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Effects of oil returns and external debt on the government investment: A case study of Syria

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Abstract. *This study attempts to investigate the effect of oil returns and external debt on the government investment in Syria over the period 1970-2010. The Johansen cointegration test showed that oil returns and external debt have a positive and significant long run relationship with the government investment. The Granger causality test indicated bidirectional causality relationships between oil returns, external debt and government investment in the short and long run. The IRFs showed that when there is a shock to oil returns or external debt, the government investment will respond positively in the following years. The study result indicates that oil returns have the biggest effect on the government investment, and both oil returns and external debt play a vital role in supporting the Syrian economy by financing the government investment.*

Keywords: Syria, public sector, oil country, cointegration test, VAR.

JEL Classification: O11, E20.

1. Introduction

Government investment plays a vital role in supporting the economic growth by improving the infrastructure and creating an attractive investment claimant. Besides, oil returns and external debt also can play an important role in supporting the economic growth by financing the government investment in the country.

In the case of Syria, since 1963, Syrian economic policy was transformed toward the socialist direction, with highly centralized planning and under full public sector control (Seifan, 2009). Based on the socialist direction of the Syrian economy, the government adopted the policy of nationalization and confiscated estates from large landowners and distributed some land to the peasants and landless farmers. Furthermore, the public sector become the owner of manufacturing and mining industries, additional to natural resources, electric power plant, telecommunication companies, transportation companies, insurance companies, and banks. Moreover, the government supported the agriculture sector, created many projects to improve the infrastructure, and most international and domestic trade were controlled by the public sector (Seifan, 2009). However, since 2000, the government has worked gradually to reform the Syrian economy from a central planning to a social market economy (Brück et al., 2007). Therefore, the government has worked to improve the infrastructure, reduce the bureaucracy and administrative obstacles, create an attractive investment climate, establish industrial cities, reform the public sector, and motivate private sector investment (NAPC, 2008). Furthermore, the government has worked to upgrade the standard of living by expanding public investment in infrastructure besides education and health services, in addition to raising the purchasing power of citizens by increasing salaries and creating new job opportunities in order to achieve a social development in the country (Dardari, 2008). Unfortunately, the war which started in 2011 has caused a huge damage to the Syrian economy and created a new situation quite different than in before 2011. Many factories have been destroyed, investment has declined, the infrastructure has been damaged, public debt has increased, and many oil wells were controlled by the terrorists (SCPR, 2014).

Given this backdrop, the aim of this study is to investigate the effect of oil returns and external debt on the government investment in Syria over the period 1970-2010, in order to evaluate whether oil returns and external debt where being used properly by the government to support the Syrian economy through financing the government investment. The organization of this study is as follows. The next section is the literature review and Section 3 provides a brief discussion on the methodology. Section 4 reports the empirical results, and the conclusion and recommendations are presented in Section 5.

2. Previous Studies

Many studies have tested the effect of oil price and external debt on the government investment of different countries. The findings from these studies tend to vary from one country to another. Fasano and Wang (2002) found that total government expenditure follows oil revenue in GCC countries during 1975-2000. Garkaz et al. (2012) and Petanlar and Sadeghi (2012) also concluded that there is a positive relationship between oil revenues and government expenditure in Iran and oil exporting countries, respectively. However, Farzanegan (2011) indicated that oil revenues affect positively and significantly the military expenditures in Iran, but it does not have any significant effect on the non-military expenditure. Hong (2010) showed that oil price has a positive effect on the government expenditure and revenue in Malaysia. Sanz and Velazquez (2002) explained that income, prices, institutional factors, population density and its age structure have significant effects on the composition of government expenditure of OECD countries during 1970-1997. Moalusi (2004) argued that there is a negative unidirectional causality relationship running from revenue to spending in Botswana during 1976-2000, and the government budget deficit can be corrected by raising taxes. However, Eita and Mbazima (2008) found that there is a positive unidirectional causality relationship moving from revenue to expenditure in Namibia during 1977-2007. Other researchers such as Narayan and Narayan (2006), Chang and Chiang (2009), Elyasi and Rahimi (2012) and Al-Zeaud (2015) also concluded that there is a positive relationship between government revenues and government expenditure in different countries. Koksal (2008) indicated that population elasticity and income elasticity affect positively the government expenditures in Turkey, while price elasticity affect it negatively. Besides, by using the Ordinary Least Square (OLS) regression method, Okafor and Eiya (2011) found that population, public debt and tax revenue have a positive relationship with total government expenditure in Nigeria, while inflation has a negative relationship with it. However, Cashel-Cordo and Craig (1990) pointed out that external debt has a negative effect on the government spending.

3. Methodology

The vector autoregression (VAR) model will be used in this study. Our model consists of three variables: government investment, oil returns, and external debt in Syria. Government investment is the dependent variable. The model is presented as follows:

$$lnGI = \alpha + \beta_1\, lnOR + \beta_2\, lnED + \varepsilon_t\ ,$$

where α is the intercept, β_1 and β_2 are the coefficients of the model, $lnGI$ is the natural log of government investment in real value (millions of SYP), $lnOR$ is the natural log of oil returns in real value (millions of SYP), $lnED$ is the natural log of external debt in real value (millions of SYP), and ε_t is the error term.

The analysis begins with the unit root test to determine whether the time series data are stationary at levels or first difference. The Augmented Dickey Fuller (ADF) unit root test is used in this study to test for the stationary of the variables. After determining the order of integration of each of the time series, and if the variables are integrated of the same order, the Johansen cointegration test will be used to determine whether there is any long-run or equilibrium relationship between the government investment and the other independent variables in the model. If the variables are cointegrated, the Granger causality test will be conducted on the vector error correcting model (VECM) to determine the causality relationships among variables. On the other hand, if there is no cointegration among the variables, the VAR model will be employed to test for short-run

Granger causality between the variables. Furthermore, the VECM will be subjected to the statistical diagnostic tests, namely, normality, serial correlation, heteroskedasticity and Ramsey RESET tests to ascertain its statistical adequacy. Lastly, impulse response functions (IRF) and variance decomposition (VD) analysis are used in this study to help in determining whether the independent variables play any important role in explaining the variation of the forecasted government investment.

This study uses annual time series data of Syria during the period from 1970 to 2010. This data are collected from the Central Bureau of Statistics in Syria (CBS) and the World Bank (WB). All variables in this study are in real value and expressed in the logarithmic form.

4. Empirical Results and Discussion

From the results of the ADF unit root test in Table 1, we can see that all the variables are not stationary at level, but became stationary after first differencing at least at the 5 percent level of significance. This means that all the variables are integrated of order one, that is I(1).

Table 1. *ADF unit root test results*

ADF	Level			First difference		
	Intercept	Trend and intercept	None	Intercept	Trend and intercept	None
lnGI	-2.182500	-2.084947	1.556743	-5.497626**	-5.520791**	-5.294474**
lnOR	-2.354454	-2.447874	2.108806	-5.898245**	-6.117964**	-5.417661**
lnED	-2.145715	-0.387202	1.629056	-4.497559**	-6.491848**	-4.336350**

Note: ** Denotes significance at the 1 per cent level, and * at the 5 per cent level.

4.1. Johansen Cointegration Test Results

Since all the variables are stationary in the first difference, we use the cointegration test to determine the presence of any cointegration or long-run relationship among the variables based on the Johansen cointegration test. However, before running the cointegration test, we run the VAR model first to determine the optimal lag length, based on the minimum Akaike Information Criterion (AIC). The maximum lag has been set to five in the lag length selection process. The optimal lag length selected is three lags based on the AIC.

After we have determined the number of lags, we proceed with the cointegration test for the model. Table 2 shows that there are one cointegration equation based on the trace test, and two cointegration equations based on the maximum eigenvalue test. In other words, the results indicate that there is a long-run relationship between lnGI, lnOR and lnED.

Table 2. *Johansen cointegration test results*

No. of CE(s)	Trace Statistic	Probability	Max-Eigen Statistic	Probability
r = 0	53.34045***	0.0002	36.09273***	0.0003
r ≤ 1	17.24771	0.1235	15.90725**	0.0497
r ≤ 2	1.340463	0.9010	1.340463	0.9010

Note: *** Denotes significance at the 1 per cent level, and ** at the 5 per cent level.

After having found cointegration relationships among the variables lnGI, lnOR and lnED, the cointegrating equation was normalized using the real GI variable. Table 3 shows the normalized cointegrating vector.

Table 3. *Cointegration equation normalized with respect to GI*

lnGI	**lnOR**	**lnED**	**C**
1.000000	-4.795108	-1.950586	-177.1949
	(1.11272)	(0.94023)	(24.3415)

From the Table 3, the long-run lnGI equation can be written as:

$$lnGI = 177.1949 + 4.795108\ lnOR + 1.950586\ lnED\ .$$

The cointegration equation above shows that the GI is positively related to OR and ED. When oil returns increases by one percent, government investment will increase by 4.795 percent, and when the external debt increases by one percent, government investment will increase by 1.951 percent. This suggests that oil returns and external debt play a vital role in supporting the government investment in the country through providing the state treasury with funds that can be used by the government to finance its production activities, improve the infrastructure and create development projects that can enhance the economic growth in the country. Our finding is in the line with Fasano and Wang (2002), Hong (2010), Garkaz et al. (2012), and Okafor and Eiya (2011).

4.2. Granger Causality Tests Results

Since the variables in the model are cointegrated, the Granger causality tests based on the VECM are used to determine the short and long run causal relationships among the variables. The Granger causality test results based on the VECM are shown in Table 4. The significance of the coefficient of the lagged error correction term shows the long run causal effect. It is clear that there are bidirectional causality relationships between lnOR, lnED and lnGI in the short and long run.

Table 4. *Granger causality test results*

	Independent variables			
	∑ Δ lnGI	∑ Δ lnOR	∑ Δ lnED	ect(-1)
Δ lnGI	-	3.122074(4)**	2.764306(3)**	-2.844203**
Δ lnOR	2.094875(3)*	-	2.740743(3)**	-2.190425*
Δ lnED	3.370327(3)**	1.633204(2)	-	-3.087164**

Note: ect(-1) represents the error correction term lagged one period. The numbers in the brackets show the optimal lag based on the AIC. D represents the first difference. Only F-statistics for the explanatory lagged variables in first differences are reported here. For the ect(-1) the t-statistic is reported instead. ** denotes significance at the 5 per cent level and * indicates significance at the 10 per cent level.

4.3. Statistical Diagnostic Tests Results

It is important to subject the VECM to a number of diagnostic tests, namely, the normality, serial correlation, heteroskedasticity (BPG and ARCH) and Ramsey RESET tests to ascertain its statistical adequacy. A 5% level of significance will be used in all these tests. The results of the diagnostic tests are reported in Table 5. The VECM with lnGI, lnOR and lnED as the dependent variables pass the normality, serial correlation, heteroskedasticity (BPG and ARCH) and Ramsey RESET tests.

Table 5. *Results of the statistical diagnostic tests on the VECM*

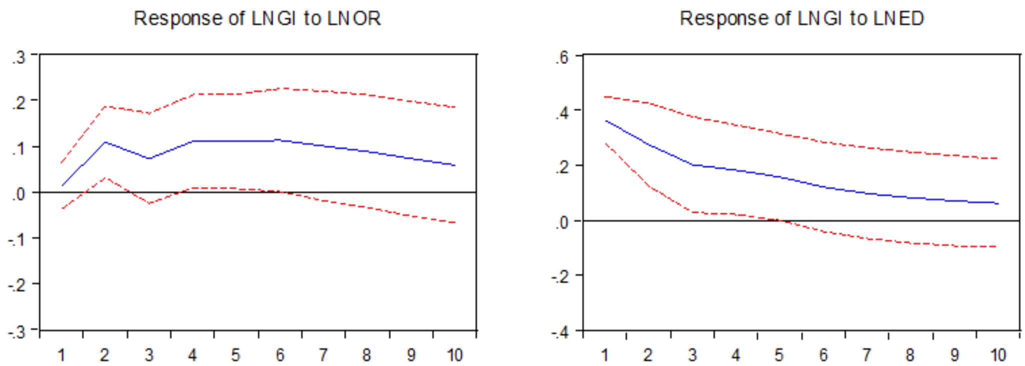
The Depended Variables	lnGEX	lnOR	lnED
Normality tests	0.544171	0.560631	0.64214
Serial correlation tests	0.3912	0.4135	0.5621
Heteroskedasticity (BPG) test	0.4312	0.3703	0.4204
Heteroskedasticity (ARCH) test	0.3236	0.5614	0.3417
Ramsey RESET tests	0.7164	0.7638	0.5276

Note: ** Denotes significance at the 1 percent level, and * at the 5 per cent level.

4.4. Impulse Response Functions (IRF) Test Results

Impulse response functions (IRF) allow us to study the dynamic effects of a particular variable's shock on the other variables that are included in the same model. Besides, we can examine the dynamic behavior of the times series over ten-year forecast horizon. There are many options for transforming the impulses. We will use the generalized impulse response functions (GIRF). Figure 1 shows that when there is a shock to lnOR or lnED, lnGI will respond positively in the following years.

Figure 1. *Generalized impulse response functions (GIRF) results*



4.5. Variance Decomposition (VD) Analysis Results

The variance decomposition (VD) for 1-year to 10-year forecast horizons will be applied to explain how much of the uncertainty concerning the prediction of the dependent variable can be explained by the uncertainty surrounding the other variables in the same model during the forecast horizon. The forecast error variance decompositions of the variables in our model are given in Table 6. In the first year, the error variance of lnGI is exclusively generated by its own innovations and has been decreasing since then for the various forecast horizons. However, at the 10-year forecast horizon, its own shocks contribute about 42% of the forecast error variance. On the other hand, lnOR and lnED shocks explain 35% and 22% of the forecast error variance of lnGI respectively. Furthermore, the contributions of lnOR and lnED in explaining lnGI forecast error variance have increased during the 10-year forecast period.

Table 6. *Variance decomposition (VD) analysis results*

Period	S.E.	lnGI	lnOR	lnED
1	0.157293	100.0000	0.000000	0.000000
2	0.239233	83.24347	16.22915	0.527386
3	0.292208	81.59974	15.17787	3.222393
4	0.333307	72.67866	20.93001	6.391328
5	0.365538	64.37190	25.54502	10.08308
6	0.394106	56.31054	29.83690	13.85256
7	0.416753	50.53617	32.34209	17.12173
8	0.434460	46.52614	33.89722	19.57664
9	0.446847	43.99910	34.68461	21.31629
10	0.455157	42.44922	35.07953	22.47125

5. Conclusion

This study investigated the effect of oil returns and external debt on the government investment in Syria using annual time series data from 1970 to 2010. The ADF unit root test, Johansen cointegration test, Granger causality tests, impulse response functions (IRF), and variance decomposition (VD) analysis were utilized in this study. The ADF test results indicate that all the variables are I(1). The Johansen cointegration test showed that that oil returns and external debt have a positive and significant long-run relationship with government investment. Furthermore, the Granger causality tests showed that bidirectional causality relationships between oil returns, external debt and government investment in the short and long run. The IRFs indicated that when there is a shock to oil returns or external debt, government investment will respond positively in the following years. The VD analysis showed that over a ten-year forecasting horizon, oil returns and external debt shocks explain 35% and 22% of the forecast error variance of government investment, respectively.

Based on the results of this study, both oil returns and external debt where being used properly by the government to support the Syrian economy through financing the government investment. Furthermore, when the war finish in Syria, oil returns and external debt can be used again by the government to rebuild what was destroyed by this war through financing and supporting the government investment in the country.

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