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Effects of Oil Price, External Debt and Population on the Government Investment in Syria

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Abstract *This study attempts to investigate the effect of oil price, external debt and population on the government investment in Syria over the period 1970-2010. The Johansen cointegration test showed that oil price, external debt and population have a positive and significant long run relationship with government investment. The Granger causality test indicates bidirectional long-run causality relationships between oil price, external debt, population, and government investment. There are also unidirectional short-run causality relationships running from oil price and population to government investment, and bidirectional short-run causality relationship between external debt and government investment. The study result indicates that, external debt have the biggest effect on the government investment, as well oil price and population can play an important role in supporting the government investment in the country.*

Key words Syria, government investment, oil price, external debt, population, VAR

JEL Codes: O11, E20

1. Introduction

Since 1963, the Syrian government has adopted the socialist direction, which depends on the centralized planning and under full government control. Based on this direction, the government has worked to nationalize the manufacturing industries, mining industry, natural resources, insurance companies, banks, electric power plant, telecommunication companies, transportation companies, and the education system at all levels. Moreover, the state intervened in domestic trade, and it was responsible for pricing consumer goods and services. In addition, most international trade and domestic wholesale trade were controlled by the public sector.

The government also supported the agriculture sector and introduced many projects to improve the infrastructure (Seifan, 2009). However, since 2000, the government has worked gradually to develop and reform the Syrian economy from a socialist central planning economy to a social market economy. Therefore, the government has changed its monetary and exchange rate policy, and has passed a number of laws to encourage the private sector and foreign investment in the country (Brück *et al.*, 2007).

Moreover, the government has worked to reduce the bureaucracy and administrative obstacles, improve the infrastructure, reform the industrial public sector, and improve the investment climate, by creating the stock market, developing industry, and establishing industrial cities. Furthermore, the state has focused on social development, and it worked to upgrade the standard of living by expanding public investment in infrastructure besides education and health services (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, the infrastructure has been damaged, investment has declined, public debt has increased, CPI has risen, unemployment rate has increased, many oil wells were controlled by the terrorists, and the appalling loss of life is one of the most horrific aspects of this war (SCPR, 2014).

Given this backdrop, the aim of this study is to investigate the effect of oil price, external debt and population on the government investment in Syria over the period 1970-2010, which may assist Syrian policy maker, after the war, to develop an economic plan that takes into account the effect of oil price, external debt and population on the government investment. The dependent variable in this study is the government investment, while oil price, external debt and population are the independent variables.

2. Literature review

Many studies have tested the effect of oil price, external debt, population and other variables on the government investment of different countries. The findings from these studies tend to vary from one country to another. By using panel data for 123 less-developed countries, Sturm (2001) tested the public capital spending during 1970-1998, and found that politico institutional variables such as ideology, political stability, political cohesion and political business cycles are not significant for less-developed economies, while other variables such as private investment, public deficits and foreign aid affect significantly public capital spending.

Urbanization and indebted affect negatively public capital spending, while economic growth, private investment and foreign aid affect positively public capital spending, and an increase in open up of economy leads to increase in investment in public capital. Sanz and Velazquez (2002) investigated the composition of government expenditure for the sample of OECD countries during 1970-1997, and found that income, prices, institutional factors, population density and its age structure have significant effects on the composition of government expenditure.

Other researchers such as Narayan and Narayan (2006), Chang and Chiang (2009), Elyasi and Rahimi (2012) and Al-Zeaud (2015) found that there is a positive relationship between government revenues and government expenditure in different countries. Furthermore, Fasano and Wang (2002) tested the causality relationship between total government expenditure and oil revenue in GCC countries during 1975-2000, by using cointegration test and error-correction model, and found that government spending follows oil revenue. 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. Hong (2010) indicated that oil price affects positively the government expenditure and revenue in Malaysia. However, Farzanegan (2011) found that oil revenues have a positive and significant effect on military expenditures in Iran, while non-military expenditure categories do not have a significant relationship with the change in oil revenues.

Moreover, by using Granger causality test, Moalusi (2004), tested the causality relationship between government spending and government revenue in Botswana during 1976-2000, and found that there is a negative unidirectional causality relationship running from revenue to spending, and the government budget deficit can be corrected by raising taxes. Eita and Mbazima (2008) also investigate the causality relationship between government revenue and government expenditure in Namibia during 1977-2007, by using VAR, unit root test, cointegration test and Granger causality test. The results show that there is a positive unidirectional causality relationship moving from revenue to expenditure.

Abu Tayeh and Mustafa (2011) investigate the determinants of the Jordanian total government expenditures during 1990-2010, and found that unemployment and inflation have a positive and significant effect on public expenditures, while population affects it negatively and significantly. However, Koksal (2008) found that population elasticity and income elasticity affect positively on government expenditures in Turkey during 1995-2001, while price elasticity affect it negatively. Besides, by using the Ordinary Least Square (OLS) regression method, Okafor and Eiya (2011) tested the determinants of government expenditure in Nigeria during 1999-2008.

Variables that are used in this study are total government expenditure, inflation, public debt, tax revenue and population. The result showed that population, public debt and tax revenue have a positive relationship with total government expenditure, while inflation has a negative relationship with it. However, Cashel-Cordo and Craig (1990) found that external debt has a negative effect on the government spending.

3. Methodology of research

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

$$lnGI = \alpha + \beta_1 lnOP + \beta_2 lnED + \beta_3 lnPOP + \varepsilon_t \qquad (1)$$

where α is the intercept, β_1, β_2 and β_3 are the coefficients of the model, *lnGI* is the natural log of government investment in real value (millions of SYP), *lnOP* is the natural log of oil price (US dollars per barrel), *lnED* is the natural log of external debt in real value (millions of SYP), *lnPOP* is the natural log of population, 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. Impulse response functions (IRF) and variance decomposition (VD) analysis also will be 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. Lastly, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) of the recursive residuals will be used to determine whether the parameters of the model are stable over the period of the study.
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***
lnOP	-2.536151	-2.542084	1.285268	-5.252982***	-5.283319***	-4.902189***
lnED	-2.145715	-0.387202	1.629056	-4.497559***	-6.491848***	-4.336350***
lnPOP	-2.119987	-2.686405	0.582563	-4.847096***	-5.164155***	-4.502795***

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

4.1. Johansen Cointegration Test Results

After determining that all the variables are stationary in the first difference, we can use the cointegration test to determine the presence of any cointegration or long-run relationship among the variables based on the Johansen cointegration test. But 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 five 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 four cointegration equations based on the trace and maximum eigenvalue tests. In other words, the results indicate that there is a long-run relationship between lnGI, lnOP, lnED and lnPOP.

Table 2. Johansen cointegration test results

No. of CE(s)	1. Trace Statistic	2. Probability	3. Max-Eigen Statistic	4. Probability
r = 0	147.5579***	0.0000	61.80947***	0.0000
r ≤ 1	85.74839***	0.0000	51.43785***	0.0000
r ≤ 2	34.31054***	0.0003	19.10280**	0.0151
r ≤ 3	15.20774***	0.0033	15.20774***	0.0033

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, lnOP, lnED and lnPOP, 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	lnOP	lnED	lnPOP	C
1.000000	5. -6.971447	-9.150676	-4.544352	560.4758
	(2.51082)	(2.08550)	(2.19895)	(344.412)

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

$$lnGI = -560.4758 + 6.971447\ lnOP + 9.150676\ lnED + 4.544352\ lnPOP \qquad (2)$$

The cointegration equation above shows that the GI is positively related to OP, ED and POP. The coefficient of lnOP indicates that when oil price increases by one percent, government investment will increase by 6.971 percent. This outcome is expected since oil sector is one of the most important sectors in Syria, and oil exports have a big percentage share of total Syrian exports. Therefore, any increase in oil prices will increase the total return from exports, which in turn provides the state treasury with foreign currency that can be used to improve infrastructure, and create new investments in the country. Our result agrees with Fasano and Wang (2002), Hong (2010), and Garkaz *et al.* (2012). The coefficient of lnED indicates that when external debt increases by one percent, government investment will increase by 9.150 percent. This suggests that external debt has a vital role in financing 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. Our result is in line with Okafor and Eiya (2011). The coefficient of lnPOP indicates that for every one percent increase in population, government investment will increase by 4.544 percent. This shows that population plays an important role in supporting the government investment in the country, because most production activities in Syria are labour-intensive activities, and the government is mainly responsible for creating different goods and services for the citizens. Our finding agrees with 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 unidirectional short-run causality relationships running from lnOP and lnPOP to lnGI, and bidirectional short-run causality relationship between lnED and lnGI. Besides, there are bidirectional long-run causality relationships between lnOP, lnED, lnPOP and lnGI.

Table 4. Granger causality test results

	Independent variables				
	Σ Δ lnGI	Σ Δ lnOP	Σ Δ lnED	Σ Δ lnPOP	ect(-1)
Δ lnGI	-	3.461034(4)**	4.131356(3)**	3.081175(3)**	-2.944203**
Δ lnOP	1.128875(2)	-	2.143951(3)*	1.073961(3)	-2.843405*
Δ lnED	3.428615(4)**	2.003652(3)	-	2.814932(3)*	-2.753221*
Δ lnPOP	1.230221(3)	2.831437(3)**	3.633207(4)*	-	-3.056581**

Notes: 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, lnOP, lnED and lnPOP 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

	Probability			
The Depended Variables	lnGI	lnOP	lnED	lnPOP
Normality tests	0.642131	0.433641	0.65224	0.61244
Serial correlation tests	0.2703	0.5023	0.5127	0.5224
Heteroskedasticity (BPG) test	0.5112	0.3372	0.4151	0.4721
Heteroskedasticity (ARCH) test	0.4256	0.5411	0.4401	0.3118
Ramsey RESET tests	0.7161	0.6508	0.3831	0.3772

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. Figure 1 shows that when there is a shock to lnOP, lnED or lnPOP, lnGI will respond positively in the following years.

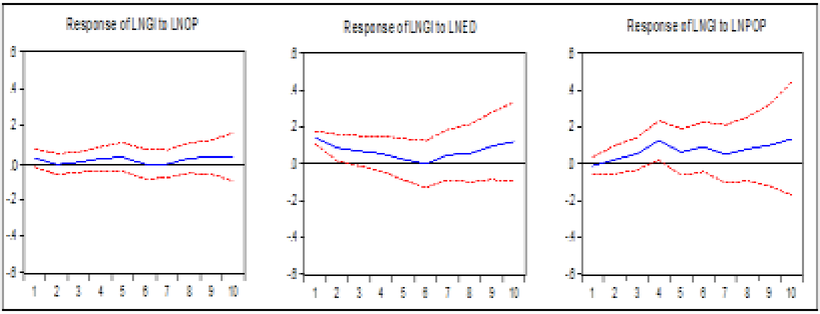

Figure 1. Generalized impulse response functions (GIRF) results

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 25% of the forecast error variance. On the other hand, lnOP, lnED and lnPOP shocks explain 3%, 30% and 42% of the forecast error variance of lnGI, respectively. Furthermore, the contributions of lnED and lnPOP in explaining lnGI forecast error variance have increased during the 10-year forecast period, while the contributions of lnOP in explaining lnGI forecast error variance have decreased.

Table 6. Variance decomposition (VD) analysis results

Period	S.E.	lnGI	lnOP	lnED	lnPOP
1	0.141299	100.0000	0.000000	0.000000	0.000000
2	0.177265	87.30204	11.60415	0.592980	0.500832
3	0.205448	76.13892	10.83700	7.126897	5.897187
4	0.266889	49.29138	9.796590	25.15124	15.76079
5	0.294499	41.15421	8.333237	25.19069	25.32186
6	0.334905	31.82455	6.599148	26.82538	34.75093
7	0.357580	29.67180	5.898468	25.80358	38.62616
8	0.385441	27.65199	5.085519	27.32778	39.93472
9	0.431914	26.96527	4.170511	28.82509	40.03913
10	0.505442	25.18808	3.046415	29.67329	42.09222

4.6. Stability Test Results

The stability tests are used to determine parameter stability. The decision about parameter stability is based on the position of the plot relative to the 5% critical bound. The CUSUM and CUSUMSQ statistics are used in this study. If the plots of the CUSUM or CUSUMSQ stay inside the area between the two critical lines, then the parameters of the model are stable over the period of the study. The results of the stability test are shown in figures 2 and 3. It indicates that the position of CUSUM plots stay inside of the area between the two critical lines which means that the parameters are stable over the period of the study. In other words, there are no structural changes in the model. However, the position of the CUSUMSQ plots lie outside of the area between the two critical lines during 2001-2005, which means that the parameters in the model are unstable during 2001-2005. This may be due to the Syrian government's strategy to reform the Syrian economy from a central planning economy to a social market economy.

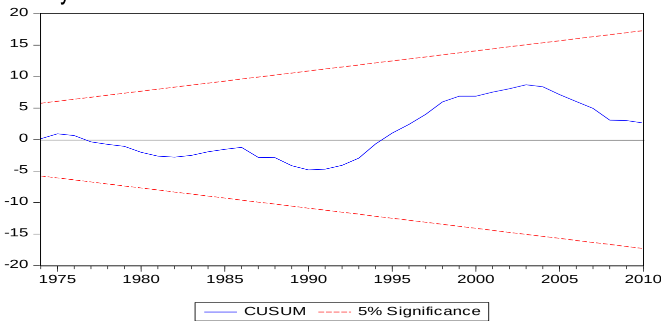

Figure 2. CUSUM test results

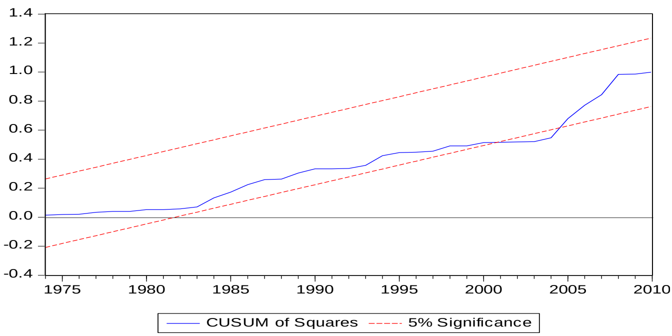

Figure 3. CUSUMSQ test results

5. Conclusions

This study investigated the effect of oil price, external debt and population 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 test, impulse response functions (IRF), variance decomposition (VD) analysis, CUSUM test and CUSUMSQ test were utilized in this study. The ADF test results indicate that all the variables are I(1). The Johansen cointegration test showed that oil price, external debt and population have a positive and significant long-run relationship with government investment in the country. Furthermore, the Granger causality tests showed that unidirectional short-run causality relationships running from oil price and population to government investment, and bidirectional short-run causality relationship between external debt and government investment. Besides, there are bidirectional long-run causality relationships between oil price, external debt, population and government investment. The IRFs indicated that when there is a shock to oil price, external debt or population, government investment will respond positively in the following years. The VD analysis showed that over a ten-year forecasting horizon, oil price, external debt and population shocks explain 3%, 30% and 42% of the forecast error variance of government investment, respectively. On the other hand, the results of the CUSUM test showed that the parameters are stable over the period of the study, that is, there are no structural changes in the model. However, the results of the CUSUMSQ test showed that the parameters in the model are unstable during the period 2001-2005.

6. Based on the results of this study, oil price, external debt and population play an important role in supporting the government investment in Syria. The boost in oil prices increases the total return from oil exports that can be used to finance the government investment in the country, and the positive effect of external debt on government investment indicates that external debt was being used properly by the government. Furthermore, since most production activities in Syria are labour-intensive that explains the important role of population growth in motivating government investment in the country. Finally, when the war finish in Syria, external debt and returns from oil exports can be used again by the government to finance the government investment in the country, and population will be an important source to supply the production activities with hands to work that can support the government investment in the country.

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