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On the Impact of Oil Revenues on Inflation in Iran

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ABSTRACT

The present paper aims to investigate the impact of oil revenues on inflation in Iran during the past three decades, employing the Generalized least squares (GLS) method. The proposed model was estimated using *Eviews* software. Coefficients obtained for the model indicated the positive effect of inflation on oil revenues and the negative impact of gross domestic product(GDP) on inflation in Iran. In conclusion, administering several tests on the model revealed no heteroscedasticity, autocorrelation, and collinearity.
KEYWORDS: Inflation; Money amount; Gross domestic product; Oil revenues; Generalized least squares.

1. INTRODUCTION

Inflation is an economic situation in which the general price level increases excessively or disproportionately, in a significant and persistent way, and it is often irreversible. Inflation can be taken into account as the widely known economic problem among the developing countries such as Iran, wherein fears of inflation and rising prices among people is tangible. Society can better realize the negative effect of inflation on economic well-being and reduction of their purchasing power. Therefore, they demand the control of prices and stability of their real income. There are various reasons behind inflation. One of the main factors that contributes to the inflation in Iran is the variations in oil revenues. However, it should be noted that the major changes in the volume of inflation depends on the volume of money.

Hooker (2002) found that oil price changes do not have a significant impact on US inflation measures that exclude energy products. LeBlanc and Chinn (2004) adopted a similar Phillips curve framework to analyze data fromG5 countries, and obtained similar findings: current oil price increases are likely to have a modest effect on inflation in the US, Japan, and Europe. Killian (2008) showed that the average contribution of an exogenous oil price shock on inflation inG7 countries is quite small and that of the 2002 - 2003 shock is negligible.

Van den Noord and Andre (2007) concluded that the spillover effects of energy prices into core inflation(inflation excluding energy and food prices) are small in comparison with the effects of the 1970s. Nakov and Pescatori (2007) estimated a DSGE model with an oil producing sector and found that the reduced oil share and the smaller size of oil price shocks are not the major drivers of the moderation in US inflation variability. Several authors argue that this breakdown of the oil prices-macroeconomic relationship reveals that the relation between these variables is non-linear and propose different non-linear specifications of this relation (e.g., Hamilton, 1996; Lee, Ni, and Ratti,1995).

Blanchard and Gali (2007) used data from industrialized economies (the US, France, the UK, Germany, Italy, and Japan), and focused on the different effects of oil price shocks on inflation and economic activities across time. Research also supports the view that these shocks have been an important source of economic fluctuation over the past three decades (Kim and Loungani, 1992). From an empirical point of view, considerable research finds that oil price shocks have affected output and inflation (e. g., Hamilton, 1983, 1988, 1996, 2000, Hooker, 1996, 1999, 2002; Huntington, 1998; Kahn and Hampton, 1990; Mork, 1989, 1994, Tatom, 1988).

2. On the Impact of Oil on Inflation

One of the main goals of macro-economy is price stability and to achieve this goal it is important to understand the factors affecting inflation. Given that the Iranian economy is an oil-based economy, and changes in prices and subsequently changes in the oil revenues have significant effects on macroeconomic variables, this paper is set out to evaluate the impact of oil revenues. If the incomes from oil revenues are saved and used in investments, the per capita revenue will increase.

If payments from oil exports are used for purchasing domestic products, but domestic products do not increase, such payments in the community will lead to inflation because demands go up, while supply does not change. Nevertheless, foreign investment has also increased in the latter case. The impact of the oil sales abroad has the same impact on economy as the effect of increased money inside the country. The main difference is that such sources can increase the purchasing power of foreign products, and thus, it plays a significant role in the economy of the country, while money increase has no such effect.

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With oil revenues rise, the implementation of the fiscal policies of the government are more possible. If expansionary fiscal policy by increasing government spending is accepted, it will lead to income rise among a group of people. If they have low propensity to savings, much of this money will be spent and it ultimately will increase demands for goods and services in the society. Provided that there is production level stability, increased demand will lead to an increase in prices.

3. Analytical model of the study

In this paper, the monetary theory of inflation was employed. According to this theory, fluctuations of money stock are considered as the main reason behind inflation. Monetary theory of inflation is expressed using an exchange equation. This equation is a simplified expression of the reality and now it is presented as M.V= P.Y. (Branson 1989).

In the above equation M stands for volume of money in circulation, V is the average velocity of any currency over a period of time (one year) for trading, P is the price index of the general price level, and Y stands for the real national output or income. Obviously, M.V represents the total value of transactions carried out over a year and P. Y is the value of goods and services produced (and traded).

In the simple or crude form of quantity theory of money or monetary theory of inflation, V is assumed to be constant and Y is fully employed and it is stable. Therefore any change in M will lead to changes in P in the same way.

The aggregate demand curve is a curve in which for each level of prices, P shows the total amount of real goods and services for final demand of Y^d.

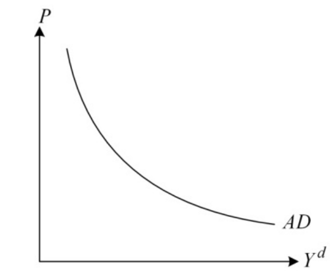

Figure1. Aggregate demand curve

The aggregate demand curve is a descending one. To extract the aggregate demand curve, LM and IS curves are usually employed. However, this feature can be used to derive the total demand of algebraic curves.

LM and IS equations for tripartite economy are as follows:

Equation IS,

$$r = \frac{\overline{C} - C\overline{T} + \overline{CTR} + \overline{I} + \overline{G}}{b} - \frac{1 - c(1-t)}{b} Y$$

Equation LM,

$$r = -\frac{1}{h}\frac{\overline{M}^S}{P} + \frac{\overline{L}}{h} + \frac{k}{h} Y$$

In the equations above, $\overline{C}$ is the independent expenditure, $\overline{T}$ is the flat tax or a lump sum, $\overline{TR}$ stands for the transfer payment, $\overline{I}$ is the independent investment, $\overline{G}$ is the government spending, $\overline{M}^S$ represents the money supply or money stock, $\overline{L}$ is the independent demand for money, r is the interest rate, Y is the total demand, and P stands for the price level. Additionally, C is the propensity to consumption, t is the tax rate, b is the investments subject to interest rate, h is the interest rate of the money demand and k is the coefficient of income of money demand.

Solving these two equations gives the total demand, which is as follows:

$$Y = \frac{\overline{C} - C\overline{T} + C\overline{TR} + \overline{I} + \overline{G} + \frac{b}{h}\frac{\overline{M}^S}{P} - \frac{b}{h}\overline{L}}{1 - c(1-t) + \frac{bk}{h}}$$

As can be seen, in the demand equation, the total demand varies as the result of changes in all the factors in the numerator and denominator of the equation. As the curve of the total demand is derived from LM and IS curves, any other factors excluding the price level, P, that a change in it leads to Aggregate Demand (AD) curve or moving on the AD curve, will bring about displacements incurves IS or LM as well as displacements in curve AD. All of these factors of AD can be shown in equation (3-4), including the transfer of IS as the use of independent consumption, $\overline{C}$; fixed tax, $\overline{T}$; transfer payments, $\overline{TR}$; government spending, $\overline{G}$; and independent investment, $\overline{I}$; the factors displacing LM, that is, the nominal money supply, $\overline{M}^S$; and independent demand for money, $\overline{L}$. As an example, by increasing oil revenues, oil revenues could appear to increase the money supply and thus can positively affect the price level.

In this paper we introduce a model which is as follows:

$$P^\circ = f(OILR, GDP, M^S)$$

Wherein P° as the inflation rate, OILR as oil revenues, GDP as Non-oil GDP, and M^S is the amount of money. P° is the dependent variable and OILR, GDP and M^S are independent variables.

In this model, inflation is considered as a reflection of oil revenues, non-oil GDP and the amount of money. Primarily, oil revenues due to an increase in government spending may have an impact on inflation. Secondly, when GDP is increased, they are considered as discount for price rise. Meanwhile, the money supply will increase inflationary pressures.

The hypotheses of the paper are as follows:

1 - Oil revenues have a positive effect on inflation.
2 - The amount of money has a positive effect on inflation.
3 - The main cause of inflation in the money stock is constant.

4. Stationarity survey

Time series designs are one of the most important statistical data used in the empirical analysis. Researchers assume that the time series is stationary, and if this is not the case, conventional statistical analysis which is based on F,t, chi-square test and the same tests are under the question.

A time series variable is constant when the mean, variance, and correlation coefficients remain constant over time.

5. Augmented Dickey-Fuller Unit Root Test

Dickey Fuller test can be utilized to find the stationarity of a time series design. In this statistical test, Augmented Dickey-Fuller(ADF) test or t as the calculated delay variable is compared with the Mackinnon critical values .If the t is smaller than the critical values obtained, it can be concluded that the variable is static.

To ensure the stativity of the used variables used in the model, all the variables based on ADF test, were studied. ADF unit root test was administered in different forms and based on the significance of each algebraic factor (the fixed values) and the significance of dependent variables with interval data for all variables in the model.

Hypothesis $H_\circ$ shows the dynamicity, and hypothesis H_1 shows the stativity of variables.

$$\begin{cases} H_\circ : \rho = 1 \\ H_1 : \rho \neq 1 \end{cases}$$

*Table 1.*Unit Root Test of Dickey-Fuller (ADF) for the data level

Critical value of MacKinnon			Algebraic factors and length of intervals	ADF statistics	Variable name
10%	5%	1%			
-2/6164	-2/9558	-3/6496	(2 ،C)	0/074041	$LN\ P^\circ$
-2/6181	-2/9591	-3/6576	(3 ،C)	-2/502856	$LN\ OILR$
-1/6211	-1/9514	-2/6344	(1 ،N)	1/614123	$LN\ GDP$
-1/6213	-1/9517	-2/6369	(2 ،N)	1/071020	$LN\ M_1$

There are three critical values of 1%,5% and 10% on the right and we can see a calculated amount of the Dickey-Fuller statistic is to the left. Since statistics from Dickey-Fuller test are higher than critical values,the variables are in an unstable level.

In the following step, generalized Dickey-Fuller test will be repeated for the first-order difference of variables.

Table 2. Unit Root Test of Dickey-Fuller (ADF) for the first-order difference of variables

Critical value of MacKinnon			Algebraic factors and length of intervals	ADF statistics	Variable name
10%	5%	1%			
-2/6181	-2/9591	-3/6576	(2 ،C)	-3/707354	$LN\ P^{\circ}$
-2/6200	-2/9627	-3/6661	(3 ،C)	-3/551260	$LN\ OILR$
-1/6213	-1/9517	-2/6369	(1 ،N)	-2/454040	$LN\ GDP$
-2/6181	-2/9591	-3/6576	(2 ،N)	-2/968655	$LN\ M_1$

ADF Statistics for all variables on 5% level was below the critical value. Accordingly, H_1 assuming the dynamicity of variables has been accepted with 95% confidence.

6. Estimate of the model

In this model, inflation is considered as the dependent variable and the independent variables of the model are comprised of oil revenues, GDP, and the amount of money. Therefore, our model is asfollows:

$$P^{\circ} = \beta_{\circ} + \beta_1 OILR + \beta_2 GDP + \beta_3 M_1.$$

Since the model parameters do not have the same detection unit (figures related to $M_1, GDP, OILR$ have units, but P° does not have any unit) and the (log) Ln of the data was employed, the model is as follows:

$$LNP^{\circ} = \beta_{\circ} + \beta_1 Ln\,OILR + \beta_2\ Ln\,GDP + \beta_3\ Ln\,M_1.$$

Therefore the coefficients show the elasticity. The estimated model using E views software and OLS Method are as follows:

$$LnP^{\circ} = 17.33 + 0.44\ Ln\ OILR - 3.66\ Ln\ GDP + 1.41\ Ln\ M_{1.}$$

(3.04) (2.69) (-3.92) (8.11)

Given that the base of Durbin-Watson was 0.87, and the area was positively correlated, so we used Ocart-Cochran to solve the test, and as a result the amount of Durbin-Watson changed to 2.09. Consequently, the estimation of the model from OLS (Ordinary Least Squares) was changed into GLS (Generalized Least Squares). The estimation of the model based on the GLS was as follows:

$$LnP^{\circ} = 12.35 \quad + 0.44\ Ln\ OILR - 2.99\ Ln\ GDP \quad + 1.31\ \ Ln\ M \quad + 0.98\ MA\ (1).$$

(12.75) (5. 38) (5.83) (3.60)

Values $\overline{R}^2, R^2$ are as follows:

$$R^2 = R - squred = 0.99$$

$$\overline{R}^2 = Adjusted\ R - squred = 0.98$$

R^2 was the coefficient of determination and the amount of R^2 in estimation showed that 0.99 expresses the inflation change by the explanatory variables. $\overline{R}^2$ is confirmed and shows the falsehood of R^2. The closer are R^2 and $\overline{R}^2$, the better they are.

7. Conclusion Remarks

According to the theoretical and econometric basics as well as the tests administered, the results obtained from the estimation model are as follows:

8. 1. The impact of oil revenues on inflation (the first hypothesis)

The coefficient of oil revenues representing $\dfrac{\delta LNP^{\circ}}{\delta LNOILR}$ or tension is equal to 0.44. It means that if oil prices rise by 1%, inflation increases by 0.44% which explains a direct and positive correlation between oil and inflation.

The first hypothesis was that the oil revenues have a positive effect on inflation and the hypotheses $H_1, H_{\circ}$ are as follows:

$$\begin{cases} H_{\circ}: \text{ Oil revenues have no effect on inflation,} \\ H_1: \text{ Oil revenues have a positive effect on inflation.} \end{cases}$$

Given that calculated t was equal to 5/83 and it was larger than the t from the Table $(t_{\frac{\alpha}{2},n-1})$ which is 2/04, the hypothesis $H_{\circ}: b_1 = \circ$ (which means that the parameter is not statistically valid at that confidence level) is rejected and the hypothesis $H_1: b_1 \neq \circ$ (which means that the parameter is statistically valid at that confidence level) is accepted at 95% confidence level.

8. 2. The effect of money amount on inflation (the second hypothesis):

The coefficient of money amount or elasticity $\frac{\delta LNP^{\circ}}{\delta LNGDP}$ is equal to 1.31. It means that if there is a 1% increase in the amount of money, inflation will increase 1.31%. This is a direct and positive relationship between the amount and the inflation.

The second hypothesis is that the volume of money has a positive effect on inflation which is as follows:

$$\begin{cases} H_{\circ}: \text{ The amount of money has no positive effect on inflation,} \\ H_1: \text{ The amount of money has a positive effect on inflation.} \end{cases}$$

Given that the calculated t for the volume of money (12.74)is larger than the t in the Table $(t_{\frac{\alpha}{2},n-1})$ which is equal to 2.04, thehypothesis $H_{\circ}: b_1 = \circ$ (which means that the parameter is not statistically valid at that confidence level) is rejected and the hypothesis $H_1: b_1 \neq \circ$ (which means that the parameter is statistically valid at that confidence level)was accepted at the confidence level of 95%.

8. 3. Continuous increase in the amount of money is the main cause behind inflation (the third hypothesis):

The third hypothesis is that the main cause of inflation is the constant increase in the amount of money. Its $H_1, H_{\circ}$ areas follows:

$$\begin{cases} H_{\circ}: \text{The main cause of inflation is the continuous increase in the amount of money,} \\ H_1: \text{The main cause of inflation is not the continuous increase in the amount of money.} \end{cases}$$

Given that the elasticity of money volume is equal to 1/31 and the elasticity of oil revenues is equal to 0.44, therefore the hypothesis $H_{\circ}: b_1 = \circ$ (which means that the parameter is not statistically valid at that confidence level) is not confirmed and the hypothesis $H_1: b_1 \neq \circ$ (which means that the parameter is statistically valid at that confidence level) was accepted within 95% confidence level. This means that the hypothesis H_1 at the confidence level of 95%is accepted.

8. 4. The effect of GDP on inflation

The coefficient of GDP which reflects $\frac{\delta LNP^{\circ}}{\delta LNGDP}$ is equal to -2.99. It means that if GDP increases by 1%,inflation will decrease within 2.99%which represents a reverse negative correlation between GDP and inflation.

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