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The Relationship between Oil Prices, Inflation and Unemployment rate in Iraq, from 2000 to 2020

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ABSTRACT

Many studies have been investigated the relationship between oil prices, inflation and unemployment, as well as some others macroeconomics variables. This paper examines the relationship between oil prices, inflation, and unemployment rate in Iraq. For this purpose, this paper utilizing unit root and co-integration test analysis to annual data from 2000 to 2020. The regression analysis was carried out by the (ARDL) model and the existence of Philips Curve between inflation and unemployment in Iraq. The result shows that the relationship between oil prices and inflation is negative in the short run and positive in the long run. In contrast, the relationship between unemployment and inflation is positive in the short run and negative in the long run. Also, the result confirms Philips curve the relationship between inflation and unemployment in the short run in Iraq. To increase employment in Iraq, it has to grow investments in different sectors. Moreover, to keep inflation under control, it is necessary to maintain a corresponding level of economic and pricing activity.

Introduction

The financial markets have seen huge price swings in recent years, which have been particularly noticeable. Oil prices have hit all-time highs, with the price of a barrel above \$100. Iraq is one of the developing countries and it has huge natural resources. Moreover, Iraq is also an oil-rich country in the world. It heavily depends on oil for budget. This depends on approximately 90 percent of total export in 2003 and 85 percent in 2018 (Sabr, Ahmed and Khan, 2021). Iraq is one of the nations in the Arab world that has both natural resources (oil and natural gas) as well as a part amount of land suitable for agricultural production. Iraq's oil and gas riches have propelled the country to a prominent world position. Iraq's oil reserves account for about 11 percent of world oil reserves. The Iraqi economy saw a precipitous fall in growth and development in the 1980s, after a period of significant expansion in the 1970s. Different types of war and innovation have taken place since then, contributing to infrastructure disarray, anomalous inflation, and weak economic development in the face of widespread poverty and unemployment. Over the past decade, the relationship between inflation and unemployment has sparked intense discussion among politicians, economists, and the general public. International attention has been drawn to the negative impacts of unemployment and inflation on economic growth, which have both garnered the attention of governments and academics across the globe (Anning, 2017). In recent years, unemployment in Iraq has increased. For example, according to world bank data, there will be more than 13 percent in 2020, and the inflation rate will fluctuate.

Oil prices fluctuate around the world. This fluctuation has a positive and negative impact on Iraq. Furthermore, the increase in oil prices had a positive impact and the fall had a negative. For example, the revenue of oil production decreased from \$77.8 barrel in 2013 to \$45 barrel in 2016 (Mehdi, 2018). According to (Amjad and Havers, 2009), two of the main problems facing the economy of Iraq are poverty and unemployment. Moreover, these problems were caused by several factors, such as corruption, weakness of all sectors, reliance on oil... etc. The unemployment rate is increasing year by year. For example, in 2012 it was approximately 7.97 %, while it became more than 13% in 2020. Also, the rate of poverty was more than 30% in Iraq. The significant workforce of Iraq is employed in the public sector, and some of

the workforce work in the private sector (World Bank and UNICEF, 2020).

The structure of this study begins with an introduction in section one and the literature review is or deal with in section two. Section three includes methodology and empirical results. The data analysis and results discussion, as well as model tests, are presented. Conclusion and recommendation in the last section of this paper.

Theoretical framework

The following part focuses on the theoretical framework by presenting certain concepts that are linked to the inflation rate, unemployment rate, and oil prices.

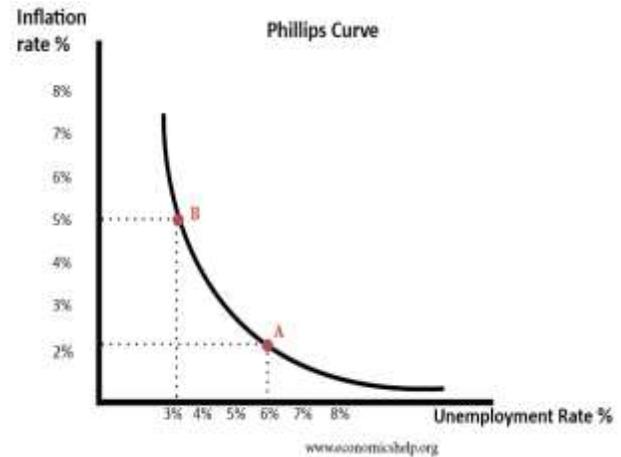
The most important material in the processes of transportation and manufacturing is oil. Hence, when it comes to manufacturing costs and consumer prices, they tend to follow the oil prices. Moreover, variations in the price of oil may cause a temporary reduction in overall output when businesses postpone investment choices because of uncertain economic circumstances or because of expenses associated with re-allocation procedures of resources (Trang, Tho and Hong, 2017). The changing price of crude oil is a worldwide phenomenon that affects every economy in all countries in the world. Therefore, the impact of oil prices is especially important in deciding the economies of rising nations when the prices fluctuate. The fluctuations in the price of oil over the past five decades demonstrate oil price volatility, which may cause economic actors to make choices that are not in their best interests (Jiranyakul, 2018).

Inflation is defined as a continuous increase in the overall price level of a wide spectrum of products and services in a nation over an extended period of time. In the past, inflation has wreaked havoc on economies and altered the path of human evolution. The yearly rate of increase in prices is referred to as the inflation rate. A phrase such as price stability may be used to characterize the economic pricing environment during periods of sound economic growth, when the economy is neither suffering from inflation nor deflation (Yelwa, David and Omoniyi, 2015). Moreover, aside from reducing economic growth, inflation imposes a significant cost on the poorer members of society, who bear this burden more heavily than the wealthy. This is because the poor are more susceptible to the effects of inflation than the wealthy (Kasseh, 2018).

As defined by the International Labor Organization, unemployment is defined as the number of economically active people who are out of work but are available for work and actively seeking work, including those who have lost their jobs as well as those who have left their jobs on their own initiative (Yelwa, David and Omoniyi, 2015). Nowadays is different 16 years old or older who worked any number of hours over the previous week is considered to be in employment. The unemployment rate is an important macroeconomic issue, and all economies and governments are trying to reduce the unemployment rate. Furthermore, economic nations are trying to increase the employment rate by adopting policies. Makers of policies investigate a variety of reasons and events that may contribute to rising unemployment rates and propose new ideas and policies to increase the rate of employment. Developing countries have a higher rate of unemployment than developed economies (Fields, 2011).

Phillips Curve

The Phillips curve is an economic concept developed by A. W. Phillips stating that inflation and unemployment have a stable and inverse relationship. After being presented in 1958 and subsequently known as the Philips Curve, the idea that showed a negative connection between inflation and unemployment has been at the heart of policy discussions ever since. Philips discovered that a single stable curve, known as the Philips Curve, may be used to illustrate the trade-off between inflation and unemployment. For many economists, this model has a special place in their hearts since it sheds light on the effects of monetary policy on the economy. Historically, the Philips Curve has played a crucial role in macroeconomics by improving policymakers' knowledge of an economy anytime they consider it necessary to develop monetary policy in a given country. In addition, since it has the potential to push both variables in opposite directions, policymakers must exercise caution when using monetary policy management strategies (Kasseh, 2018).



There are many papers that support this study related to the Philips curve, such as (Anning et al., 2018), (Furuoka, 2007) and (Dritsaki and Dritsaki, 2013).

Literature Review

There are many studies related to oil prices and macroeconomic variables. However, a few papers have been written about this topic in all countries. For these reasons, the literature review in this paper is divided into mixed literature. Furthermore, this paper will discuss the relationship and impact of oil prices on inflation rates and unemployment in different countries.

There are several papers related to this research topic that will be discussed below. According to Hooker (2002), the relationship between oil prices and inflation in the U.S. from 1962 to 2000 was divided into two periods of time. They find that oil prices have a significant impact on inflation. Similarly, the research (Bala and Chin, 2018) applied to some African countries that are members of OPEC, like Algeria, Libya, Nigeria, and Angola, It depended on annual data from 1995 to 2014. It used the ARDL method to analyze data, they found that the impact of oil prices has significant positive and negative significant on inflation, and also found that some impacts on microeconomics are positive related to inflation. One of the researches from Malaysia authors (Xuan and Chin, 2015) used quarterly data from 2005 to 2013, to analyzed data adapted to the (ARDL) method. They documented that the relationship between oil prices and inflation is positive. Similarly, Tang, Wu and Zhang, (2010) estimated oil price shocks had an effect on China's economy. Their analysis indicates that increased oil prices cause increased inflation and the relationship is positive.

Chou and Lin (2013), use a nonlinear error correction model for annual data from 1981 to 2011

in Taiwan, they found they discovered that the effects on oil producer prices were both long-term and short-term. Jiranyakul, K (2018) examined oil price shocks and domestic inflation in Thailand, adapted quarter data from 1993 to 2016, and also used linear and nonlinear Co-integration tests. They found that in the short run, there is a relationship between oil price shock and domestic inflation. Another finding is that oil price uncertainty does not cause inflation while increasing inflation is caused by the oil price shock. The paper from G-5 countries finds that the relationship between oil prices and inflation is positive in the U.S. and E.U. Furthermore, increase 10 percent oil prices will lead to an increase in inflation by 0.1 to 0.8 (Chinn and Leblanc, 2004). Azerbaijani researchers Mukhtarov, Mammadov and Ahmadov, (2019) examined the impact of oil prices on inflation, using annual data from 1995 to 2017, and employed the VECM model. They found that, in the long run, there is a relationship between variables and those variables have a positive significant impact on the inflation rate. This means that when oil prices and exchange rates are increased by 1 percentage, it causes increased inflation between 0.58 and 1.81 respectively.

Raifu, Aminu and Folawewo, (2020) examined the relationship between changes in oil prices and the unemployment rate in Nigeria. They used quarterly data with an adapted estimation method lag (NARDL), They found that there is no significant effect between changes in oil prices and unemployment in the short run, according to linear ARDL. However, the relationship between both of them has a positive significant effect in the long run, as found by the NARDL method. In the long run, the decrease in oil prices has a significant effect, while the increase worsens the situation. Similarly, the research on oil and unemployment in Germany uses monthly data from 1973 to 2008, applies a VAR approach. They found that the relationship between oil prices and unemployment is positive. When the oil price increase, the unemployment rise (Löschel and Oberndorfer, 2009). Swedish researchers Mellquist, Femermo and Hacker, (2007) examined the relationship between oil prices and unemployment using quarter data from 1980 to 2004, and used linear regression and granger causality test methods. They found that, in linear regression, the relationship between both variables is positive. However, in the Granger causality test, relations were positive and negative.

The Pakistani researcher Ahmad, (2013) examined the effect of oil prices on unemployment, adapted by Toda Yamamoto model and using monthly data from 1991 to 2010. They find that the relationship between both variables is positive and significant. Another research from Pakistan examined the oil price shock and its impact on the macroeconomics. It uses annual data from 1960 to 2014, and employs on the SVAR model. They found that there is a positive relationship between variables (Malik, Ajmal and Zahid, 2017). Additionally, researchers Cheratian I, Farzanegan MR, Goltabar S, (2019) from 19 countries (Middle East and North Africa) examined oil price shocks and unemployment rates, adapting the NARDL model and using annual data from 1991 to 2017. They found that the change in oil prices in both countries (Importers and exporters) has a significant effect on unemployment in the long run. However, the change in oil prices has a positive effect on the unemployment rate for oil exporting countries in the short run. Vietnamese researchers collected data from 2000 to 2015, in addition, they found that when oil prices are increasing, inflation reaches a high rate, and finding that the impact of oil prices on unemployment is unclear (Trang, Tho and Hong, 2017). Mohseni and Jouzaryan, (2016), examined the effects of inflation and unemployment on the economy of Iran, using ARDL models to estimate the data from 1996 to 2012. They found that inflation and unemployment have a negative impact on economic growth in Iran in the long run.

(Kasseh, 2018) studies the relationship between inflation and unemployment in Gambia, applied data from 1991 to 2015. They documented that the relationship is positive between inflation and unemployment. However, according to (Yelwa, David and Omoniyi, 2015) examined the relationship between inflation, unemployment and economic growth in Nigeria, use data from 1987 to 2012. They documented that there is a negative relationship between inflation and unemployment. Iraqi researcher Anning et al., (2017), adapted the VAR model and used annual data from 1990 to 2014. He found that according to the Phillips Curve theory, there is an equilibrium effect between unemployment and inflation in Iraq, which supports the validity of the concept.

Empirical section

Data

This paper uses annual secondary data from 2000 to 2020. The variables are inflation rate (INF), unemployment rate (UER) and oil prices (OP). The

data was collected from the Word Bank 2020 Database, Statista.com.

Econometric Approach

This study applies empirical analysis to Examine the relationship between oil prices, inflation rate and unemployment rate in Iraq. This research uses ARDL. First, a time unit root, it was Provided by (Dickey and Fuller, 1986), Co- integration test (Johansen) and an autoregressive distributed lag (ARDL). Second, this it evaluates and reliably data using Diagnostic testing, variance inflation factors (VIF) and Stability Diagnostics. Therefore, it tests the Philips Curve to determine the relationship between inflation and unemployment in above. Additionally, oil prices have a great relationship with inflation and unemployment, which shows the significance of the topic and it could find another curve between variables in the future.

To accomplish the aforementioned goal, the present research uses the short-and long-run relationships between three oil price, inflation and unemployment. variables. The study's model is as follows:

$$EMP = F(INF, OIS) \dots \dots \dots (1)$$

$$OIS = F(INF EMP) \dots \dots \dots (2)$$

$$Ln EMP_t = \beta_0 + \beta_1 Ln INF_t + \beta_2 Ln OIS_t + Ut \dots \dots \dots (3)$$

$$Ln OIS_t = \beta_0 + \beta_1 Ln INF_t + \beta_2 Ln EMP_t + Ut \dots \dots \dots (4)$$

$$Ln INF_t OIS_t = \beta_0 + \beta_1 Ln OIS_t + \beta_2 Ln EMP_t + Ut \dots \dots \dots (5)$$

Where:

β_0 = Intercept coefficient

β_1, β_2 = slope (measure the effect of the independent variables on the dependent variable)

EMP = Unemployment

INF = Inflation

OIS = Oil prices

t = Time

U = Random Error Term

in order to examine the interrelationship between the variables as well as the response of the dependent variable to independent Variable, several econometric analytic techniques have been used in this research, including the ones described below:

Econometric results

One of the significant and popular tests is unit root, it was created by (Dickey and Fuller, 1986). In this research, a time series analytic method was utilized to determine if a variable was stationary or not. In a spurious regression study, no stationary series were

employed in the regression equation (Lim, n.d.). If this is the case, the findings may not be reliable. A regression analysis should be performed on data that is non-stationary before using it. At the log levels, all variables will be evaluated. The test may also reveal that a variable is non-stationary, which means that its p value is important and it has unit root (Gujarati, 2004).

**Table (1) Unit Root test result
Constant and trend**

Augmented Dickey-Fuller (ADF) statistics test						
Variable	Level	ADF t-Statistic	Critical value with the constant and trend			Prob.*
			1%	5%	10%	
LINF	Level	-4.253651	-5.295384	-4.008157	-3.460791	0.0081

constant

Augmented Dickey-Fuller (ADF) statistics test						
Variable	Level	ADF t-Statistic	Critical value with the constant			Prob.*
			1%	5%	10%	
LEMP	Level	-3.466602	-3.831511	-3.029970	-2.655194	0.0030
LOP	Level	-3.085537	-3.831511	-3.029970	-2.655194	0.0067

The results show that in table (1), the ADF t-statistic of the LINF at the level with constant and trend is equal (-4.25). Otherwise, the value of the ADF t-statistic LINF at the level is lower than the critical value constant and trend at 5% (-4) and 10% (-3.46) significant levels, and the probability is (0.0081). For this reason, the null hypothesis can be rejected. Similarly, the ADF t-stationary value of the LEMP and LOP have problems with unit root at the 1% level, but the level form is stationary at 5% and 10%, and the probability is lower than 5%, which is (0.0030) and (0.0067), respectively. The result shows that all variables (LINF, LEMP, and LOP) are stationary. All variables accepted the alternative hypothesis (H1 Unit root exists) and rejected (H0= Unit root exists).

There is co-integration between oil price, unemployment and inflation rate. Therefore, this test will be employed, and it denotes rejection of the hypothesis at the 0.05 level (MacKinnon-Haug-Michelis, 1999). According to Maximum Eigenvalue testing table (2) there is no co-integration at the 0.05 level. This indicates that the null hypothesis was rejected at the (0.05) level. Following that, analysis of the effect of the independent on the dependent variable and the model formulation. Generally, two hypothesis H_0 : no co-integration and H_1 : cointegration exist.

Table (2): Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.727854	37.00112	35.01090	0.0302
At most 1 *	0.702661	18.78127	18.39771	0.0442
At most 2	0.120708	1.800936	3.841466	0.1796

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.727854	18.21985	24.25202	0.2564
At most 1	0.702661	16.98034	17.14769	0.0528
At most 2	0.120708	1.800936	3.841466	0.1796

This study utilized the Johansen co-integration test to examine the hypothesis that the variables are co-integrated and the relationship between variables are long-term. Table (2) shows that Trace test indicates 2 cointegrating eqn(s) at the 0.05 level. This study accepted H_1 and rejected H_0 , because the Unrestricted Cointegration Rank Test supports the assumption that the indicates 2 cointegrating.

ARDL Models

The primary benefit of ARDL modelling is that it can estimate both the long-run and short-run relationships in the model. The short-run and long-run coefficients of the model are calculated at the same time in this step.

Table (3) short and long-run estimation ARDL models

Short-run estimation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEMP)	-5.290502	2.867641	-1.844897	0.0921
D(LOP)	0.389515	0.653341	0.596190	0.5631
CointEq(-1)	-0.030984	0.119942	-0.258322	0.8009
Long-run estimation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEMP	12.617956	50.877674	0.248006	0.8087
LOP	-6.301413	27.330640	-0.230562	0.8219

Table 3 shows the coefficient for the short- and long-runs, respectively. The results show that an increase of 1% in unemployment rate decreased Iraq's inflation by 5.29%. Therefore, the long-run estimates are different from the short-run estimates. Also, the results show that 1% increases in unemployment rate increase inflation by 12.6% and a 1% increase in oil prices decreases inflation by 6.3% in the long run. In sum, there is a significant positive relationship (which mean, inflation is a phenomenon with a negative factor) between D (LEMP) and LINF in the short-run which is supported by the pervious study (Kasseh, 2018). However, in the long run, the

relationship between both variables is significant and negative (which mean, unemployment is a phenomenon negative factor) supported (Yelwa, David and Omoniyi, 2015). Rising inflation as a result of rising wages and the expansion of the money supply in Iraq. Also, there is an increasing unemployment rate in Iraq because of the increase in the population, as well as the weakness and lack of private sector employment. Moreover, the results show a weak significant negative between oil prices and inflation in the short run and this is supported by (Xuan and Chin, 2015) and (Chinn and Leblanc, 2004). However, the relation between oil prices and inflation shows a significant positive the long run. The result in table (3) also, showed that, using the production gap as a proxy for unemployment, the calculated coefficient for the period is -5.290502 and is statistically significant at the 10 percent level, confirming that there is a positive relation between unemployment and inflation in Iraq. The fact that the findings of the study confirmed the Philips curve at such a large level may indicate that a rise in unemployment in Iraq could result in a decrease in inflation in the country's economy (Anning, 2017). Unemployment and inflation are two factors that have negative effects on the economy.

Table (4) Diagnostic testing for Estimation ARDL model

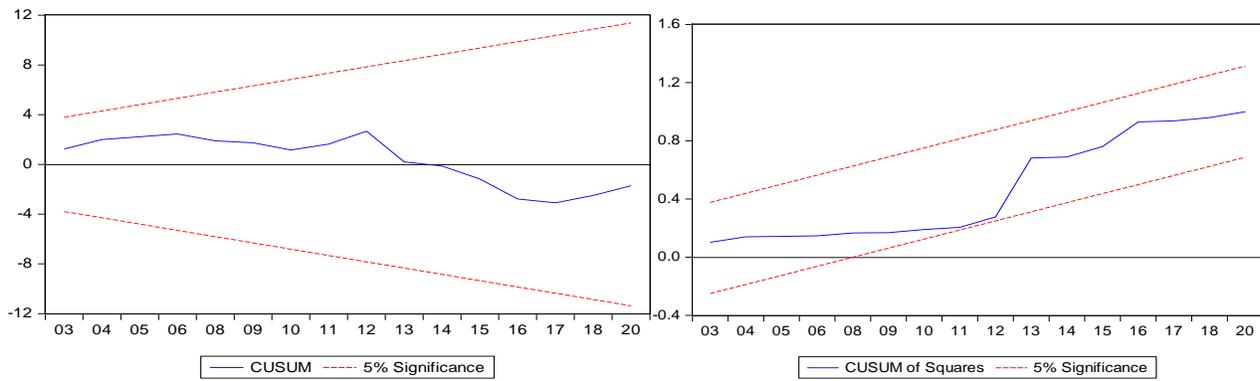
Test statistics	Name of t-statistics	Probability	Final decision
Normality	Jarque-Bera	0.962747 more than 0.05	Accept
Function form	Ramsey RESET Test	0.8888 more than 0.05	Accept
Serial Correlation LM Test	Breusch-Godfrey	0.6172 more than 0.05	Accept
Heteroskedasticity	Breusch-Pagan-Godfrey	0.6472 more than 0.05	Accept
Variance Inflation Factors	VIF	1.85743 less than 10	Accept
Stability	CUSUM	Structure stable at level (5%)	Stable
	CUSUMQ	Structure stable at level (5%)	Stable
Statistics Test			
R-Squared	0.88	S.E for regression	0.68
Adjusted R ²	0.84	D.W stat	1.96

Diagnostic testing is one of the most essential to ensuring that the ARDL model does not have any regression problem. The Diagnostic testing includes normality, Ramsey RESET test, serial correlation LM test, heteroskedasticity, variance inflation factors, and stability. The normality test by Jarqu-Bera was a good fit and passed in this study, because the probability was more than 0.05, and the findings of Breusch-Pagan is that the error of homoscedasticity.

Table (4) also shows that all diagnostic test that has been used in the paper is fixed and correctly specified. The Variance inflation factor is between one to ten, then this result was accepted. The ARDL models were specified and findings reported that R-squared 0.88 and adjusted R² 0.84. This means that this model is correct and fitted the data.

Structure stability testing model.

The Structure stability testing model is one of the models that has been adapted in this research. It depends on (CUSUM) and (CUSUMQ) for checking the change in structure, and whether it is a stability test or not.



The result shows that the blue line is between both the red lines for (CUSUM) and (CUSUMQ). This means that the structure is stable at a level (5%) significant level, and it is useful for decision makers.

Conclusion

Many studies have been investigated to show the relationship between oil prices, inflation and unemployment, as well as some macroeconomics. Iraq is one of the developing countries and it has huge natural resources. In this paper, tried to the relationship between oil prices, inflation and unemployment. This paper used the unit root (ADF), co-integration test, and (ARDL) to determine the long and short-run relationships between variables, which includes annual data from 2000 to 2020. The paper use of Philips curve to compare the result between inflation and unemployment.

The result shows that in used unite root test all variables accept the alternative hypothesis (H1 Unit root exists) and rejected (H0= Unit root exists). Also, increase of 1% in unemployment rate decreased Iraq's inflation by 5.29%. There is a significant positive relationship between D (LEMP) and LINF in the short-run and negative relation in the long-run.

The following is some policy suggestions and recommendations that will aid in the alleviation of the present issues of oil price, inflation and unemployment in Iraq. Increased investments in different sectors of the economy are required in the private and public sectors. Moreover, in order to decrease Iraq's unemployment rate, policymakers have to concentrate on providing work opportunities for people of all educational levels. In addition, training programs and other educational activities should be encouraged and oriented toward increasing creativity and production. Moreover, to keep inflation under control, it is necessary to maintain a corresponding level of economic and pricing activity.

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