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## **DETERMINANTS OF INFLATION IN JORDANIAN ECONOMY: FMOLS APPROACH**

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### **Abstract**

The current study assesses the determinates of inflation in Jordanian economy over the period 2000:1 to 2017:4, by using quarterly data on inflation, money supply, interest rate, credit, oil price and the output gap. Fully Modified Ordinary Least Square (FMOLS) approach was applied. The empirical findings of the present study showed that money supply, credit and oil price variables have a positive and significant impact on inflation in Jordanian economy, while the interest rate and output gap have an adverse and significant effect on the inflation in Jordanian economy. The impulse response functions and variance decomposition analysis test were used. Both tests have showed that the inflation in Jordanian economy mostly explained by oil price in the long run which indicated that the supply side is persisted inflation in Jordan economy.

**Keywords: Inflation Rate; FMOLS Approach; Money Supply; Credit; Oil Price Impulse Respond Functions; Variance Decomposition Analysis**

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## **INTRODUCTION**

The causes of inflation may be theoretically divided into three categories: those who believe that the inflation is a monetary phenomenon which means that inflation stem from increasing money in circulation i.e. too much money chasing too low goods and services, which was adopted by classical quantity theory of money, and monetarism theory , and those who attribute inflation to the upward pressure of wage cost on price which was adopted by Keynesian theory i.e. the cost-pull inflation, and the third category is those who attribute inflation to structural factors or supply bottleneck in the concern country, which was adopted by Structuralists.

The consequences of inflation on economic whether in developed countries or in developing countries, are well known. Hence it has a serious effect on consumption decision by households as well as investment decision by investors, for instance it lower the purchasing power of money, worsen the country's term of trade. In Jordan the inflation considered to be one of the most economic problems that face the Jordanian economy.

The present study has been divided into four parts as follows: the first part provides the theoretical framework and empirical literature; Second part demonstrates the model specification, data source and variables definitions; The empirical finding will be discussed in third part; And the fourth part is dedicated to the conclusion.

## OBJECTIVES

The major aim of the current study is to answer the following question:

What determines the inflation rate in Jordanian economy?

More specifically, to answer the main question, several objectives have to be achieved and these are:

1. Determining the effect of gross domestic product gap on inflation in Jordanian economy;
2. Determining the impact of oil price on inflation in Jordanian economy;
3. Determining the impact of interest rate on inflation in Jordanian economy;
4. Determining the impact of board money on inflation in Jordanian economy;
5. Determining the impact of credit on inflation in Jordanian economy.

## THEORETICAL AND EMPIRICAL LITERATURE REVIEW

A significant and growing body of literature has investigated the determinate of inflation whether in developed countries or in developing countries. One of the most well-known theory that the classical theory of inflation. Such classical theory of inflation attributes inflation to the growth in the quantity of money in circulation, (Ireland, 2014). As Irving Fisher illustrated in his famous equation of exchange that  $MV=PT$ , therefore the change in general prices is determined by the change in quantity of money in circulation, in which velocity of money in circulation (V), and transactions (T) remain constant in short run, which means that the increase in stock money (M) causes a proportionate rise in price level (P). More specifically there is a unite elasticity between stock money (M), and price level (P) [1]. Another widely accepted theory is the Monetarism theory of inflation, in which monetarists opine that inflation is always and everywhere a monetary phenomenon that arises from a rapid increase in the quantity of money more than total output [2]. They believe that too much money chasing too few goods [3], which means that the inflation is a function

of money supply and real output. Monetarism adopt the quantity theory of money to explain the sources of inflation after transformed it to a percentage form, they defined  $m$ ,  $v$ ,  $y$  and  $\pi$  as the percentage change in money supply, velocity of money in circulation, output and prices respectively, their works can be briefly illustrated as follows:

$$MV=PY \quad (1)$$

Where  $Y$  is output, after transformed eqn. (1) to a percentage form, it became

$$m+v=\pi+ y \quad (2)$$

Rearranging the eqn. (2), the change in level price will be as

$$\pi=m+v- y \quad (3)$$

Eqn. (3) reveals that inflation ( $\pi$ ) is equal to the rate of growth in money supply ( $m$ ) plus the growth in velocity ( $v$ ) minus the growth in output ( $y$ ). If ( $y$ ) represents the growth rate of aggregate supply and  $+$  is the growth of aggregate demand. Eqn. (3) says that inflation arises, whenever the growth in aggregate demand exceeds the growth in aggregate supply, i.e.  $+$  is greater than  $y$ .

Believed to be linked to two parts, Keynesian theory of inflation suggests that these parts can be; first, Cost-push inflation, in which it asserts that the pressure in wages and monopolistic pricing strategies causes inflation. Indeed, this theory argues that the sources of inflation can be categorized as follows:

- Wage: Push inflation where A strong labour unions forcing wages goes up by putting pressure on employers to increase their wages, as a result, the labour factor

becomes more expensive, so does the cost of production of goods and services, which passed on to the consumers through higher prices [4].

- Profit: Push inflation, this kind of inflation occurred when monopolistic and oligopolistic firms used their monopoly power to raise the price to increase their gain, in which causes price level to go up.
- Supply shock inflation: Such theory indicates that the causes of inflation are due to a decrease in the aggregate supply which attributed to increases in the price of the industrial input, shortage of particular good, or international events like war for example.

The second part of the Keynesian theory of inflation falls in the fact that the demand-pull inflation. This Demand-pull inflation theory argues that inflation occur when aggregate demand exceeds the total supply due to expansionary monetary policy (i.e. increasing in money supply or decreasing the discount rate granted by central banks) or expansionary fiscal policy such as increasing the government expenditure or decreasing in tax. The last argument from the theoretical point views is the Structural inflation theory. This theory argues that inflation is not a monetary phenomenon, as stated previously, in which the money supply is responding to inflation rather than initiative it. Structural theory of inflation, explains inflation in terms of structural features of LDCs, which can be described by supply bottleneck likes: food bottleneck (i.e. food scarcity due to imbalance between the demand for and supply of food), resources bottleneck (i.e. shortage of capital, higher unemployment rate , lack of oil), foreign exchange bottleneck (i.e. deficit of balance of payment ,and huge colossal import bill), infrastructural (i.e. weakness of telecommunication, communication, transportation, and electricity) and finally social and political constraint, and corruption [5].

### **Empirical Literature Review**

There is a large volume of published studies investigating the determinates of

inflation, much of that literature pays particular attention to some explanatory variables, such as money supply, gross domestic product (GDP), interest rate, budget deficits, exchange rate, import price, and GDP gap. One of the most studies by Chankreusna [6] investigates the determinant of inflation in Cambodia by using monthly data for the period 2004 to 2016. VEM model and OLS method are employed to capture the short and long-run relationship between inflation, and some explanatory variables, namely heading inflation, and food inflation of main trading partners of Cambodia, narrow money supply, nominal effective exchange rate, output gap, fiscal revenue and expenditure. Study results reveal that the food inflation of main trading partners of Cambodia, have a positive impact on headline inflation in Cambodia. Also, the narrow money supply, nominal effective exchange rate, output gap, fiscal revenue and expenditure are considered as a fuel for inflation in Cambodia in the long run. Similarly, Alam and Alam [7], applied the co-integration method to investigate the sources of inflation in India, both in short and long run. Empirical findings of their study indicate that supply bottleneck, depreciation of the rupee, and money supply have a positive impact on inflation in India in the long run. The analysis also reveals that money supply, and bottleneck supply dominates the external factor as a measure causes for inflation India in the short term. By contrast Rahimov et al. [8], assess the determinant of inflation in Azerbaijan by employing VAR model, impulse response and variance decomposition on quarterly data for the period 2003-2015. The study results indicated that the leading causes of inflation in Azerbaijan are foreign inflation, fiscal policy, and exchange rate.

Preliminary work was undertaken by Mohammed [9], this study investigates the determinants of inflation in Algeria using the ARDL model during the period 1980-2012. The imports price, oil price and money stock, government expenditure, and effective nominal exchange rates of the Algerian Dinar were used as an explanatory variable. Empirical results indicate that there is a stable long-run relationship exists between inflation, and its determinants. Whereas only external factors namely import price, oil price and nominal exchange rates, in the long run, have impact inflation in

Algeria. Using the same techniques, Lim and Sek [10] examine factors that impact the inflation in two groups of countries (high inflation group and low inflation group). ARDL model has been employed in this study by using annual data for the period 1970-2011, finding of the study reveal that in low inflation countries GDP and import have a significant impact on inflation, while money supply, national expenditure, and GDP are the leading causes of inflation in high inflation countries. In short run, none of the explanatory variables is found to be significant causes of inflation in high inflation countries. However, in low inflation countries, it has a substantial impact on inflation.

Adopting Ordinary Least Square OLS, Ruzima and Veeraachamy [11] study the influence of agriculture output, population growth, government expenditure, foreign direct investment, and import on inflation in Rwanda from 1970 to 2013. The researchers find that the primary drivers for inflation in Rwanda are the import and agriculture output. Population growth is significant, and has a negative impact on inflation, while FDI, and government expenditure has an insignificant effect on inflation in Rwanda. Similar approach was used by Kirim [4], in which the author studies the determinants of inflation in Kenya for the period 1970 -2013. OLS method is used to estimate the relationship between, corruption, political instability, oil price, food price, money supply, wages, central bank rate and exchange rate, and inflation in Kenya. The study showed that food price, GDP growth, and corruption had a negative impact on inflation in Kenya, while money supply and exchange rate had a positive effect on inflation in Kenya. Wage and political instability were found insignificant in effecting the inflation in Kenya.

Determinants of inflation in Malaysia for the period 1980-2012 were analyzed by Hashim et al. [12] using multiple regression analysis, the results of the study showed that GDP, government spending, and interest rate had a negative effect on inflation in Malaysia, whereas money supply has a positive impact on it. The import of good and service was found insignificant. The Indian case also received attention in the

study of Tiwari [13]. The explanatory variables included in his study are the consumer price index, broad money, import indices and index of industrial productions, by using the VECM. The results show that the broad money supply and import index are the most factors explaining inflation in India, while index industrial production has a negative impact on inflation in India. Ahmed et al. [14] examine, from their hand, long and short-run dynamics of inflation in Pakistan for the period 1971-2012, empirical results reveal that GDP, import, money supply energy crises, output gap and government expenditure have a positive impact on inflation in Pakistan. Also, the results showed that both the supply side and the demand side are persisted inflation in Pakistan. Also, Bandara [15] study the determinants in Sri Lanka during 1993-2008 using VAR model. The overall findings of the study reveal that exchange rate, GDP and money supply are considered a driver of inflation in Sri Lanka.

One seminal study by Morsy and Jaumotte [16] examined the determinants of inflation differentials in the Euro area for the period 1983-2007. Results show that central coordination of collective bargaining, high union density, and high employment protection, increase the persistence of inflation.

Regarding the Jordanian economy, two works have been done. Jaradat and Al-Hhosban [17] examined the relationship between interest rate and inflation in Jordanian economy over the period 1990-2012, by using multiple regression and co-integration test. The empirical findings show that there is a positive relationship between these two variables. Another study by Jaradat et al. [18] investigate the determinants of inflation in Jordan by employing ECM, using quarterly data during the period 2000 Q1 to 2010 Q3,.Finding indicate that import inflation ,export ,credit facilities have a positive impact on inflation in Jordan , whereas GDP has a negative effect on inflation in Jordan.

### **Model Specification**



Based on economic theory and concerning the previous empirical literature, the economic model of the present study will be as follows:

$$\pi = (Y\_GAP, POIL, MS, IR, CCF) \quad (4)$$

Where:  $\pi$ ,  $Y\_GAP$ ,  $POIL$ ,  $MS$ ,  $IR$ , and  $CCF$ , are inflation rate, output gap, oil price, broad money, interest rate .and credit respectively, and they defined as stated hereunder. Given that chosen macroeconomic variables are more likely to have non-linear relationships, all the variables have been converted into a linear form by taking their natural log values, the variables become in the growth rate form, and the parameters are the output elasticity. The logarithm form of the econometric model is as follows:

$$\ln \pi = b_0 + b_1 \ln Y\_GAP + b_2 \ln POIL + b_3 \ln MS + b_4 \ln IR + b_5 \ln CCF + \varepsilon_t \quad (5)$$

With reference to theoretical framework and empirical literature, the relationship between inflation and the explanatory variables in the present study [19].

It is hypothesized that  $b_i > 0$ , which indicates that all the explanatory study variables are expected to have a positive impact on inflation rate in Jordanian economy. Table 1 illustrated some of these references.

**Table 1:** The hypothesized expected sign of the inflation and its determinists.

The variables	The expected sign	Theoretically framework	Empirically reference
Money supply	Positive	Quantity theory of money and monetarism theory	Alam and Alam [6]; Kirim [4]; Kiganda [16]; Bandara [15].
Oil price	Positive	Cost-pull theory	Mahabadi and Kiaee H [20]; Malhotra and Krishna [21]; Kirim [4]

Interest rate	Negative	Cost -pull theory	Kirim [4]; Ebiringa and Anyaogu [22]; Tiwari [13]
Credit	Positive	Demand-pull theory	Rahimov et al. [8]; Jaradat et al. [18]
Output gap	Positive or Negative	Structuralist theory	Azam and Rashid [23]; Ruzima and Veeraachamy [11]

### Data source and Variables Definition

The empirical analysis applied in the present study is the Fully Modified Ordinary Least Squares (FMOLS), by using quarter time series data for the period 2000:1 to 2017:4. The variables included in the current study are inflation rate ( $\pi$ ) as an independent variable defined as the quarter percent change in consumer prices compared with the previous quarter's consumer prices, and gross domestic product gap (Y\_GAP) which is calculated as the difference between actual GDP and potential GDP, which is obtained based on HP filters, broad money supply (M2) which is equal to money supply (M1) plus quasi-money, interest rate (IR) which is the weighted average interest rate on loans and advances. Oil price (POIL), and credit (CCF) defined as the amount of total credit supplied by a central bank of Jordan to the banking system as explanatory variables. All data are extracted from the central bank of Jordan database, except data for the oil price which obtained from IMF database.

## EMPIRICAL INVESTIGATION

### The Unit Root Test

Augmented Dickey-Fuller (ADF), Phillips-Peron (PP) unit root tests were applied in the current study to check the order of integration of the variables. Table 2 highlights

the outcome of the stationary results. It can be seen from the data in Table 2 that all variable exhibit unit root at level which is indicated the non-stationary of variables, while they are all become stationary at first difference at 1% and 5%, which means that there is a co-integration among study variables, in which there is a long run relationship between the inflation rate in Jordanian economy, and other variables.

**Table 2:** Unit root tests results.

Variable	ADF		Decision Inference	PP		Decision Inference
	Level	1 <sup>st</sup> diff		Level	1 <sup>st</sup> diff	
INF	-2.573567	-6.182737*	I(1)	-2.586096	-5.629543*	I(1)
Y_GAP	-1.575682	-5.556334*	I(1)	-0.571288	-3.059781**	I(1)
M2	0.958194	-8.487286*	I(1)	0.850086	-8.499307*	I(1)
CCF	1.600953	-3.437531**	I(1)	2.146314	5.588037*	I(1)
POIL	-2.194887	-5.045714*	I(1)	-1.836921	-6.299969*	I(1)
IR	-2.540870	-4.114048*	I(1)	2.416056	-6.808963*	I(1)

ADF and PP Critical values (level) 1% -3.525618, 5% -2.902953  
 ADF and PP Critical values (1stdiff) 1% -3.527045, 5% -2.903566  
**Note:** \*\*\*, \*\*, imply significance at the 1%, 5%, respectively.

### Co-integration Test

One crucial econometric issue is to determine the existence of the long-run equilibrium relationship among study variables. In this regard, the nonlinear approach can be better explained such relationship than the linear does [24,25]. This can be done by applying the Johansen co-integration approach. Having concluding from the ADF, PP, tests results that the variables are integrated of order one, I(1), which is a necessary condition for applying the Johansen co-integration approach [26,27]. So now we can move to the next step to determine the existence of at least one linear combination of these variables that is a stable and non-spurious

relationship exist among variables. Due to sensitively of co-integration to the lag length employed, the optimal lag length in the current study is determined by the Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC) statistics.

As it is apparent in the Table 3 the results show that the calculated value is higher than the critical value for both the trace and Max-Eigen statistics, which indicated that there are two co-integrating equations at a 5% significance level, suggesting a long stable relationship between inflation in Jordanian economy and the explanatory study variables.

**Table 3:** The co-integration test results.

<b>Unrestricted Co-integration Rank Test (Trace)</b>			
<b>No. of CE(s)</b>	<b>Trace Statistic</b>	<b>0.05 Critical Value</b>	<b>Prob.**</b>
$r=0^*$	149.635	95.754	0.000
$r \leq 1^*$	87.232	69.819	0.001
$r \leq 2$	45.594	47.856	0.080
$r \leq 3$	21.912	29.797	0.303
$r \leq 4$	10.265	15.495	0.261
$r \leq 5$	0.461	3.841	0.497
<b>Unrestricted Co-integration Rank Test (Maximum Eigenvalue)</b>			
<b>No. of CE(s)</b>	<b>Max-Eigen Statistic</b>	<b>0.05 Critical Value</b>	<b>Prob.**</b>
$r=0^*$	62.403	40.078	0.000
$r \leq 1^*$	41.639	33.877	0.005
$r \leq 2$	23.681	27.584	0.146
$r \leq 3$	11.647	21.132	0.583
$r \leq 4$	9.805	14.265	0.225
$r \leq 5$	0.461	3.841	0.497

\* denotes rejection of the hypothesis at the 0.05 level.

### Fully Modified Least Squares (FMOLS) Results

Having confirmed the existence of long-run equilibrium relationships among the model's variables by Co-integration results, and the explanatory variables are integrated of order one,  $I(1)$ . The Fully Modified Least Squares (FMOLS) approach can be used to estimate the long run elasticities of the explanatory variables. As shown in Table 4 the estimated coefficients of all the variables are statistically significant at 1% level and have the hypothesized sign. The coefficient of (Y\_GAP) was negative, and this can be explained due to supply bottleneck shocks such as resources bottleneck like a lack of financial resources, higher unemployment rate shortage of oil, or foreign exchange bottleneck like deficit of balance of payment, and huge import bill), and infrastructural weakness like transportation, and electricity. The FMOLS results reveal that money supply (MS), oil price (POIL), and credit (CCF) have a significant positive impact on inflation rate in Jordanian economy, which indicated that a one percent increase in (MS), (POLI), and, (CCF) leads to increase in inflation rate in Jordanian economy by (0.001), (0.102), (0.002238) respectively.

While the interest rate has a negative effect on inflation rate in Jordanian economy, indicated that a one percent increase in interest rate (IR), will lead to decrease in the inflation rate in Jordanian economy by (0.793044). These results match those observed in earlier studies. Also, the empirical analysis results reveal that the oil price has a higher effect on inflation rate in Jordanian economy in the long run, and dominates the domestic factors (i.e. MS, CCF) for a drive the inflation in Jordanian economy, which indicated that the supply side is persisted inflation in Jordan economy, it can be suggested, therefore, that inflation in Jordan is not a monetary phenomenon. The diagnostic tests shown in the bottom of the Table 4, reveals that the model has the econometric aspiration property, and the model's residuals are serially being uncorrelated, and the Heteroscedasticity problem doesn't appear.

**Table 4:** Fully modified ordinary least squares (FMOLS) Regression Results dependent variable ( $\pi$ ).

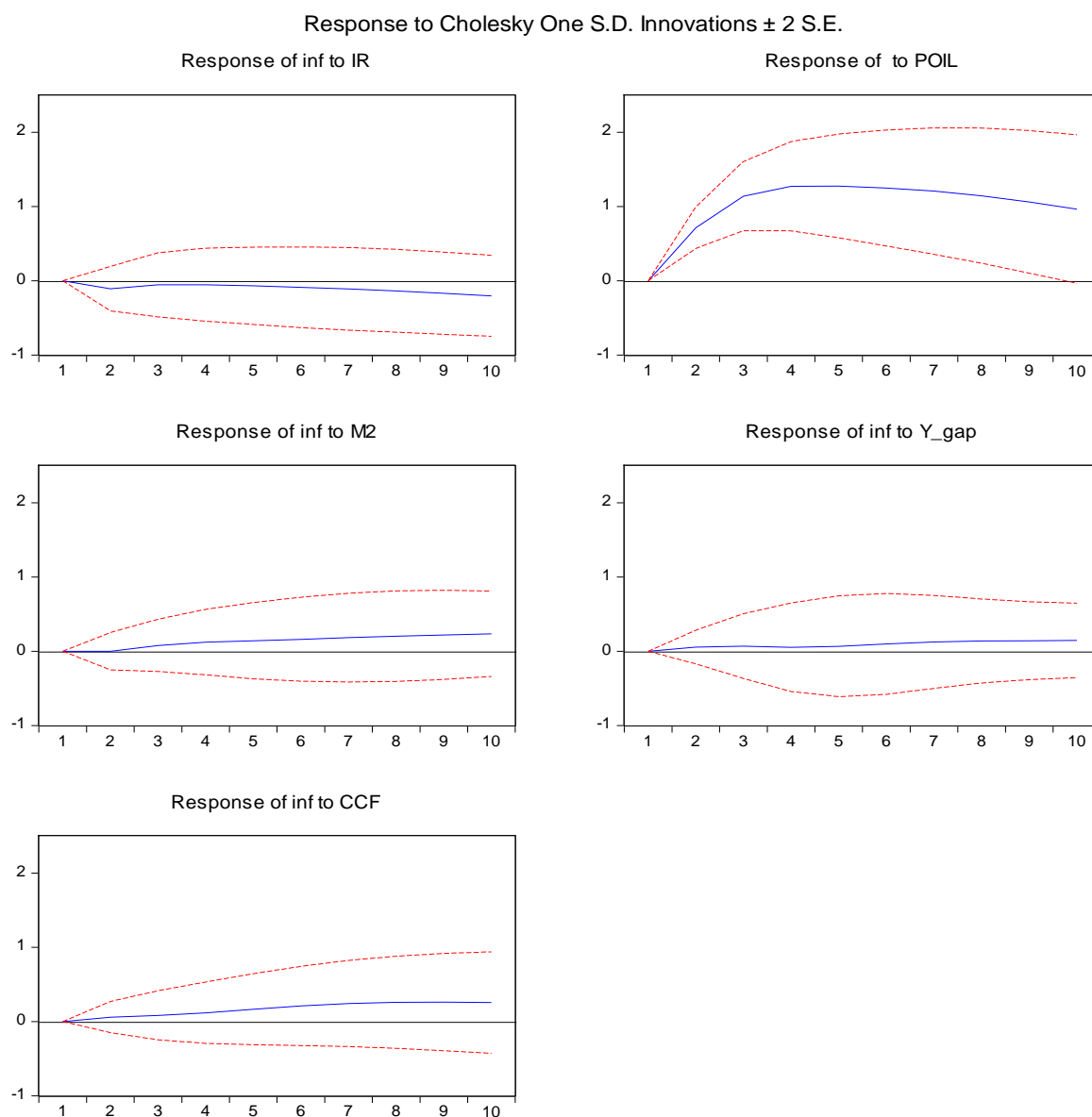
Variable	Coefficient	Std Error	t- Statistics	Prop
Y_GAP	-0.030782	0.012292	-2.523435	[0.0094]
CCF	0.002238	0.000360	6.210391	[0.0000]
M2	0.001158	0.000544	2.129352	[0.0372]
IR	-0.793044	0.374765	-2.115949	[0.0000]
POIL	0.101737	0.008425	12.07527	[0.0000]
C	17.41968	3.164199	5.505243	[0.0000]
R-squared	0.5637323	Adj R-squared	0.521502	
Co integration Test - Hansen Parameter Instability		0.752	[0.137]	
Heteroscedasticity Test: Breusch- Pagan-Godfrey		0.769	[0.575]	
Breusch-Godfrey Serial Correlation LM Test		0.845	[0.690]	

### Impulse Response Functions

The impulse response functions test was applied in this study to test the track of time path of inflation rate in Jordanian economy to the sudden change rate of one standard deviation in each of the following: money supply, Y\_GAP, oil price, credit, and interest rate. Figure 1 demonstrates the impulse response functions results, which indicates how the inflation in Jordanian economy responds to shocks occasioned by money supply, Y\_GAP, oil price, credit, and interest rate. It is noticed that the response of inflation rate in Jordanian economy to one standard deviation shock of the money supply, Y\_GAP, oil price, credit, and interest rate was positive from the first period, and continued to be positive beyond the ten periods, except for interest rate which was negative from the first period, and continued to be harmful beyond the ten periods. Also, it appears from Figure 1 that oil price has a higher

effect on inflation rate in Jordanian economy, one standard deviation increase in oil price leads to 0.9 standard deviation in the inflation rate in Jordanian economy, this result is in line with economic theory and empirical finding of this study.

**Figure 1: Impulse Response Function.**



**Variance Decomposition Analysis**

The variance decomposition analysis employed in this study to determine the

percentage of change in each of the explanatory variables that are attributable to variation of all variables in the study's model. The results of variance decomposition estimated of all explanatory research variables, and inflation rate in Jordanian economy was mentioned in Table 5, with a ten-quarter forecast horizon, and it explains how much of an inflation in Jordanian economy predicated error variance is described by the innovation from each of money supply, Y\_GAP, oil price, credit, and interest rate. As shown in Table 5 the results reveal that the inflation rate in Jordanian is explained as follows the oil price (POIL) explained of (59%), interest rate (IR) explained of (0.678%), money supply (MS) explained of (1.258%), Y\_GAP explained (0.513%), credit explained of (1.826%), and (36%) is described by its innovation at period -10. Thus, among the major shocks to the inflation rate in Jordanian economy is mainly from oil price, this result confirming the IRS results and empirical finding of the current study. The remaining periods of Table 5 it can be interpreted likewise.

**Table 5:** Variance Decomposition of the shocks.

Period	S.E.	Inf	IR	POIL	M2	Y_GAP	CCF
1	0.993	100.000	0.000	0.000	0.000	0.000	0.000
2	1.734	82.422	0.385	16.982	0.000	0.097	0.113
3	2.354	66.666	0.262	32.647	0.107	0.134	0.183
4	2.838	56.536	0.217	42.568	0.258	0.125	0.296
5	3.222	50.040	0.214	48.728	0.389	0.138	0.490
6	3.541	45.499	0.239	52.792	0.527	0.191	0.753
7	3.812	42.125	0.289	55.582	0.683	0.271	1.050
8	4.042	39.603	0.371	57.472	0.858	0.355	1.341
9	4.233	37.743	0.497	58.673	1.049	0.434	1.603
10	4.392	36.393	0.678	59.333	1.258	0.513	1.826



## CONCLUSION

The purpose of the present study was to capture the determinants of inflation in Jordan. FMOLS approach, impulse response functions, and variance decomposition analysis were employed by using quarterly data over the period 2000:1 to 2017:4. Considering inflation rate as a dependent variable and money supply, credit, output gap, interest rate and oil price as explanatory variables, empirical finding of the current study highlight that the oil price play crucial role in determining the inflation rate in Jordan. Further, Money supply and credit positively affect the inflation, however such effect was only about (3.5%) of the variation in the inflation in Jordanian economy. On the other hand, the output gap and interest rate have a negative effect on inflation in Jordanian economy. The most interesting result to emerge is that the inflation rate in Jordanian economy is considered as a supply side, in which the oil price explained a round of (59%) of the variation of inflation in Jordanian economy. It can be suggested, therefore, that inflation in Jordan is not a monetary phenomenon.

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