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Dynamic relationship between Oil Revenues, Government Spending and Economic Growth in an oil-dependent economy

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Abstract

The aim of this paper is to empirically examine the relationship between Oil revenues, government spending and GDP growth in the kingdom of Bahrain. Oil revenues are the main source of financing government expenditures and imports of products. Increasing oil prices in the recent years have boosted public expenditures on social and economic infrastructure. In this paper we will investigate whether the huge government spending has enhanced the pace of economic growth or not. To this end we use a trivariate cointegration analysis and error-correction model and data for 1960-2010. Overall results suggest that oil revenues remain the principal source for growth and the main channel which finance the government spending.

Key word: Oil revenues- Government expenditures- Growth- Bahrain- ECM

JEL Classification: E62, H50, H54, N15

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1. Introduction

Is natural resources-rich a blessing or a curse? This question has generated a considerable academic work. Even though an extensive literature, it does not provide convincing answer. Furthermore, the relationship between natural resource abundance and economic growth is controversial among scholars. Therefore, it could not be settled among economists that natural resource abundance is either curse or blessing for natural resources-rich countries.

The first body of the literature establishes a negative relationship between resource abundance and poor economic performance (Auty 1986, 1990, 1993, 1998, 2001), Bulmer-Thomas (1994), Gelb (1988), Lal and Myint (1996), Ranis (1991), Sachs and Warner (1995, 1997, 1999)). The results appear to support the 'resource curse' hypothesis. Sachs and Warner (1997) find a clear negative relationship between natural resource based exports (agriculture, minerals and fuels) and growth in the period 1970-90 from a sample of 95 developing countries. Two exceptions were Malaysia and Mauritius that sustained 2 % per year growth during 1970-80. In the same way, Auty (2001) establishes that per capita incomes of resource poor countries grew between two to three times faster than those of the resource abundant countries for the period 1960-1990. He admits that crop-led resource abundance would be expected to have lower growth comparing with its manufacturing equivalent. Furthermore, mineral driven countries have been among the weakest performers. This so-called "resource curse" has inspired many economists to explain its origins.

Nevertheless, such conclusions exposed above are not without criticism. The results are very sensitive to the period chosen; to the definition of 'natural resources' and the methodology used. Some scholars put forward some doubts about the robustness of these findings due to differences in the measurements of natural resources abundance (Stijns 2005). Shrank(2004) explains that these evidence do not prove that natural resources abundance of any kind causes poor economic growth even if they are correlated. Correlation does not mean causation. This is what we read in each econometrics manual. Ross (2003) goes further and put forward that the relationship between natural resources abundance and poor economic may be completely spurious by omitting a third variable.

As in most natural resources-rich countries, Bahrain's economic growth has been strongly influenced by the volatility of oil, gas and mineral prices in international markets. This reveals Bahrain's economy dependence on its oil sector even though it is considered as least oil dependent compared to its regional peers. Bahraini growth rates have generally followed a similar path to Saudi growth rates but have been less volatile because of huge gap in oil and gas production and reserve between the two countries.

Bahrain became one of the first Gulf countries to start diversifying its economy. It was among the first countries in the region to build an industrial base and has been the most attractive for foreign investors, including regional ones in its industrial development (Looney 1989). In the late 70's, the government went one step further in its diversification policy by attracting financial and service institutions to set up regional offices in the country. Quickly, Bahrain emerged as key player for banking, transportation and communication in the Gulf region and has become home to many multinational firms.

However, the slow-down in economic activity between the 1990s and 2000s has caused severe fiscal unbalances for Bahrain and oil revenues decreased drastically¹. The last decade, the situation has worsened as the world economy has known a period of severe volatility in oil prices². As a result, Bahrain's fiscal position moved from a minor deficit in 2002 (-0.1% of GDP) to a greater on deficit of about 10% of GDP in 2009 due to drop in oil revenues. Total revenue increased from BD 1.04 billion in 2000 to BD 2.8 billion in 2008 before decreasing to BD 1.7 billion in 2009. Oil and gas revenues registered a growth from BD 765 million in 2000 to BD 2.3 billion in 2008 before decreasing to BD 1.4 billion in 2009, while non-oil revenues rose from BD 264 million in 2000 to BD 367 million in 2008 before going back BD 262 million in 2009.

It is worth to recall that in Bahrain there are no taxes imposed on personal income, wealth or capital gains. Furthermore, there are no death duty taxes or inheritance taxes. This means that the government revenues and the overall fiscal policy in the Kingdom remain hugely based on Oil revenues despite the several efforts undertaken by the government during the last decade to diversify the economy. Otherwise. When oil prices go down, however, the government is not able reduce the size of its activities immediately, leading to a significant budget deficit. The goal of the Iranian government in development plans was to reduce the dependence of current expenditures to oil revenues, financing these costs through nonoil sources such as taxes.

Regardless of oil revenues volatilities, the government has always kept a high level of current expenditures. By contrast, capital or development expenditures are sensitive to fluctuation of oil revenues. This simple and general observation shows the vulnerability of the government fiscal situation to unexpected oil revenues shocks. Government cannot adjust its current spending easily in the case of a negative oil market. This makes budget deficits a critical issue for the government. It is then important to consider a reform of the tax system more seriously

This paper shed lights the importance of oil revenues in financing the government needs and improving well-being of Bahraini households. To the best of our knowledge, this type of question has never been analysis in modern literature despite the importance of oil in financing the economies of oil-dependent countries³. Therefore, It is important to examine to what extent the shocks to Iranian oil exports affect the military and non-military expenditures of the Iranian government . The current and capital expenditures of government in annual budgets have been financed by oil revenues during various political regimes. Since on average 60% of government revenues come from oil and gas, the budget is especially affected by sudden negative or positive shocks in oil prices.

To reach our goal, we use an econometric analysis based on error correction model and granger causality test for a long time series from 1960 to 2010.

¹ This is mainly due to the gulf wars and the Asian crisis. South Asian countries are the most important trade partners of Bahrain.

² For example, average oil prices were 12.716 dollar in 1998, became 28.831 dollar in 2003 and 97.256 dollar in 2008 (they reached a record in July 2008: 135.09 dollar per barrel). (OECD database 2009).

³ The paper of Fasano and Wang (2001) is the only academic work which analyzes the relationship between fiscal expenditure policy and non-oil real GDP growth in member countries of the Gulf Cooperation Council (GCC). Their model comprises the three following variables: capital expenditure, recurrent expenditure and GDP.

2. Macroeconomic consequences of oil

3. The Econometric methodology

3.1. Data

The empirical study is based on annual time series data from 1960 to 2010 of the following three variables: oil revenues, government spending and economic growth.

Oil revenues refer to the rents from oil and gas; these rents are the main source of income of the government of Bahrain and they represent 22.7 % of GDP and of 87.85 % of government revenues in 2011 (Ministry of Finance 2012). Therefore, oil revenues are the main source of government expenditures. This means that in the case of increasing oil revenues, the government expenditures also go up because of the larger size of government (Farzanegan 2011). When oil prices fall, the government expenditures would also shrink and in some cases it can cause a significant budget deficit.

The second variable is Government spending, which are the sums of current and capital expenditures⁴. The current expenditures intend to maintain the current capacities of government administration. Capital expenditures try to expand the current capacities of the government. In detail, current expenditures include the following items: expenditures on goods and services such as wage bills of government employees, employer contribution including social security and pensions, interest payment, subsidies and all other payments which relate to the management of government functions in military, health, education, cultural, and social activities. The government invests and creates new capacities in infrastructure services and public goods through the capital or development expenditures... Current expenditure includes final consumption expenditure, property income paid, subsidies and other current transfers (e.g., social security, social assistance, pensions and other welfare benefits).

and finally economic growth is proxied by gross domestic product per capita (current US dollar).

The government expenditure data is from the Ministry of Finance annual National Accounts. All variables are in logarithmic form. Data is collected from various sources (the World Bank Development Indicators (WDI), IFS-IMF CD-ROM, the Ministry of Finance and the CIO Bahrain)⁵.

Figure 1 illustrates the trajectory of oil revenues, government spending and economic growth during the period of our study. Oil revenues increased significantly since 1960, this due to the increase in oil prices and the high demand for oil and energy. As a result, the increase in oil revenues allows the Bahraini government to invest and to improve the infrastructure of the small kingdom. From figure 1, we can clearly see the trajectory of GDP per capita which follows the revenues of oil. Therefore, we can conclude that when oil revenues increase, government expenditures increase which in turn improve the economic growth. The positive relationship between the three indicators started in 1973 following the oil shock, where the prices of oil reached a record.

⁴.

⁵ Data from WDI and IFS are available from 1970 while data from the Central informatics Organization (CIO) in Bahrain as well the Bahraini ministry of finance start since 1960. Therefore we completed the published data from WDI and our study covers the period from 1960 to 2010. The aim is to have a long time series data and efficient results.

Another important conclusion which could be drawn from Figure 1 is that the economy of Bahrain as an oil dependant country remains based in oil revenues.

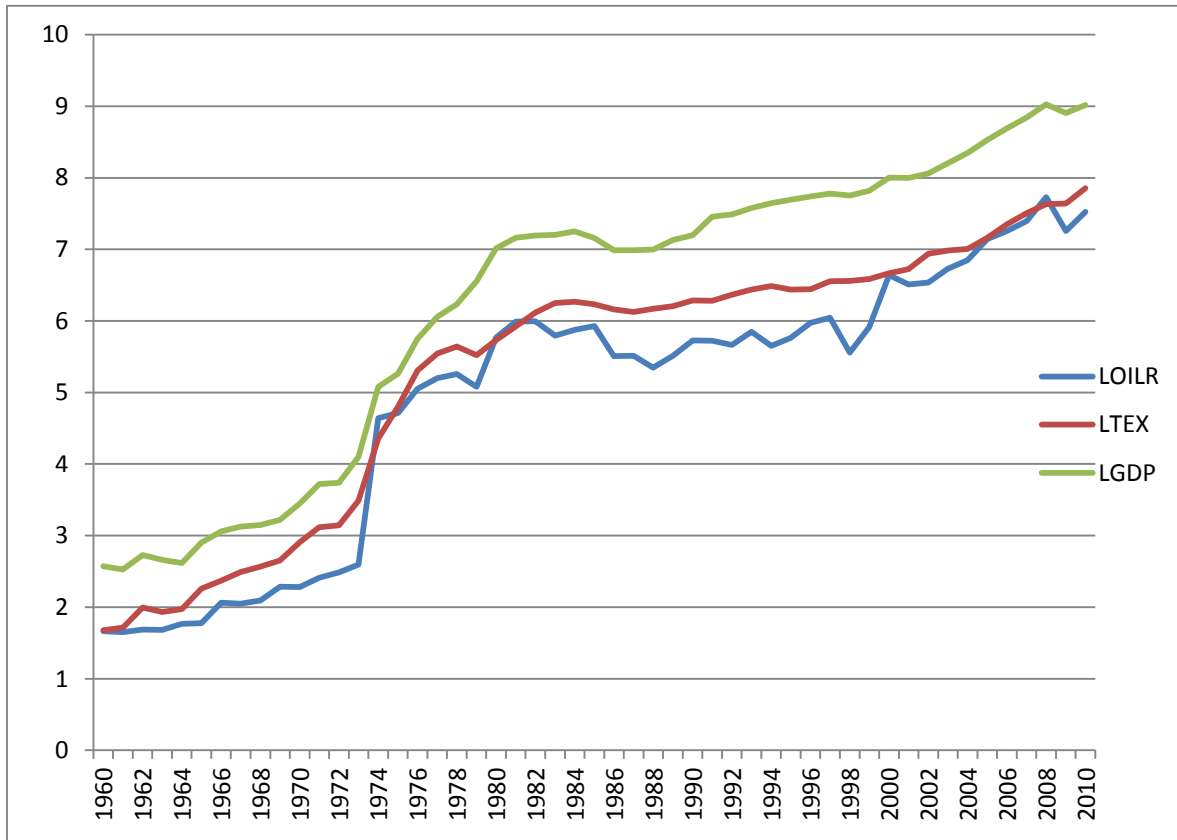


Fig. 1. Evolution of Oil Revenue, Government Spending and GDP per capita in Bahrain

3.2. Methodology

Our empirical investigation has two dimensions. The first is to examine the long-run relationship between GDP, government expenditures and oil revenues, while the second is to examine the short-run dynamic causal relationship between the variables. The basic testing procedure requires three steps. The first step is to test whether the variables contain a unit root to confirm the stationarity of each variable (Engle and Granger, 1987). This is done by using the Augmented Dickey–Fuller tests (F-ADF) and Philips–Perron (PP) tests (1998). The second step is to test whether there is a long-run cointegrating relationship between the variables. This is done by the use of the Johansen-Fisher methods. Finally, the last step, if all variables are I(1) (integrated of order one) and cointegrated short-run elasticities can be computed using the vector error correction model (VECM) method suggested by Engle and Granger (1987). In this case, an error correction mechanism exists by which changes in the dependent variables are modeled as a function of the level of the disequilibrium in the cointegrating relationship, captured by the error-correction term (ECT), as well as changes in the other explanatory variables to capture all short-term relations among variables.

The VECM in four variables case can be written as follows:

$$\Delta LGDP_t = \alpha_1 + \sum_{i=1}^p \beta_{1i} \Delta LGDP_{t-i} + \sum_{i=1}^q \beta_{1i} \Delta LOILR_{t-i} + \sum_{i=1}^q \beta_{1i} \Delta LTEX_{t-i} + \lambda_1 ECT_{t-1} + \mu_{1t} \quad (1)$$

$$\Delta LOILR_t = \alpha_2 + \sum_{i=1}^p \beta_{2i} \Delta LGDP_{t-i} + \sum_{i=1}^q \beta_{2i} \Delta LOILR_{t-i} + \sum_{i=1}^q \beta_{2i} \Delta LTEX_{t-i} + \lambda_2 ECT_{t-1} + \mu_{2t} \quad (2)$$

$$\Delta LTEX_t = \alpha_3 + \sum_{i=1}^p \beta_{3i} \Delta LGDP_{t-i} + \sum_{i=1}^q \beta_{3i} \Delta LOILR_{t-i} + \sum_{i=1}^q \beta_{3i} \Delta LTEX_{t-i} + \lambda_3 ECT_{t-1} + \mu_{3t} \quad (3)$$

Where ECT is expressed as follows:

$$ECT_t = LGDP_t - \beta_0 - \beta_1 LOILR_t - \beta_2 LTEX_t, \quad (4)$$

Where $t=1...T$, denotes the time period

A major advantage of VECM is that it can also be used to verify causality among the variables in case of cointegrated series. Although cointegration indicates the presence of causality, yet the direction of causality amongst the variables is identified through VECM. Moreover, one can also distinguish between the short- and long-run causality with the help of vector error correction model.

4. Empirical Results

4.1 Unit Root Tests

We use the Augmented Dickey–Fuller (F-ADF) unit root tests to test the non-stationarity in our data series. Considering the low power of the ADF test we also use the Phillips-Perron (PP) test (1988), which takes account of the serial correlation and heteroscedasticity, as an alternative test. The results are displayed in Table 1.

The test statistics for the log levels of GDP (LGDP), Oil revenues (LOILR) and total expenditures (TEX) are statistically insignificant. When we apply the unit root tests to the first difference of the two variables, both tests reject the joint null hypothesis for each variable at the 1 per cent level. Thus, from all of the tests, the unit roots tests indicate that each variable is integrated of order one

Table 1

Results of the Unit Roots Tests for Bahrain

	ADF		PP		Order of Integration
	level	1st diff,	level	1st diff,	
LGDP	-1.108	-6.168***	-1.074	-6.184***	I(1)
LOilR	-2.331	-7.905***	-2.286	-8.090***	I(1)

LTEX	-1.555	-4.913***	-1.524	-4.913***	I(1)

Note: The regressions in first difference include intercept.

*** Indicates rejection of null hypothesis of non-stationary of the variable at 1% level of significance.

After checking the integration of our four variables at order one, I (1), we selected the optimal lag length of underlying Vector Auto Regression (VAR henceforth) using the conventional model selection criteria. These criteria established that the optimal lag length is two.

4.2 Cointegration : Long run and short run

The cointegration tests based on multivariate Johansen approach (1988) which uses two statistic tests namely: Trace test and Max-Eigen value. The likelihood Ratio (LR) test is based on the trace statistics (λ_{trace}) which tests the $H_0: r \leq q$ against $H_1: q = r$ is calculated thus:

$$\lambda_{trace}(r) = -T \sum_{l=1}^p \ln(1 - \hat{\lambda}_l) \text{ where } \lambda_1, \dots, \lambda_n, \text{ are the least value of eigenvectors } (p - r). \text{ The}$$

second test is the maximal eigenvalue test (λ_{max}) which tests the H_0 : there are r cointegrating vectors against the H_1 : there are $r + 1$ cointegrating vectors and is calculated as follows:

$$\lambda_{max}(r, r + 1) = -T \ln(1 - \hat{\lambda}_{r+1})$$

Results of the Johansen cointegration tests are displayed in Table 2 below. The Trace test and Max-Eigen value) suggest the existence of one cointegrating vectors at 1% of significance.

Table 2
Results for Johansen cointegration tests

Hypothesized	Trace	Max-Eigen
No. of CE(s)	Statistic	Statistic
None *	31.664**	20.724**
At most 1	10.939	7.967
Trace test and Max-Eigen statistics indicate 1 cointegrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values		

The existence of cointegration signifies that there is at least one long-run equilibrium relationship among the variables. In this case, Granger causality exists among these variables in at least one way (Engle and Granger, 1987). The VECM is used to correct the disequilibrium in the cointegration relationship, as well as to test for long and short-run causality among cointegrated variables. The correction of the disequilibrium is done by the mean of the Error correction term (ECT).

The results of the long-run equilibrium relationship are presented in Table 3 below. It shows that the coefficient of LOILR is 0.143 which is positive and significant at the level of 10%.

Moreover, the table reveals that LTEX is also positively associated to GDP and significant at a level of 1% of significance. This conclusion shows that the government of Bahrain adopts the *spend- and-tax hypothesis* as suggested by Peacock and Wiseman (1961, 1979) and Barro (1974). This means that changes in expenditures induce changes in revenue. This could be evidence since the continuous effort of the government to diversify the economy and to diminish its dependency to oil and energy sector. Nowadays, the small kingdom is becoming a hub of finance, especially for Islamic finance, and a center for business and economic affairs. Therefore, financial sector starts contributing significantly in overall GDP as well as Tourism and manufactory.

Table 3

The results of the long-run equilibrium relationship

Dependent variable: lgdp

Regressor	Coefficient	t-Values
LOILR	0.143	1.875*
LTEX	0.880	5.051***
C	0.212	

Note: * and *** indicate therejectionofnull-hypothesisat10% and 1%significance levels, respectively.

We now turn to short-run results which are presented in Table 4. Since the objective of the study is to investigate the dynamic relationships between oil revenues, government expenditures and economic growth, Table 5 illustrates the results only in which DLgdp is the dependent variable. Since the optimal lag length was two, the short-run results are also presented for two lags of each variable. The results reveal that oil revenues respond negatively and significantly to GDP at the level of 10% of significance. Again, this show the weight of oil Bahrain and in improving the wellbeing of Bahraini households as the dependant variable is GDP per capita.

Table 4

ECM results based on Johansen cointegration

Regressor	Coefficient	t-value
Δ LOILR(1)	-0.186	-1.887*
Δ LOILR(2)	0.114	1.049
Δ LTEX(1)	-0.146	-0.535
Δ LTEX(2)	-0.436	-1.616
ECM	-0.276	-2.058**
C	0.103	3.082***

Diagnostic tests	t-stats	p-value
White Test	0.532	0.804
Normality	0.96	0.613
Serial Correlation	0.825	0.572
ARCH	0.028	0.825

Note: ***, **and * indicate the rejection of null-hypothesis at 1%, 5% and 10% significance levels, respectively.

We performed several diagnostic and stability tests to the ECT model. The results are reported in the lower part of Table 4. They confirm the absence of serial correlation (Breusch-Godfrey Serial Correlation LM Test), heteroskedasticity (White Test) and autoregressive conditional heteroskedasticity (ARCH) in the model. The underlying model also passes diagnostic test for normality (Jacque-Bera).

After discussing long-and short-run dynamics, the next task is to examine the direction of causality between these variables. There results of causality tests based on the VECM model are reported in Table 5. We have performed three Granger causality tests: short-run causality long-run causality and the joint short and long run. The first test indicates the significance of the sum of lagged terms of each explanatory variable by the mean of joint Fisher test; the second test indicates the significance of the error correction term by the mean of the t-test and finally the third test is the short-run adjustment to restore the long-run equilibrium.

Table 5
Results of causality tests based on VECM

Variable	Short run (F-stats)			ECT (t-stats)	Joint short and long run (F-stats)		
	Δ GDPpc	Δ OilR	Δ TEX		Δ GDPpc& ECT	Δ OilR & ECT	Δ TEX & ECT
Δ GDPpc	-	2.946*	0.323	-2.052**	-	3.425 **	0.488
Δ OilR	1.627	-	2.037	0.805	2.057	-	1.669
Δ TEX	0.392	1.627	-	-0.25	0.268	1.976	-

Note: ** and * indicate the rejection of null-hypothesis at 5% and 10% significance levels, respectively

The F-statistics for short-run significance reveals that GDP is only caused by oil revenues. As we discussed before, this conclusion also supports the one revealed in Table 4 where short-run coefficients of OilR was significant. The results further show no causality between the other variables of the system. Turning now to error correction results, it is observed that deviation from the long-run equilibrium is mainly corrected by GDP while Oil revenues and Total expenditures appears to be weakly exogenous. This indicates the fact that any changes in the latter two variables that disturb long- run equilibrium are corrected by counter-balancing changes in the GDP. In this context, it may be concluded that GDP is caused Oil revenue and LTEX but these two variables are not caused by the former.

In the last part of Table 5, the results of F-statistics indicate the significance of combined short-and long-run effects. In the GDP equation, error correction term and oil revenues are jointly significant. In the other equations, there are no significant results. Once again, the results confirm the importance of oil as a chief factor in the economy of Bahrain as well as in the improvement of wellbeing of households.

The results appear robust and can be used to draw some important policy lessons for economic policy in Bahrain. In fact, government should adopt structural reforms that promote

non-oil sector development independent from government spending. It is also worth noting that the Bahraini government is attempting to restrain the impact of sudden changes in oil prices and revenues by intensifying the role of the private sector in the economy and maintaining adequate fiscal policies. The government would need to continue its structural adjustment efforts to encourage diversification of the economy, broaden and deepen the financial market, remove domestic price distortions, and improve the effectiveness of the public sector.

3.3 Generalized impulse-response functions

We employ impulse response functions (IRFs), which trace the impact of a one-standard-deviation shock in a variable on current and future values of the variables, in order to capture the short-run dynamics of the model. Considering that the IRFs based on a Cholesky decomposition is sensitive to the ordering of the variables, we apply generalized impulse-response functions (GIRFs) proposed by Pesaran and Shin (1998).

The impulse response functions (IFRs) derived from unrestricted VAR for GDP is presented in fig. 1. The diagram shows the response of each variable of the VAR in its own and impact of other variables. The diagram shows that the response of GDP to the ED is negative for the initial two years and become positive after ward, reaches at its peak in 4th year. The response of capital stock (K) to standard deviation shock of external debt (ED) is negative for the first four years and then become positive. The fig. 1 shows the response of exports to standard deviation shock of external debt (ED) is initially negative for the first four years and after that becomes positive.

The main applied tools in the VAR model estimation are the impulse response functions (IRFs) and the variance decomposition analyses (VDC). The dynamic response of different kinds of government spending to innovations in oil export revenues can be examined through IRFs. Through IRF we can observe the magnitude and statistical significance of such responses to one standard deviation increase in oil market related variable error (see Stock and Watson, 2001 for more details on IRF). In addition to IRF, we also use the VDC tool. VDC is slightly different from IRF. VDCs examine the relative importance of oil export revenues shocks in the volatility of other variables in the system. A shock to the oil export revenues variable will of course directly affect the variable itself, but it will also transfer to other variables in the VAR system. VDC measures the share of the movements in a respected variable (e.g. government expenditures

5. Conclusion

In this study, we set out to investigate the dynamic relationships between oil revenues, total government expenditures and economic growth in the Kingdom of Bahrain. We used annual time series data from 1960 to 2011 and we performed an econometric model based cointegration analysis and error-correction model. The estimations were made to obtain both short and long-run results. The time series characteristics were investigated before the estimation and diagnostic tests were applied afterwards to validate the robustness and stability of results. The Johansen method of cointegration confirmed existence of unique long-run relationship among

the variables. The long-run results indicate that coefficients of all the three variables are statistically significant. The results for short-run; however, show that oil revenue is the only significant variable. The significance of coefficient of the error correction term means that all the error is corrected by EC term only, and the value of 0.143 of the underlying coefficient suggests that the convergence is relatively fast enough towards the long-run equilibrium. The study also finds uni-directional causalities from oil revenues to GDP. These results might be useful to policy makers and government of Bahrain. For example, by continue implementing policy reforms in the main sectors of the economy. There are no doubts that the increase of the oil prices recorded in recent years has allowed the government to use oil windfalls to modernize infrastructure, create employment and improve social indicators and helped the government to accumulate official reserves and maintain relatively low levels of external debt. Bahrain is the most diversified economy in GCC region; however, as oil is an exhaustible natural resource, the diversification of the GDP appears to be a must. This would reduce the sudden shock in oil prices and makes the economy less dependent to energy resources. Here, the government has to double of its effort in encouraging the development of the private sector by ensuring proper environment and adequate strategies.

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