirement: test the validity of the VAR model

For the purpose of verifying the validity of the model, and before moving on to study the dynamic property of the model, we use a set of statistical tests, such as the model stability test, LM test, homogeneity of variance, and stability of residuals: We note from Figure (1) that all roots are located within the circle and that the residuals are stable and distributed normally.

Figure (1) The stability of the residuals of the model



Source :From the researcher's work based on the results of the Eveiws12 program

fifth requirement: the causality test for the VAR model

For the purpose of the effect relationship between the model variables, it is necessary to test Granger's causality, and Table (6) shows the causal relationship between the variables. We note that the value of Chi-sq is significant for the variables m1 and m2 where it was less than 0.05, which means rejecting the null hypothesis and accepting the alternative hypothesis that confirms the existence of a causal relationship that goes from oil prices to the money supply in the narrow and broad concepts. And the absence of a causal relationship between oil prices and the exchange rate And the inflation rate for statistical insignificance Chi-sq, where the probability value was greater than 0.05, which means acceptance of the null hypothesis and therefore the absence of a causal relationship.

Table (6) Granger causality test for the estimated model

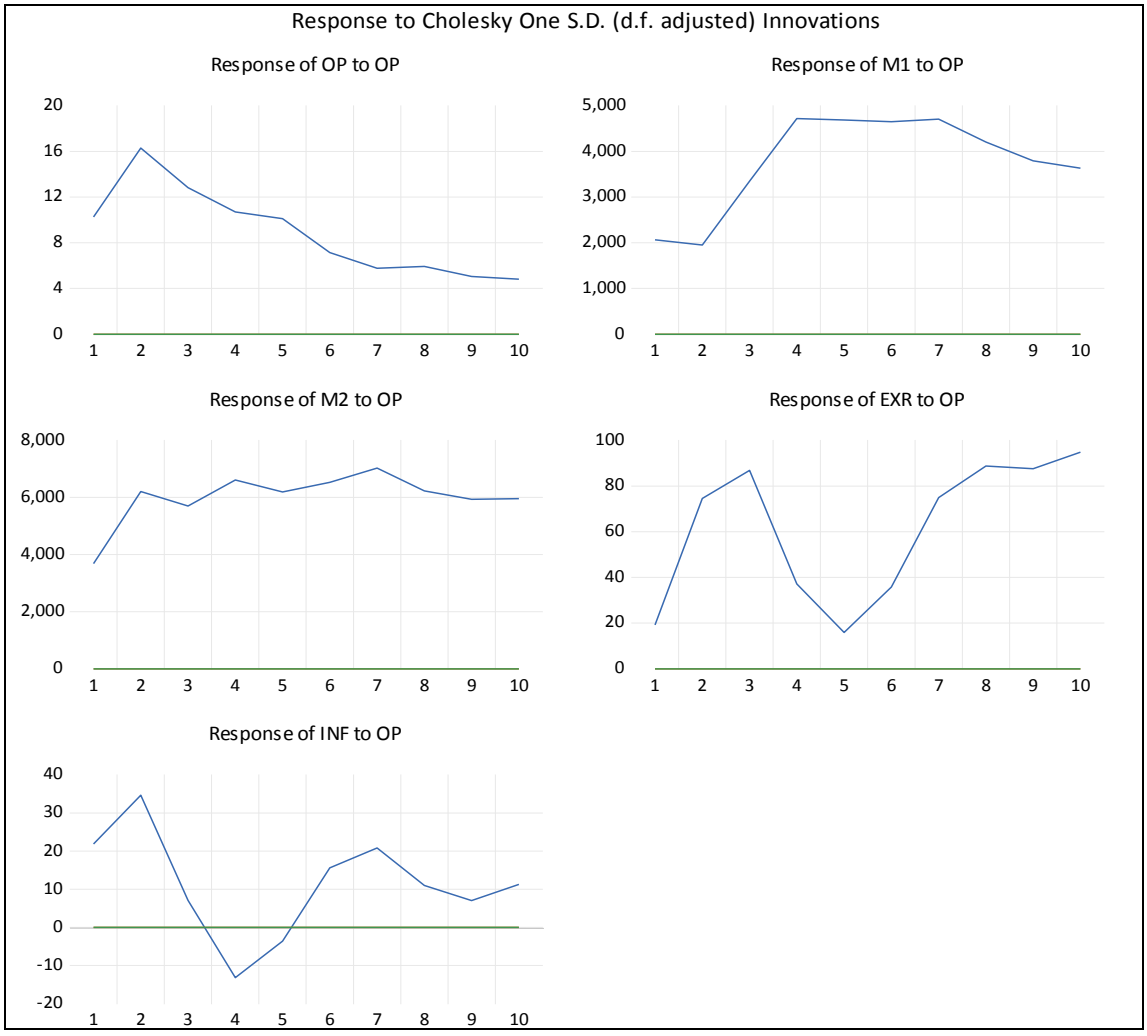
Prob.	df	Chi-sq	Excluded
0.0020	2	12.42166	D(M1)
0.0523	2	5.902573	D(M2)
0.3173	2	2.295659	D(EXR)
0.6364	2	0.903747	D(INF)
0.0001	8	32.15355	All

Source :From the researcher's work based on the results of the Eveiws12 program

The sixth requirement: the immediate response function of the VAR model

The VAR and ECM models allow the analysis of random shocks, by measuring the impact of a shock in a variable on the rest of the other variables. Figure 3 shows the response of variable m1 to a shock in oil prices that was positive at the beginning of the period and reached a maximum of the fourth, fifth and sixth periods, then took a slight decrease with the effect remaining Positive to the shock. As for the m2 response to the shock in oil prices, it was positive and fluctuated between rise and fall. It reached the highest response in the seventh period, after which it decreased until the end of the period. As for the exchange rate's response to a single oil price shock, it was also positive and highly volatile, reaching the highest response in the third period and the lowest response in the fifth period, then it began to improve and rise in the subsequent periods. As for the response of inflation to a shock in oil prices, it started with a positive response and then became negative. In the fourth period, which means that the rise in oil prices leads to a decrease in inflation, then it returns to the positive response, but it is weak and approaches zero in the ninth period.

Figure (2) The response function to monetary variables to oil price shocks



Source :From the researcher's work based on the results of the Eveiws12 program

Eighth requirement: Variance Decomposition

The degree of variance analysis aims to analyze the knowledge of the contribution of random shocks to each variable in explaining its variance and the variance of the variables. After conducting an analysis of variance for the variables that make up the model studied in Table (7), it was found that: For the variable OP, we find that in the first period it explains 100 of the variance in the same variable. Then I took This percentage decreased until it reached its lowest value in the recent period by 59.35. As for the other variables (money supply, exchange rate and inflation), they did not explain anything about the variation in oil prices in the first period, and in the second period they began to contribute to explaining the variance, but at very low rates. 10.9, the exchange rate is about 0.226, and inflation is 0.034. Then this ratio was taken with variation in the later periods, and the highest contribution of these variables was to the narrow money supply in the last period, which amounted to about 16.5. This means that the oil price variable has the largest percentage in explaining itself, while the percentage of the contribution of other variables decreases, which indicates that the oil price variable is an exogenous variable.

Table (7) analysis of variance

INF	EXR	M2	M1	OP	S.E.	Period
0.000000	0.000000	0.000000	0.000000	100.0000	10.26220	1
0.034005	0.226884	10.98959	9.830828	78.91870	21.66318	2
0.255803	2.840092	7.784187	10.06871	79.05120	26.01489	3
0.456489	6.260500	7.711152	8.125973	77.44589	28.95982	4
0.576168	8.068474	12.96088	6.517794	71.87669	32.33577	5
0.779871	9.345364	13.44270	6.524339	69.90773	33.88222	6
1.075581	10.17490	13.30778	8.773745	66.66799	35.40587	7
1.268291	10.19659	13.90397	11.07034	63.56081	37.01607	8
1.386649	9.962841	13.48736	13.78017	61.38299	38.21273	9
1.492131	9.627042	12.92088	16.59249	59.36745	39.35296	10

Cholesky Ordering: OP M1 M2 EXR INF

Source :From the researcher's work based on the results of the Eveiws12 program

The third topic

Conclusions and Recommendations

First, the conclusions

Through the foregoing in the research, the researchers reached a set of conclusions, which are:

1. The shocks of crude oil prices affect the size of the monetary mass represented in the money supply in Iraq, which is reflected in the occurrence of economic problems such as inflation or economic stagnation.
2. The monetary policy represented by the Central Bank seeks to maintain the money supply and smooth the fluctuations that occur in the economy as a result of the oil shocks.

3. Iraq did not adopt a new economic approach that is concerned with industrial, agricultural and tourism economic diversification, as it is the best way to deal with oil shocks and the drop in global oil prices.
4. The results of the static tests showed that the studied variables were not static at the level in each of the ADF and PP tests, and they stabilized after taking the first difference for them, according to the PP test
5. The results of the VAR error correction model showed a long-term relationship between oil prices and monetary variables through the adjustment limit parameter, which was negative and significant. The response function showed that there is an immediate positive response in both with the narrow and wide money supply and the exchange rate to one positive shock in oil prices and it was volatile in most periods, while the response to inflation was positive at the beginning of the period and then became negative at the fourth period and returned to the positive response, but weak in end of the period.
6. After analyzing the variance of the variables, it was found that the oil price variable is an exogenous variable and explains the largest percentage of the variances that occur in it and the low percentage of the contribution of other variables in explaining its variances.

Secondly, recommendations

1. The need for the government in Iraq to be concerned about not relying on oil resources as a major source of public revenues, due to its connection with fluctuating global markets, and its impact on oil shocks.
2. The necessity for there to be coordination between monetary and fiscal policy in order to mitigate the oil shocks that Iraq is negatively affected by, and to invest positive shocks from them.
3. That the role of the central bank has a major role in determining and controlling the money supply, and that there should be deterrent laws against currency leakage, and there must be encouraging laws for individuals in the event that the central bank aims to withdraw the monetary mass from the market.
4. That the competent authorities use the means available to them in order to maintain economic stability and to ensure that it does not affect the public budget and achieve revenues.

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