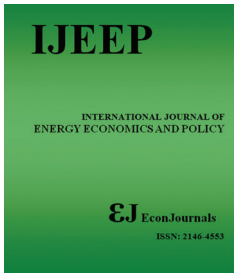

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Effect of Oil Revenues on Government Size in Selected Oil-exporters with an Emphasis on Iran's Economy

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ABSTRACT

As a huge source of wealth, oil can serve as the engine of, or a barriers to, economic growth in oil-rich countries. The important issue is how to manage oil revenues while taking into account the welfare of future generations as a foundation of sustainable development. On one hand, oil-exporters can lay the groundwork for sustainable development by allocating these revenues to infrastructural projects; on the other hand, they can create rents through corruption or mismanagement and thus create a strong barrier to the growth of macroeconomic indicators (Sala-I-Martin and Subramanian, 2003). Oil revenues have a significant role in Iran's economy and are the main source of government expenditures. Oil accounts for the bulk of the country's exports. One of the issues highlighted in Iran's 2025 Vision is to cut the country's dependence on oil revenues and finance spending through tax revenues, while allocating oil rents to efficient and productive investments. Therefore, the present research uses generalized method of moments (GMM) and autoregressive distributed lag (ARDL) to examines the effect of oil revenues on government expenditures and size in selected oil-exporting countries during 1980-2015 with an emphasis on Iran's economy. The results suggest that oil revenues, with a lag, have a significant positive effect on government expenditures and size in the selected oil exporters. Moreover, In the case of Iran, increase in oil revenues have significant short-run and long-run effects on government size.

Keywords: Oil Revenues, Government Size, Generalized Method of Moments, Oil-exporting Countries, Iran's Economy
JEL Classification: Q43

1. INTRODUCTION

Access to natural resources is a major factor in the output and economic development of countries. Therefore, resource-rich countries have an advantage in economic and political spheres. However, it is clear that the mere abundance of natural resources cannot bridge the existing gap beween a country and the world's powerful economies.

How to use the revenues from extracting natural resources, including oil, has always been a of interest to experts in economics, politics, and social sciences. The performance of resource-rich countries suggests that vast amounts of valuable natural resources can improve economic processes and contribute to economic development, but can also have devastating effects on the economy.

For a country like Norway, the wealth generated through oil sales has been a blessing, bringing about economic prosperity and welfare to the people. However, in countries like Iraq and Iran, a vast amount of foreign currency from oil and gas exports are injected into the economy beyond its capacity and become central to economic policies; as a result, not only does it increase government expenditures, but also expands government interventions in the economy and disrupts market performance. In most of these countries, these revenues are directly injected into the public sector to support government spending instead of being invested on infrastructures and institutions that would accelerate economic development. As evidence suggests, this process eventually leads to expansion of state power, state-owned monopoly, lack of competition, and suboptimal allocation of resources. This, in turn, places the economy in the hands of politicians, and oil and other natural resources are used as means of consolidating political power (Sala-I-Martin and Subramanian, 2003).

This article is organized in four parts. The first part is the introduction; the second part presents the theoretical framework and a review of the literature; the third part provides the methods and the results, and the last part presents the conclusion and recommendations.

2. LITERATURE REVIEW

2.1. Theoretical Framework

2.1.1. Different perspectives on government size and role in the economy

Government size and role has been a controversial topic among economists and political leaders since the classical period and Adam Smith's theories in the 18th century. However, economic ideas and policies have changes significantly in the last century. In the classical school, market creates equilibrium and efficiency, and self-interest is pursued by taking into account the interests of the society. Presence of the government in the economy limits freedom, prevents equilibrium, and reduces productivity. Government is present only in cases of market inefficiency, such as lack of economic freedom, inequality and insecurity, violation of human rights and personal freedoms, monopolization, and unhealthy activities with no regard for social justice or anti-discrimination laws (Naderan, 2002).

The neo-classical perspective is quite different. Especially with the evolution of economic theories in the 20th century, the government is allowed to interfere to correct deviation in the performance of economic actors through fixed taxes and transfer payments. Market failure and imperfect competition justify government intervention. Provision of public goods such as the legal system, national defense, public transportation, education, or addressing market failious such as monopolies, externalities as well as incomplete information and unfair distribution also justify government intervention. Market is the top priority. Only in the case of deviation from efficient distribution of resources does the government intervene. The government serves as the public defendant to maximize the welfare of the society (Dadgar, 2001).

In the 20th century, the old doctrine of economic liberalism, like other schools, was modernized and adapted to the new socioeconomic environment. Economists acknowledged that the government plays a new role in the current state of world affairs; that is, it can use means other than economic mechanisms to remove obstacles and solve problems. This new school holds that freedom of natural prices is the best and most effective tool for regulating the economy and that government intervention can be detrimental. However, it also holds that government intervention is, at times, necessary to create the suitable environment for free and natural economic activity within limited, rational frameworks (Khabazi et al., 2014).

John Maynard Keynes, the prominent British economist, started a new chapter in the history of economic thought, especially with regards to theories of state intervention in economic affairs (Al-Qudair, 2005). Regardless of the many components of the traditional economics model and the multitude of organizational and policy factors that had been carefully examined by economists, Keynes managed to revive the relationship between economics and government policies. His explanation of the modern capitalist downturn with an imperfect market and a growing public sector lead to a new approach. Perhaps the most important aspect of Keynes's scientific endeavor was his conceptualization of a new role for the government. Keynes is the first capitalist economist who analyzed the importance and the growing capability of public sector in capitalism. According to the official theory, the role of the government in a market economy is to safeguard—i.e., enforce contracts, balance the budget, and maintain the stability of the currency. The new dimensions of the public sector and the new institutional organization of the private sector (especially the focus on production and the growth of trade unions) show that the economy can no longer simply play a passive role. Keynes realized that state power enables the government to bring about economic prosperity by regulating tax policies and its costs (Garrett and Rhine, 2006). Therefore, Keynes' work can be interpreted as a serious attempts to explain the importance of the state as a major actor in the economic environment and to recognize its new role, thus justifying the positive intervention of the government in the economy for a more optimal allocation of resources (Khabazi et al., 2014).

Therefore, there is a disagreement between conventional perspectives on the role and size of the government. The degree of state intervention lies on a spectrum running from free market on one end to centralized planning on the other end. Today, however, there are few instances of state intervention in one of these extremes, and often there are mixed economies. There is an extensive literature on state intervention in the economy. Those who believe in the minimal role of the state argue that the state is allowed to intervene only where the private sector does not have the incentive or efficiency to invest, i.e., where the private sector fails. This includes public goods such as roads, public transportation, education, and health, but the state is not allowed in sectors of the economy that would lead to inefficient allocation of resources, disrupt market performance, or reduce welfare. Therefore, despite the important role of the state in creating balance between the interests of the public and the private sector, it is only allowed to intervene in the economy where it does not create market imbalance or disrupt the market and simply create the infrastructure and policies needed to improve market performance. It must also be noted that greater government presence in the economy increases rent-seeking activities and reduces economic growth (Heitger, 2001).

2.1.2. Government size

Generally, there is a wide range of perspectives on government intervention from free market to centralized planning. In practice, however, countries have a mixed economy with a preference for one of these two extremes. Government size is a measure of the role of the state budget in the economy. According to the latest World Bank statistics, government size in different countries is not merely a product of their level of development. For example, government size is higher than 40% in developed countries such as France, UK, and Italy, while in other developed countries such as Singapore, Canada, and the US, it is 13%, 18%, and 14%

respectively. Therefore, what determines the level of development is not government size, but government spending. In Iran, budget and off-budget interventions have played a critical role in the development process. These interventions can disrupt market efficiency and competition. The history of Iran's commodity, currency, credit, and energy markets has been a prime example of these inefficiencies.

Nevertheless, excessive government size negatively affects economic growth (Gwartney et al., 1998) in two ways: (1) the bigger the size of the government, the more it will need to raise taxes and borrow to cover its costs, which reduces its financial resources as well as the private sector's incentive to invest; (2) according to the law of diminishing returns, the bigger the government, the larger will be its activities, which leads to suboptimal allocation of resources in the economy; and (3) the public sector is slower than the private sector in responding to new information and the use of technologies, which lowers economic growth (Bergh and Karlsson, 2010). As a result, government size has always been of interest to economists and policymakers. There are various measures for determining government size, but two measures are most commonly used by researchers: share of government purchases (excluding transfer payments) in GDP, and government expenditures as a percentage of GDP (Guerrero and Parker, 2007; Pajouyan, 2012). Here, we use the ratio of government expenditures to GDP as the measure of government size. In Iran, calculation of government expenditures includes current payments and development payments (ownership of capital assets) and excludes the budget of state-owned corporations, banks, and non-profit institutions.

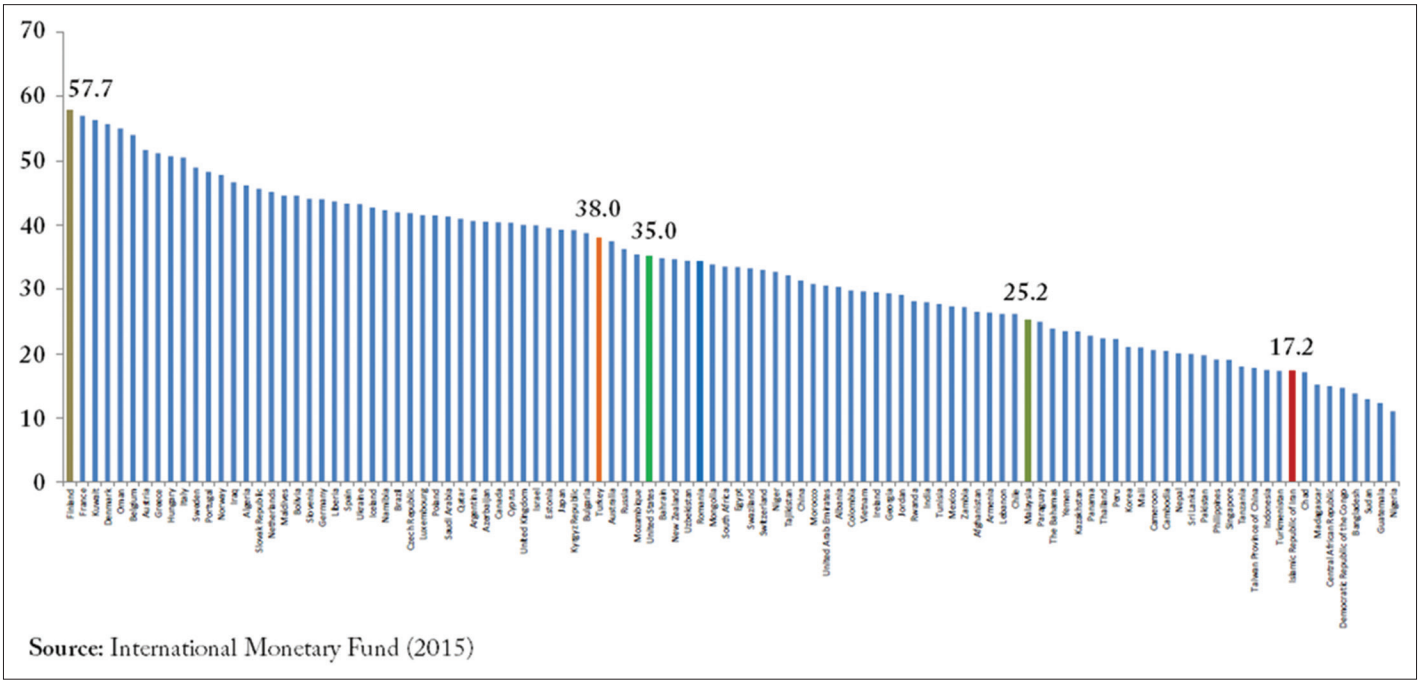
2.1.3. Comparison of government size in different countries

As discussed earlier, a commonly measures of government size is the ratio of government expenditures to GDP. A review of the statistics of different countries in 2015 reveals that Iran is ranked 9th in the world in the ratio of government expenditures to GDP (17.2%). The highest values largely belonged to advanced European economies such as Finland (58%), France (57%), and Denmark (56%). For the US and the UK, this ratio is 35% and 40% respectively. Among neighboring developing countries, Turkey has a ratio of 38%, which is more than twice the ratio for Iran. Comparison of economic regions shows that the ratio of government expenditures to GDP in Iran is less than the average ratio of EU countries (47%), advanced economies (39%), emerging and developing economies (31.4%), Latin America (35%), and even Middle East and North Africa (35.5%) (Figure 1). These numbers suggest that the ratio of government expenditures to GDP shows Iran to be a small government (Economic Review Department Report, 2016).

2.1.4. Government size in iran

In Iran, government size has fluctuated in the last three decades and has been constantly affected by oil revenues, the Iran-Iraq war and post-war reconstructions, and economic sanctions. These effects are especially noticeable in the government's dependence on oil revenues. Studies show that government expenditures have increased with rising oil revenues and have decreased with drops in oil revenues. Being affected by oil shocks has always lead to instability in Iran's economy and has resulted in excessive state interventions. Fluctuations in government size in Iran can be explained by examining the trend of expenditures as a percentage of GDP from 1989, i.e. the beginning of the 8-year war, to the present. In 1989 at the start of the fifth government (First Development Plan), government size was 20.2%, which decreased to 16.1% in 1992 at the start of the next government. However, in Iran, government size has fluctuated in the last three decades and has been constantly affected by oil revenues, the Iran-Iraq war and post-war reconstructions, and sanctions. These effects are especially noticeable in the government's dependence

Figure 1: Government expenditures as a percentage of GDP in 2015



on oil revenues. Studies show that government expenditures have increased with rising oil revenues and have decreased with drops in oil revenues. Being affected by oil shocks has always lead to instability in Iran's economy and has resulted in excessive state interventions. Fluctuations in government size in Iran can be explained by examining the trend of expenditures as a percentage of GDP from 1989, i.e., the beginning of the 8-year war, to the present. Between 1989 and 1992 during the terms of the fifth and sixth governments (the First Development Plan), government size decreased from 20.2% to 16.1% with some fluctuations. Afterwards, however, government size increased mainly due to the increase in current and development expenditures, reaching 23% in 1997. During the terms of the seventh and eighth governments, government size fluctuated, but decreased from 23% to 20% over the 8 year period. Until 1999, negative oil shocks and reduction in oil revenues lead to a proportional decrease in government size, while the subsequent economic boom increased government spending. However, his ratio decreased since the increase in GDP was greater than government expenditures. During the terms of the ninth and tenth governments, government expenditures dramatically increased, especially in the development sector in 2005, reaching the highest level in 2006 with a ratio of 26%. There were some fluctuations afterwards, but since 2011, economic and political sanctions has led to a significant decrease in oil revenues and, as a result, in the ratio of government expenditures to GDP. The financial resources of the government decreased with the drop in oil revenues, and despite the economic recession during this period, the decline in government expenditures was mainly due to the reduction in GDP, with this ratio reaching its lowest value in the last three decades in May 2013 (13%) (Figure 2).

2.1.5. Oil revenues and government size

Oil is one of the main sources of energy that has always played a critical role in the global economy and macroeconomic indicators, especially in oil-exporting countries. Almost no activity is possible without energy and, at the moment, the global economy cannot continue to function without it. The unique role of oil revenues in the economies of oil exporters can be observed in the structure of their budgets and social programs.

The governments of oil-rich countries gain a considerable share of their revenues through ownership and sales of this depletable resource. Many economists argue that the use of oil revenues for current expenditures have adverse impacts on the economy like the Dutch disease or the voracity effect (Akinlo, 2012). In addition, large and unpredictable fluctuations in oil prices can make it difficult for oil exporters to determine the appropriate level of spending (Habibi, 1998; Eltony, 2002). Plenty of studies have shown that resource-rich countries tend to have a much slower growth than resource-poor countries. This has been empirically proven as well and has been analyzed in a large body of research. There are also very poor countries that have abundant natural resources. Therefore, understanding the roots of these failures can have significant implications for development in these countries (Sachs and Warner, 1995, 1999, 2001).

Economic growth slows down in economies that lack a strong legal-political institutional infrastructure and looks at oil as a source of revenue and economic consumption (Tornell and Lane, 1999). In these countries, a rise in oil revenues increases current expenditures, but with a drop in oil prices, the government cannot decrease its current expenditures immediately (Villafuerte and Lopez-Murphy, 2010). Therefore, it first offsets a portion of the drop in oil revenues by reducing its expenditures and development costs, but faces budget deficit in the medium-term, which leads to more borrowing and adverse impacts such as increased money supply and inflation (Emami and Adibpour, 2012). The problem is solved when these countries view oil as a source of wealth rather than revenue and invest the oil income on human and physical capital (Gylfason, 2001).

In general, oil rents create opposite forces in the economy, the sum of which is determined by the institutional infrastructure of the country and by the management of these revenues. If the management of oil revenues is led and supervised by an efficient structure, we can expect the economy to grow and macroeconomic variables to improve. However, in an state with poor institutional infrastructure and extensive bureaucracy, oil revenues lead to the resource curse and have adverse impacts on the economy.

Therefore, oil revenues play an important role in the economy of oil-exporting countries, especially Iran, where oil revenues are the main source of government expenditures and have the largest share of exports. In recent years, oil and gas has accounted for about 60% of government revenues and 80% of exports in these economies. Given the importance of oil revenues and their impact on welfare programs, it is important to examine their impact on government size.

Oil revenues affect government expenditures, the structure of the economy, and government behavior in Iran (Pazoki, 2012). However, regardless of the rise in oil prices and government revenue in recent years, Iran is faced with many problems in carrying out economic projects. Given that Iran is the third largest oil producer among OPEC countries, its economy is largely dependent on oil and greatly affected by oil price shocks. Rising oil prices in recent years has led to an increase in oil revenues and government expenditures. However, there have been international pressures to limit Iran's oil exports and investments in oil-related projects, and these sanctions have had negative impacts on Iran's oil industry. Therefore, oil revenues act as a key variable that determine government spending for current and development costs (Mehrara, 2008). As the main recipient of oil revenues, the Iranian government must distribute oil revenues within the economic structure and pay various types of subsidies. Given the importance of these issues, the present study investigates the effects of oil revenues on the size of government in selected oil-exporting countries with an emphasis on Iran's economy.

Trends in the last 27 years indicate fluctuations in government size in Iran. The reason for this ebb and flow is entirely related to government spending. Government size has been affected by changes in oil prices and spending of oil revenues (Falahi, 2011).Statistical analysis show

Table 1: A review of relevant studies

Authors	Aim	Method	Time period	Result
Bachmeier (2008)	Examining the role of monetary policy in the transmission of oil shocks to the US economy	VAR model	1986-2003	Oil shocks have had a negative effect on stock returns
Reyes-Loya and Reyes (2008)	Examining the relationship between government expenditures, tax revenues, oil revenues, and industrial production index in Mexico	ARIMA model	1990-2007	There is an inverse relationship between oil-related revenues and tax revenue from non-oil sources
Chun (2010)	Exploring the impact of oil revenue on the national defense spending of five oil-exporting countries (Iran, Saudi Arabia, Kuwait, Venezuela, and Nigeria)	Measuring elasticity of demand	1997-2007	In each of these countries, the demand for military spending is largely inelastic, meaning that attempts to limit defense spending by tinkering with oil revenues are likely to fail
Mehrara et al. (2010)	Studying the non-linear relationship between oil revenues and real output growth of the Iranian economy	ECM model	1959-2007	The response of economic growth to oil revenue growth in low regimes of oil revenues is greater than in high regimes of oil revenues
Hassani and Nojoomi (2010)	Examining the factors that determine Iran's oil revenues	ARDL model	1970-2008	Factors such as oil production, oil price, and oil proved reserves have long-run effects on Iran oil export revenues. The effects of variables such as domestic oil consumption and world oil production are negative
Farzanegan (2011)	Analyzing the dynamic effects of oil shocks on different categories of the Iranian government expenditures	VAR model	1959-2007	Iran's military and security expenditures significantly respond to a shock in oil revenues (or oil prices), while social spending components do not show significant reactions to such shocks
Shahnazi et al. (2011)	Examining the effect of oil revenues on government fiscal policy	Uzawa-Lucas model		Optimal policy requires making use of subsidies to invest in human and physical capital. Human capital can be financed by oil revenues and income tax, and physical capital can be financed by oil revenues alone. Government size depends on oil revenues: As the share of oil revenues in GDP or the ratio of oil revenue to physical capital increases, government size increases and vice versa
Garkaz et al. (2012)	Examining the relationship between oil revenues and government expenditures	Wavelet analysis	1996-2007	There is a significant positive relationship between oil revenues and government expenditures in the long run
Hamdi and Sbia (2013)	Examining the dynamic relationships between oil revenues, government spending, and economic growth in the Kingdom of Bahrain	Panel VAR model	1960-2010	Oil revenues are the principal source for growth and the main channel which finances government spending
Aregbeyen and Kolawole (2015)	Examining the relationships among oil revenue, government spending, and economic growth in Nigeria	OLS model	1980-2012	Oil revenue Granger caused both total government spending and growth, while there was no-causality between government spending and growth in the country. Thus, government should increase spending on capital projects and intensify efforts at increasing output in the oil sub-sector in order to boost economic growth in Nigeria
Ahmad and Masan (2015)	Examining the dynamic relationships between oil revenue, government spending, and economic growth in Oman	VAR model	1971-2013	There is a long-run relationship between the real GDP, the real government expenditure, and the real oil revenues. Government expenditure appears to be the main source for long-run economic growth, and in the short run, variations in government expenditure are generally derived by oil revenue shocks
Ghadiri (2000)	Analyzing the determinants of economic growth in Iran	ARDL model	1971-1996	Fiscal policies and oil revenues encourage economic growth, while monetary policies have negative impacts on economic growth
Farhangi and Shirkavand (2011)	Examining the effect of oil revenues on economic management process in Iran	Statistical analysis	1994-2004	Oil revenues have adverse effects on Iran's economy and have led to inefficient economic management in the country
Arsalani (2011)	Investigating the role of oil price and oil revenues in Iran's economy and their relationships with macroeconomic variables		1963-1999	When oil price rises, foreign exchange earnings from oil increases, leading to an increase in the government budget
Mehnatfar (2004)	Examining the factors that increase current costs of Iran's government	OLS model	1959-2001	Tax revenues and oil revenues significantly increase government expenditures

(*Contd...*)

Table 1: (*Continued*)

Authors	Aim	Method	Time period	Result
Mehrara and Oskoui (2006)	Examining the dynamic effects of oil shocks on economic variables in four oil-exporting countries (Iran, Indonesia, Kuwait, and Saudi Arabia)	SVAR model	1960-2003	The degree of outsourcing oil revenues is higher in Saudi Arabia and Kuwait than Iran. Moreover, oil price shocks are the most important source of GDP fluctuations in Saudi Arabia and Iran. Iranian and Saudi economies are more dependent on, and susceptible to, oil revenues than the other two economies
Renani et al. (2006)	Investigating the relationship between financial decentralization and government size in Iran	Statistical analysis	1989-2003	Financial decentralization of expenditures is negatively related to the size of the central government, but positively related to the size of provincial governments. Moreover, estimation of the parameters of the control variables show that the effect of oil and gas revenues on government size is insignificant
Esmailnia (2012)	Examining the effect of oil shocks on government expenditures in Iran's economy	VAR model	1965-1999	Military and social security expenditures have a significant positive response to oil revenue (or oil price) shocks. Other social expenditures do not significantly respond to shocks. Moreover, Iran's military activities are highly sensitive to unexpected negative shocks. Therefore, sanctions aimed at limiting Iran's oil export capacity can have significant effects on Iran's military spending, but no significant effect on education healthcare, and cultural expenditures
Emam et al. (2013)	Effects of oil revenues on spending behavior and government size in Iran	GMM model	1971-2011	There is a significant positive relationship between oil revenues and government size in Iran. Oil revenues have significant positive effects on military and cultural spending, while education, healthcare, and social security expenditures are not affected by oil shocks. Since about 49% of government expenditures are military expenditures, this is the sector that is most affected by oil shocks
Mohammadi and Barat (2013)	Examining the effect of shocks from reduction in oil revenues on government spending and money supply in Iran	VAR model	1970-1990	Oil revenue shocks have significant effects on development and current expenditures of the government as well as the money supply
Zonouzi et al. (2014)	Examining the effect of oil revenues on good governance in selected OPEC member countries	Panel model	1996-2011	Oil revenues have a significant negative effect on good governance, suggesting the negative impact of oil revenues on corruption control, political stability, and accountability. Oil revenues also have a negative effect on government effectiveness and the quality of laws and a positive effect on the rule of law, but these effects are not significant
Komijani and Nazari (2015)	Examining the effect of oil revenues on government expenditures in Iran	VAR model	1974-2011	Oil revenues have significant positive effects on government expenditures (total, consumption, and development), both in the short and long run

that government size fluctuated within a specific interval from 1989 to 2005 (16%-23%). However, with rising oil prices and a shift in the approach to spending oil revenues, government expenditures in the budget has grown since 2005. In 2006, government size reached its highest level in 27 years at 26%. In 2013, sanctions and the reduction in oil revenues led to a decline to record lows in government expenditures in the development sector. Although there was an economic recession in this period, the decline in government expenditures has mainly been due to the reduction in GDP.

2.2. Literature and Empirical Evidence

A review of literature review and relevant studies are presented in Table 1.

3. METHODOLOGY AND RESULTS

3.1. Analysis and Results for Selected Oil-exporting Countries

This section examines the relationship between oil revenues and government size in selected oil-exporting countries.

3.1.1. Stationarity test

The first step in time series estimation is testing for stationarity of the variables, as non-stationary series in econometrics estimations lead to spurious regression and the results will not be reliable or interpretable. Unlike time series data, panel data cannot be tested for stationarity using the Dickey–Fuller test or augmented Dickey–

Table 2: The results of unit root test using LLC

Variable	Proxy	Test conditions	Test statistic	P value
Log of government size	LGOVSIZE	With intercept and trend	−3.32	0.0004*
Log of oil revenues	LOILREV	With intercept and trend	−1.80	0.0359**
Log of economic openness	LOPEN	Without intercept and trend	−3.11	0.0009*
Log of income per capita	LYPC	With intercept and trend	−2.00	0.0224**

Source: Present research calculations; * and ** indicate significance at the 0.01 and 0.05 levels

Fuller test (Ashrafzadeh and Mehregan, 2010). For panel data, the levin-lin-chu test (LLC), the Im-Pesaran-Shin test (IPS), Fisher-ADF, the Phillips–Perron test, the Choi test, the Breitung test, and the Hardi test have been proposed. In this research, LLC is used to test for stationarity of the variables with the following hypotheses:

- H_0: Variable contains a unit root
- H_1: Variable is stationary.

If the absolute value of the test statistic is less than the absolute value of critical values and/or the test probability is less the 0.05, the null hypothesis is rejected and the variable is stationary. The results of this test are provided in Table 2.

The results of the LLC test indicate that the probability of the test statistic is <0.05 for all the variables. This suggests that the null hypothesis is rejected and the variables are stationary. Therefore, the log of all the variables are stationary at the level of data, and the results of model estimation are reliable enough for interpretation.

3.1.2. Results of model estimation

The generalized method of moments (GMM) is one method for estimating model parameters in the dynamic panel data approach that can be used for time series, cross-sectional, and panel da-ta. GMM accounts for the dynamic adjustments of the dependent variable. A dependent variable with lagged values causes a correlation between explanatory variables (regressors) and error terms, and thus using ordinary least squares (OLS) will lead to biased and inconsistent results. GMM can solve this problem by using instrumental variables. The following dynamic model is the mathematical expression of GMM:

$$y_{it} = \alpha y_{it-1} + \beta' x_{it} + \eta_i + \varnothing_t + \varepsilon_{it} \quad (1)$$

where y is the dependent variable, x is the vector of explanatory variables, η denotes individual and country fixed effects, $\emptyset$ is the fixed effect of time, ε is the error term, i denotes country, and t denotes time. In equation 1, it is assumed that error terms are not correlated with individual and country fixed effects and lagged values of the dependent variable. If η is correlated with some of the explanatory variables, one way to remove individual and country fixed effects is through first-order differencing; otherwise, using the fixed effects model will lead to biased estimators from coefficients. Therefore, equation 1 is converted to the following:

$$\Delta y_{it} = \alpha \Delta y_{it-1} + \beta' \Delta X_{it} + \Delta \varnothing_t + \Delta \varepsilon_{it} \quad (2)$$

In this equation, the lagged difference of the dependent variable (Δy_{it-1}) is correlated with the first order difference of error terms ($\Delta \varepsilon_{it}$). There is also the problem of endogeneity for some of the explanatory variables, which is not accounted for in the model. Therefore, it is necessary to use instrumental variables to address this problem. The following moment is true about equation 2:

$$E\left(y_{u-s}\Delta\varepsilon_{it}\right) = 0 \;; s \geq 2; t = 3,4,\ldots,T \quad (3)$$

$$E\left(X_{u-s}\Delta\varepsilon_{it}\right) = 0 \;; s \geq 2; t = 3,4,\ldots,T \quad (4)$$

The following matrix of instrumental variables is used to estimate the parameters of equation 2:

$$z_i = diag\left(y_{i1}, y_{i2}, \ldots, y_{it-2}, X_{i1}, X_{I2}, \ldots, X_{it-2}\right) \quad (5)$$

The estimators of GMM $\hat{\delta}$ are defined as follows:

$$\hat{\delta} = (B'zA_N z'B)^{-1} B'zA_N z'Y \quad (6)$$

After estimating the coefficients, it is necessary to use the Sargan test to examine the validity of the instrumental variables that are incorporated into the model and test for over-identification of the equation. In addition, the order of autocorrelation in error terms must be determined, since first-order differencing is effective only when autocorrelation in error terms is not of the second order. The Sargan test (1958) has an asymptotic x^2 distribution, which is defined as:

$$S = \hat{\varepsilon} z' \left(\sum_{i=1}^{N} z_i' H_i z_i\right)^{-1} z'\hat{\varepsilon} \quad (7)$$

In this test, $\hat{\varepsilon} = Y - X\hat{\delta}$, $\hat{\delta}$ is a $k \times 1$ matrix of estimated coefficients, is a matrix of instrumental variables, and H is a square matrix with (T-q-1) dimensions, where T is the number of observations and is the number of explanatory variables in the model. If the null hypothesis of the test is not rejected, the instrumental variables are valid and sufficient. Otherwise, more appropriate instrumental variables must be defined for the model (Baltagi, 2005).

Table 3 shows the results of model estimation for the effect of oil revenues on government size using Arellano-Bond dynamic panel data model in selected oil-exporting countries over the period 1980-2015. Estimation is done in STATA.

The results of estimating the first model show that government size (government expenditures as a percentage of GDP) with one lag and a coefficient of 0.623 has a significant positive effect on government size in the next period. That is, an increase in government size in the previous period significantly increases government size in the current period.

Oil revenues with a coefficient of −0.031 have no significant effect on government size in the selected oil-exporting countries. That

is, current oil revenues have no significant effect on government expenditures and size in the selected oil-exporting countries.

Oil revenues with one lag and a coefficient of 0.057 have a significant positive effect on government size in the current period. In oil-exporting countries, rising oil revenues in the previous period affect government expenditures in the next period through the budget, and these governments adjust their future expenditures based on their current oil revenues. Therefore, increase in oil revenues have a significant positive effect on government expenditure and size.

Economic openness with a coefficient of −0.056 has a significant negative effect on government size in the selected oil-exporting countries at the 0.1 significance level. Also income per capita with a coefficient of −0.118 has a significant negative effect on government size.

The results of Sargan test for examining the validity of the instrumental variables used in the Arellano-Bond panel data model suggest that these variables are indeed valid (P = 0.2976).

3.2. Results from Iran's Economy

This section examines the relationship between oil revenues and government size in Iran.

3.2.1. Stationarity test

It is again necessary to test for stationarity before estimating the model. The augmented Dickey-Fuller test is used and the results are provided in Table 4.

As the data in Table 4 show, government size, oil revenues, economic openness, and income per capita are not stationary at the level of data and are stationarized through differencing. Therefore, all the variables have a cointegration degree of one, and ARDL is used to examine short-run and long-run relationships as well as cointegration of the variables.

3.2.2. Short-run model of the effect of oil revenues on government size

In model estimation using ARDL, first the dynamic model (short-run) must be estimated (Table 5). The optimal variable lag is ARDL(0,0,0,1) based on the Schwarz-Bayesian criterion.

As the data in Table 5 show, government size with one lag and a coefficient of 0.15 has a positive effect on government size in the current period, but the effect is not statistically significant. Oil revenues and income per capita with coefficients of 0.14 and 0.48 respectively have significant positive effects on government size in the short run. That is, rising oil revenues and income per capita significantly increase government expenditures and government size. The results also show that economic openness with a coefficient of −0.60 has a significant negative effect on government size in the short run.

In estimation of time series models, serial autocorrelation, non-normal distribution of the residuals, incorrect functional form, and heterogeneity of variance are major problems that undermine the results. Normal distribution of residuals, serial autocorrelation, homogeneity of variance, and functional form are examined using the Jarque-Bera test, the Breusch-Godfrey test, the Breusch-Pagan-Godfrey test, and the Ramsey test respectively. Table 6 provides the results of diagnostic testing of these classical assumptions.

The results of the Breusch-Godfrey LM test show that the null hypothesis for lack of serial autocorrelation is true, as the probability of the test statistic is >0.05 (0.3442).

The results of Ramsey's test for functional form indicate that the probability of the test statistic is >0.05 (0.1331); thus, the null hypothesis is true and the model has correct functional form.

Table 3: The results of estimating the first model: Effect of oil revenues on government size in selected oil-exporting countries (dependent variable: Government size)

Variable	Proxy	Coefficient	t-statistic	P value
Intercept	C	0.186	0.83	0.407
Log of government size with one lag	LGOVSIZE(-1)	0.623	16.92	0.000*
Log of oil revenues	LOILREV	−0.031	−1.14	0.254
Log of oil revenues with one lag	LOILREV(−1)	0.057	2.18	0.0029*
Log of economic openness	LOPEN	−0.056	−1.76	0.079**
Log of income per capita	LYPC	−0.118	−3.39	0.001*

Sargan test statistic: 449; sargon test probability: 0.2976; wald Chi-squared test statistic: 456; wald test probability: 0.000. Source: Present research calculations; * and ** indicate significance at 0.01 and 0.1 respectively

Table 4: The results of augmented dickey-fuller test (ADF)

Variable	Proxy	Test conditions	Test statistic	P value	Result
Government size	LGOVSIZE	Without intercept and trend	0.28	0.7634	I(1)
	dLGOVSIZE	Without intercept and trend	−4.18	0.0001*	
Oil revenues	LOILREV	Without intercept and trend	0.24	0.7521	I(1)
	dLOILREV	Without intercept and trend	−6.09	0.0000*	
Economic openness	LOPEN	Without intercept and trend	−0.97	0.2864	I(1)
	dLOPEN	Without intercept and trend	−4.41	0.0001*	
Income per capita	LYPC	Without intercept and trend	−3.26	0.0910	I(1)
	dLYPC	Without intercept and trend	−4.11	0.0146**	

Source: Present research calculations; * and ** indicate significance at 0.01 and 0.05 respectively

The Jarque-Bera test is used to examine the distribution of residuals. Given that the probability of the test statistic is >0.05 in each model (0.7524), the null hypothesis is true and the error terms are normally distributed.

Finally, results of the Breusch-Pagan-Godfrey test for homogeneity of variance show that the probability of the test statistic is >0.05 (0.5506), indicating that the null hypothesis is true and the model has homogeneity of variance.

3.2.3. Long-run model of the effect of oil revenues on government size

Bounds testing is used to test for the presence of long-run relationships between the variables. This approach provides an upper and a lower bound, and test statistics higher than the upper bound critical value confirm the presence of a long-run relationship.

The results of bounds testing indicate that the lower and upper bounds are 3.23 and 4.35 respectively at the 0.01 significance level, and the F-statistic is 4.52. Thus, the F-statistic is greater than the upper bound and the presence of long-run relationships and cointegration is confirmed.

The results of estimating the long-run model are provided in Table 7.

The results of estimating the long-run model show that oil revenues with a coefficient of 0.17 have a significant positive effect on government size in Iran at the 0.05 significance level. That is, one percent increase in Iran's oil revenues increases government size by 0.17 in the long run. Therefore, oil revenues increase government size in Iran.

Income per capita with a coefficient of 0.57 has a significant positive effect on government size in the long run at the 0.1 level. That is, one percent increase in income per capita increases government size by 0.57 in the long run. Therefore, income per capita increases government size in Iran.

Economic openness with a coefficient of −0.71 has a significant negative effect on government size in the long run. That is, one percent increase in economic openness decreases government size by 0.71 in the long run. Therefore, increase in trade and economic openness decreases government size in Iran.

Table 5: The results of estimating the short-run model of the effect of oil revenues on government size

Variable	ARDL(0,0,0,1) coefficient	t-statistic	P-value
C	14.41	4.35	0.0002*
LGOVSIZE(-1)	0.15	1.23	0.2281
LOILREV	0.14	1.87	0.0712***
LYPC	0.48	1.90	0.0668***

R^2=0.96; R^{-2}=0.96; F statistic=199; P value=0.000. Source: Present research calculations; * and *** indicate significance at 0.01 and 0.1 respectively

Table 6: Diagnostic testing

Test	Statistic	P value
Breusch-Godfrey lm test for serial correlation	1.10	0.3442
Ramsey's test for functional form	1.54	0.1331
Jarque-Bera test of normality	0.56	0.7524
Breusch-pagan-godfrey test for homogeneity	0.77	0.5506

Source: Present research calculations

3.2.4. Error correction model

The short-run fluctuations of the variables can be examined using an error correction model and their long-run relationships can be discussed. The results of estimating the error correction mod-el (ECM) are provided in Table 8. The data show that the coefficient of the error correction term is -0.84 and statistically significant. Therefore, we can conclude that the speed of adjustment toward a long-run relationship is very high in the estimated model. Therefore, the model quickly adjusts itself toward a long-run relationship.

3.2.5. Structural stability test

The structural stability and robustness of the estimated coefficients of the model are examined using CUSUM and CUSUMSQ tests. The results are provided in Figures 3 and 4.

As these the results of CUSUM test show, the cumulative sum of recursive residuals fall inside the critical bounds. Therefore, the estimated model has no structural breaks and the coefficients are stable during the studied period.

The results of CUSUMSQ test show that the cumulative sum of recursive residuals fall inside the critical bounds and, therefore, the estimated model does not have a structural break.

4. CONCLUSION AND IMPLICATIONS

As a strategic commodity, oil plays a significant economic and political role. World's economy has experienced considerable fluctuations in oil prices in the last half the 20th century. Oil price volatility has had direct and indirect effects on many macroeconomic variables in oil-exporting countries, thus posing new challenges to officials in these countries by creating macroeconomic instability. Rising oil prices stimulates the economy of these countries from both demand and supply sides—from the demand side through the state budget and from the supply side by affecting public and private investments—which, in turn, accelerate or decelerate their economic growth. The sum of these effects is referred to as the net effect of oil revenues on

Table 7: The results of estimating the long-run model of the effect of oil revenues on government size in iran

Variable	Coefficient	t-statistic	P value
C	17.04	8.49	0.0000*
LOILREV	0.17	2	0.0539***
LOPEN	−0.71	−12.9	0.0000*
LYPC	0.57	1.76	0.0874***

Source: present research calculations; * and *** indicate significance at 0.01 and 0.1 respectively

Table 8: The results of estimating the error correction model

Variable	Coefficient	t-statistic	P value
ECM(−1)	−0.84	−24.6	0.0000

Source: Present research calculations

Figure 2: Government size in Iran

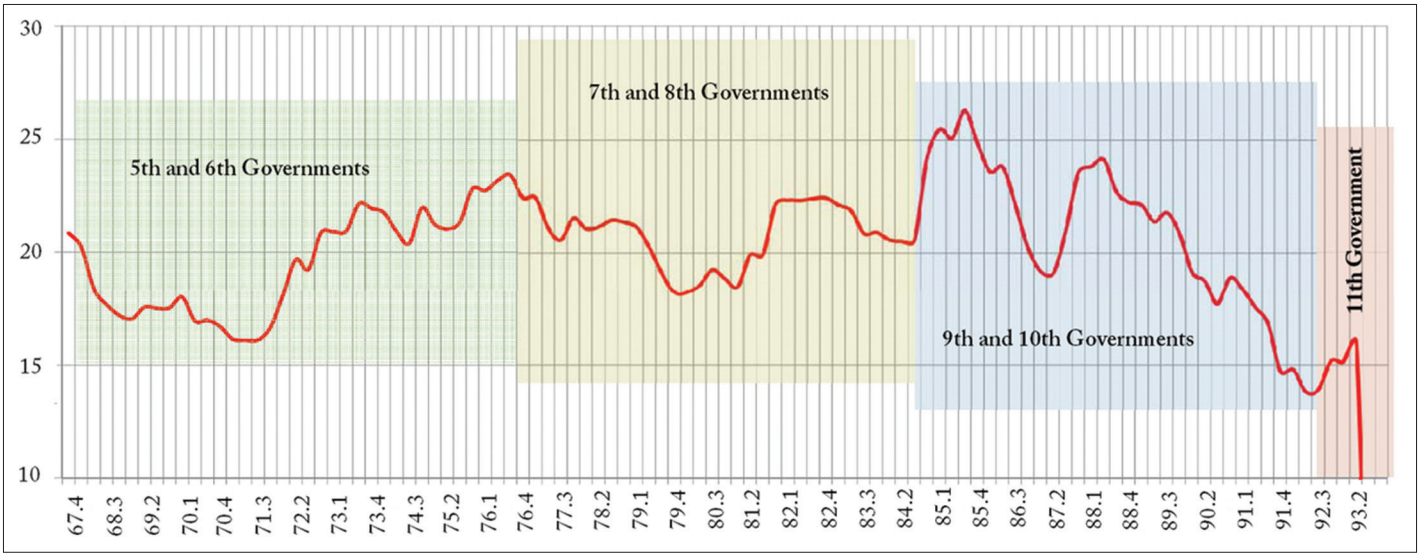


Figure 3: The results of CUSUM test

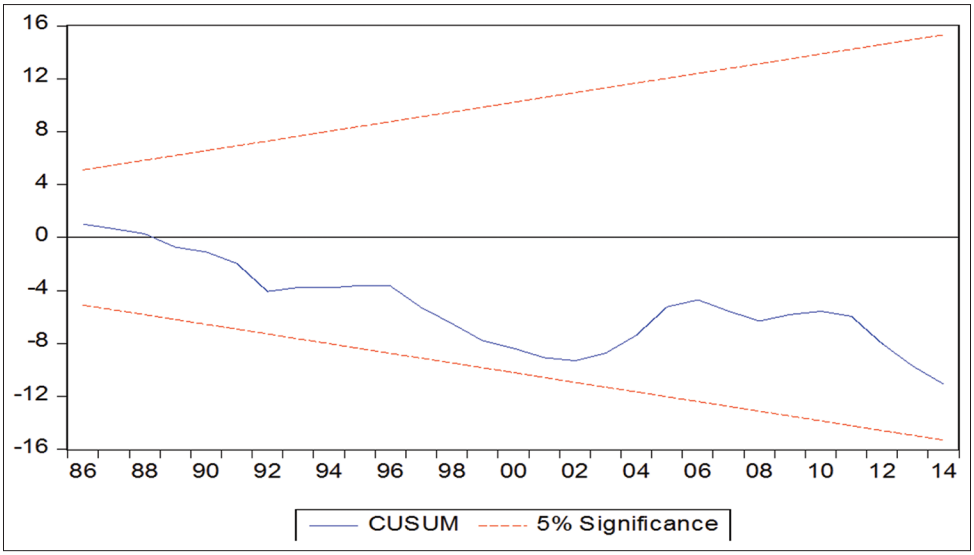
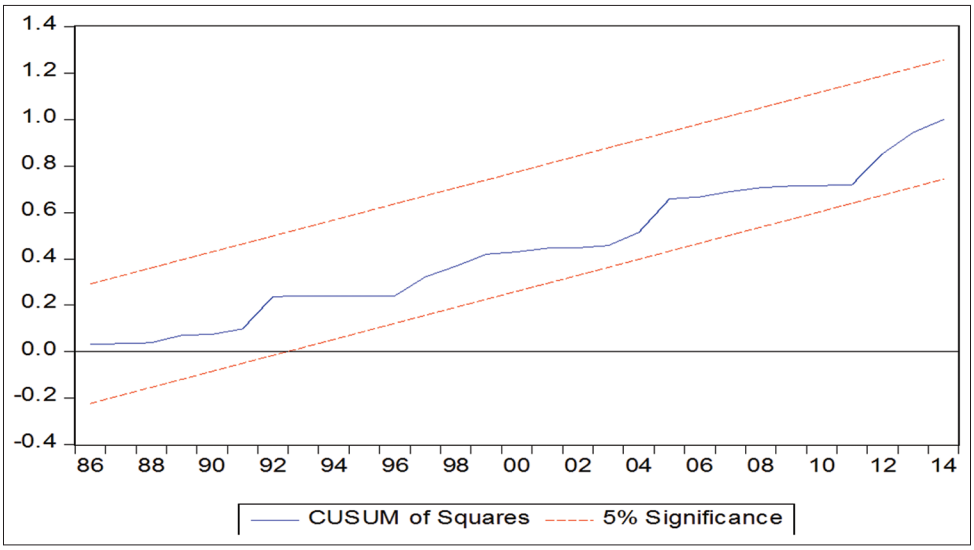


Figure 4: The results of the CUSUMSQ test



the economy. Oil revenues make up a large portion of government revenues and government expenditures. Therefore, government size in oil-exporting countries is affected by oil revenues.

Oil and gas exploration has been the source of many of the rapid socioeconomic changes that have occurred in Iran over the last century. Oil has been woven into the fabric of Iran's economy and oil production and revenues have been the main agent of change, whether positive or negative. It scope beings at the level of government expenditures and political power and continues by affecting the balance of payments, domestic demand, growth of financial and monetary markets, and eventually, economic growth. Current economic statistics also confirm the dominant role that the oil industry still plays in Iran's economic structure, and today, like most countries that produce hydrocarbon resources, oil revenues are the main drivers of the economy in Iran. These revenues usually have two different, but related, roles in the Iranian economy. First, as a key source of foreign exchange, oil revenues enable the country to import various capital, intermediate, and consumption goods. Secondly, they make up a considerable portion of government revenues and are used to finance current and development expenditures.

Given the impact of the export of crude oil and oil products on Iran's economy and the financing of a major portion of public spending through oil revenues, the performance of the oil sector is of special importance. One of the most important issues facing the country's financial system is the dependence of tax revenues and other sources of government earnings on oil revenues. That is, rising oil revenues increase direct and indirect revenues, allowing the government to expand its size. The lack of discipline in Iran's public sector as a structural problem has always exacerbated this issue. Therefore, if oil revenues are not properly managed, they can undermine the macroeconomics, budgeting structure, and governance of the country, thus resulting in waste of resources. The economic situation of many other oil-rich economies confirms this notion, which is extremely alarming. Oil revenues has often led to the resource curse, revenues which will not last for a very long time. These revenues must benefit future generations, but they are often not devoted to sustainable development. To avoid such a fate for this unprecedented opportunity, special, and sometimes, creative policies are required.

Despite these adverse effects, proper management of oil exploration, extraction, and exports can accelerate economic growth and the country's development (Gylfason, et al. 1999). In order to stabilize economic and social developments upon oil and gas sectors, revenues must be managed in such a way as to reinforce other sources of wealth. Of course, given that the future value of hydrocarbon resources is largely uncertain due to being non-renewable, managing these revenues is a critical and complicated challenge. Addressing this challenge requires developing meticulous policies that can serve as a useful guide for investing or saving oil revenues so that, eventually, implementation of these policies would increase the efficiency of macroeconomic management in the face of various opportunities and barriers. Moreover, national policies in the oil and gas sectors require a proper framework to facilitate sustainable management of revenues from these natural resources. These policies generally aim to reduce any adverse effect on the economy by providing the details of how to manage predicted oil revenues and integrate them into existing government systems. They require the highest standards of transparency and accountability in management of hydrocarbon revenues and must recommend the appropriate institutional and governance structures to allow for optimal use of these revenues.

In this article, a model was proposed to examine the effect of oil revenues on government size in selected oil-exporting countries with several variables, including oil revenues, economic openness, income per capita, and government expenditures as a percentage of GDP (a measure of government size). First, the levin-lin-chu (LLC) unit-root test was performed to test for stationarity. The results showed that were stationary at the level of data ($P = 0.05$).

In the next step, the generalized method of moments (GMM) was used to estimate the relationship between oil revenues and measures of macroeconomic stability in selected oil-exporting countries. The results suggested that oil revenues with a lag and a coefficient of 0.057 have a significant positive effect on log of government size; that is, rising oil revenues in selected oil-exporting countries positively affect government size with a 1-year lag. Also the results of the Sargan test showed that the instrumental variables incorporated into the Arellano-Bond panel data model were valid.

As for Iran's economy specifically, the results of stationarity test showed that all the variables contained a unit root and were stationarized by differencing. Thus, the variables were I(1) stationary. Subsequently, short-run and long-run relationships between the variables were examined using the autoregressive distributed lag (ARDL) approach. The results of short-run estimation of the effect of oil revenues on government size in Iran showed that oil revenues have a significant positive effect on government size (0.14). In fact, in the short run, increase in oil revenues increases the current size of the government. The results of long-run model estimation showed that log of oil revenues has a significant positive effect on government size (0.17). The coefficient of the error correction term was −0.84 and was statistically significant. This suggested that the speed of error adjustment toward a long-run relationship was very high and the model quickly adjusts itself to a long-run relationship. In addition, the results of CUSUM and CUSUMSQ showed that the sum of sum of recursive residuals fall inside the critical bounds and, therefore, the estimated model had no structural break and the estimated coefficients were stable in the studied period.

Nonetheless, it must be recognized that dependence of the government on oil revenues and the fluctuations and uncertainties of the oil market are major challenges that Iran as an oil ex-porter faces. Iran's forex reserves account was established at the beginning of the third development plan to prevent or reduce the negative effects of strong fluctuations in the global price of crude oil on the economy and government budgets. However, the balance of the foreign exchange reserves and frequent withdrawals indicate the reality that oil price fluctuations can still threaten Iran's macroeconomic

stability. One of the goals of Iran's 2025 vision is for the country to become the strongest economic, technological, and scientific power in the Middle East. An important issue highlighted in this document is to reduce the country's dependence on oil revenues for financing current spending and instead use tax revenues, and to allocate oil revenues to efficient and productive investments. Below are the implications of the present findings for practice:

1. A portion of oil revenues must be allocated to development projects to increase and expand the economic infrastructure of the country. Of course, these investments must be done in areas where the private sector is not allowed, capable, or willing to get involved
2. Since it is impossible to suddenly cut oil revenues from the budget, it is better to finance the current expenditures of the country through tax revenues
3. There must be a transition from an economy that is entirely dependent on oil revenues to a knowledge-based economy that benefits from the oil industry. Given the fluctuations in oil prices and oil revenues, it seems that the discourse on "economy without oil" should not merely be a slogan, but rather guide the behavior and economic policies of the country
4. Fundamental measures and changes need to be made within the government's structure to reduce its expenditures, since a drop in oil revenues leads to serious budget deficits with grave consequences for the economy.

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