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Asymmetric Impacts of Oil Price Shocks on Iranian Economic Growth

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Abstract

The study examines asymmetrical effects of ups and downs in oil price on Iran's economic growth from 1990 to 2022, which also includes unemployment and inflation as major macroeconomic factors. The nonlinear autoregressive distributed lag (NARDL) model was employed to examine the effects of positive and negative shocks of oil price on the economic growth. Conclusions make a contribution to the literature on the economic implications of oil price fluctuations, especially in oil -dependent economies such as Iran. The results of the unit root tests indicate that variables are integrated of different orders, which justify the use of the NARDL approach. Structural break tests highlight significant economic changes in the period analyzed in Iran, especially for oil prices in 2012 and 2017, for unemployment for 1994 and 1998, and for inflation in 2012 and 2002. Furthermore, the findings confirm the presence of long -term relationship between oil price fluctuations and economic growth. The results for short -term estimation suggest that a positive oil price shock adversely affects economic growth, while the negative oil price shock has an insignificant effect. Unemployment plays an important role, with positive shock in unemployment showing a strong negative effect on economic growth. Inflation pressure, both positively and negatively, has a small effect. Long -lasting results confirm the asymmetrical effects of oil price movements, a shock of positive oil price adversely affects the GDP growth, while negative oil price shows an insignificant effect.

Introduction

Oil price fluctuations represent one of the most important external shocks that affect the oil exporting economies, especially they are very dependent on oil income, such as Iran. As an important oil -producing country, Iran's economy are significantly associated with the dynamics of global oil price. The relationship between changes in oil price and economic growth is often complicated, both symmetrical and asymmetrical effects. While symmetrical effects suggest that the negative and positive oil price shocks have the same effect on economic growth, the asymmetrical approach argues that the extent of influence and the direction of price movement may vary depending on type of the shocks (Mork, 1989).

In addition, economic indicators, such as unemployment and inflation, play an important role in designing the relationship between oil shock and economic growth. High oil prices can promote government revenues and increase economic growth, possibly reducing unemployment (Mehrara, 2008). On the other hand, a sharp fall in oil prices can lead to fiscal imbalance, economic recession and increasing unemployment. In addition, the inflation pressure associated with an increase in oil prices can affect consumers' purchasing power and general economic stability (Hamilton, 2003).

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In recent years, several studies have emphasized the importance of assessing the asymmetrical effects of the price shock of oil on macroeconomic variables. According to Ghosh and Kanjilal (2014), the effect of the price shock of oil on economic growth depends on whether the price increases or falls, and highlights the need to use the non-linear model. Similarly, Ratti and Vespignani (2015) claim that fluctuations in oil prices have a strong effect on global economic activity, especially in oil exporting countries.

Understanding how the price of oil ups and downs - whether it is symmetrical or asymmetrical - affects economic growth in the presence of large macroeconomic variables such as unemployment and inflation to shape economic policy effectively. The study examines asymmetrical effects of changes in oil price on Iran's economic growth between 1990 and 2022, which includes unemployment and inflation as an independent variables. The analysis provides valuable insight into dynamic interaction between oil price fluctuations and macroeconomic performance in the oil-dependent economy.

Model and Method Specification (NARDL)

THE nonlinear autoregressive distributed lag (NARDL) developed by Shin et al. (2014), is an econometric technique used to investigate a possible asymmetrical relationship between dependent and independent variables in both the short run and the long term. Unlike traditional linear models, the NARDL model decomposes independent variables in positive and negative partial quantities, and assesses the different effects of positive and negative changes on dependent variable. This approach is particularly useful in macroeconomic studies, especially to analyze the effect of external shocks such as oil prices on the economy (Ghosh and Kanjilal, 2014). The model is much preferred due to the flexibility of handling the mixed order integration series (I (0) and I (1)) and has its ability to detect asymmetrical correlation between economic variables (Shin et al., 2014).

NARDL -MODEL SPECIFICATION

The main idea behind the NARDL model is to decompose independent variable (oil value) into two components:

Positive shock (increase in oil prices)

Negative shock (decrease in oil price)

This decomposition is expressed mathematically through the following equation:

$$OIL_t^+ = \sum_{j=1}^{t} max\left\{\Delta OIL_j, 0\right\}$$

$$OIL_t^- = \sum_{j=1}^{t} min\left\{\Delta OIL_j, 0\right\}$$

Where:

- OIL_t^+ represents positive changes in oil price
- OIL_t^- represents the negative changes in oil price

The general form of the NARDLmodel is given as follows:

$$GDP\_GROWTH_t = a + \sum_{i=1}^{p} \theta_j^{+} OIL\_PRICE\_POS_{t-j}^{+} + \sum_{i=1}^{p} \theta_j^{-} OIL\_PRICE\_NEG_{t-j}^{-} + \sum_{i=1}^{p} \theta_j^{+} UNEMPLOYMENT\_POS_{t-j}^{+} + \sum_{i=1}^{p} \theta_j^{-} UNEMPLOYMENT\_NEG_{t-j}^{-} + \sum_{i=1}^{p} \theta_j^{+} INFLATION\_POS_{t*j}^{+} + \sum_{i=1}^{p} \theta_j^{-} INFLAION\_NEG_{t-j}^{-} + \gamma X_t + \varepsilon_t$$

- X_t: Control variable (inflation and unemployment)
- $\theta_j^{+}$and θ_j^{-} : Long-lasting coefficients for positive and negative shock
- ε_t : error term

Data sources include World Bank and central bank in Iran.

Results and Discussions

Unit root test

The results of Kapetanios and Shin (2008) GLS based nonlinear unit root test is as flows:

The Results of Kapetanios and Shin Unit Root Test

Variable	Lags	KS-stat(level)	Lags	KS-stat(1st difference)
OIL_PRICS	0	-1.512	0	-3.556***
Unemployment	0	-2.723*	0	-4.760***
inflation	1	-2.595*	0	-3.235**

The results indicate mixed integration orders that support the use of the NARDL approach. The significant levels of first-difference statistics confirm the stationary.

Structural Break Test

Zivot -andrews structural break test was done as follows.

Results of Zivot -andrews Test

Variable	TB1	t-statistics (level)	TB2	t-statistics (1st difference)
OIL_PRICS	2012	-2.574	2017	-4.776**
Unemployment	1994	-5.175***	1998	-6.911***
inflation	2012	-4.549**	2002	-4.776**

Macroeconomic data often shows structural breaks due to the major economic and geopolitical

events that reflect vulnerability of Iranian economy to the external and internal shocks. The results highlight significant economic changes in the period analyzed in Iran, especially for oil prices in 2012 and 2017, for unemployment for 1994 and 1998, and for inflation in 2012 and 2002.

Bound test 4.3

Bound test results are as follows:

Results of Bound test

F-statistic	**Signif**	**I(0)**	**I(1)**
7.447090	10%	1.99	2.94
	5%	2.27	3.28
	2.5%	2.55	3.61
	1%	2.88	3.99

In order to assess the long run relationship between variables, the bound test was carried out (Pesaran et al, 2001). The F-statistics are significantly higher than significant upper limit values, which confirms the existence of long-term relationships of oil prices, unemployment, inflation and economic growth.

NARDL Model Estimation Results

The results of NARDL model estimation is as follows:

Results of NARDL Model Estimation

Short-run	
C	-11.6884**
GDP_GROWTH(-1)*	-0.8967***
OIL_PRICE_POS	-0.2274***
OIL_PRICE_NEG	-0.0273
UNEMPLOYMENT_POS	4.0910**
UNEMPLOYMENT_NEG	0.7764
INFLATION_POS	0.1485
INFLATION_NEG	0.1563
D(OIL_PRICE_POS)	0.1309
D(OIL_PRICE_POS(-1))	0.1143
D(UNEMPLOYMENT_POS)	2.0565
D(INFLATION_NEG)	-0.2269
Long run	
OIL_PRICE_POS	-0.2536**
OIL_PRICE_NEG	0.0304
UNEMPLOYMENT_POS	4.5622**
UNEMPLOYMENT_NEG	0.8659
INFLATION_POS	0.1659
INFLATION_NEG	0.1744
C	-13.0346

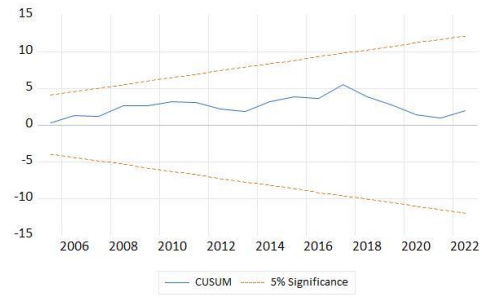
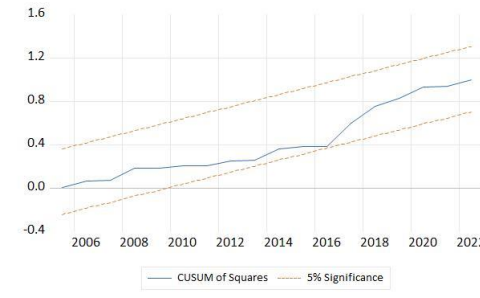
R-squared	0.6614	
F-statistic	0.4545	
Diagnostic tests		
Normality test	Jarque-Bera	Probability
	2.8479	0.2882
LM test	F-stat	Probability
	0.8679	0.4387
ARCH test	F-stat	Probability
	0.9630	0.3351

Short -term and long -term results confirm the asymmetrical effects of oil price shock. The shocks in the price of positive oil affect negative growth, while negative shocks remain insignificant. The high importance of unemployment suggests the important role of the labor market in the economy. The diagnostic checking including normality test, LM test and ARCH test indicate that the model does not suffer from and problem, ensures the reliability of the results.

Structural Stability Tests

The stability tests including Cusum and Cusumsq tests suggests that the estimated model is structurally stable during the study period.

Results of Cusum and Cusumsq Tests

Cusum test	**Cusum of Squares**
	

Conclusion

The study emphasizes the asymmetrical nature of oil price shocks on economic growth in Iran. The negative effects of the positive oil price shock can be attributed to structural problems and mismanagement. In contrast, the insignificant effect of negative oil price shock suggests that the Iranian economy should develop some mechanisms, such as diversification strategies, to reduce unfortunate results of the decline in oil revenues.

Unemployment appears to be an important determinant for economic growth, with increasing unemployment, there is a significant decline in economic growth. This discovery highlights labor market reforms and the need for active employment policy to maintain economic growth, especially during the instability of oil price. Inflation, although less impressive, is still an

important factor that decision makers must monitor in order to maintain extensive economic stability.

Policy Implications

Political decision makers in Iran should consider implementing structural reforms to increase economic flexibility against ups and downs in oil prices. Strategies such as financial diversification, improving effectively of oil revenues management and reducing unemployment can reduce the harmful effects of oil price volatility. In addition, inflation measures should be reinforced to prevent potential economic instability due to rising oil prices.

This study highlights the need for an active economic policy structure that is responsible for the asymmetrical effects of oil value fluctuations, which ensures permanent growth and extensive economic stability in Iran's oil -dependent economy.

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