Determinants of External Debt: A Panel Data Analysis for Oil and Gas Exporting and Importing Countries

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ABSTRACT

This study investigates the macroeconomic determinants of external debt in oil and gas exporting and importing countries. The study uses panel data of 12 oil and gas exporting and 12 oil and gas importing countries covering the period 2004-2013. The study identifies eight macroeconomic factors that significantly affect the external debt of oil and gas exporting and importing countries. The major lesson learnt from this study is the importance of avoiding particular generalization for external debt accumulation factors for oil and gas exporting and importing countries. Furthermore, the effect of different macroeconomic factors can be different in these two groups of countries.

Keywords: External Debt, Panel Data, Oil and Gas, Exports and Imports
JEL Classifications: C13, C33, Q41, F14

1. INTRODUCTION

The recent decades witnessed a significant increase in external debt of many developing countries due to persistent current account and fis al imbalances. This rising burden of external debt and high debt service payments is becoming a constant source of concern for these economies.

The determinants of external debt in developing countries have generated a lot of interest among scholars and policy makers in recent years. Most of the previous studies are either time series or cross sections and there are few studies that used panel data. This study uses panel data analysis for two reasons. First given the rapid changes in global macroeconomic environment in the past years, the application of panel data approach seems to be highly preferred, as it allows to control time-specific events that are linked to overseas borrowing. Second most of the previous studies used aggregate set of data. Since it is believed that determinants of external debt could be different in various economies, this study tries to explore the determinants of external debt in the sample of oil and gas exporting and importing countries.

The study focuses on oil and gas exporting and importing countries for various reasons. First, the oil and gas exporting countries are

mostly high income and oil and gas importing are mostly low income indebted countries. Second, the oil and gas exporting countries have surplus in their current account while oil and gas importing countries are facing a deficit in their current account. Third, both classifications of countries are badly suffering from high external debt, and many of them are classified as highly indebted poor countries (HIPC) by the World Bank. The findings from this study will be a great help for designing their external debt reduction strategy.

After introduction section, the rest of the paper is organized as follows. Section-2 discusses the review of literature. Section-3 presents the modeling framework and the econometric models for both oil and gas exporting and importing countries. Section-4 first performs the preliminary data analysis and then discusses the panel data models' estimation results. Section-5 concludes the study, discusses the policy implications and set directions for further research.

2. REVIEW OF LITERATURE

There are several studies that investigated determinants of external debt using time series, cross section or panel data. Since the current

study uses panel data, therefore, this review of literature mainly focuses on the findings of panel studies

Barro (1979) argued, theoretically and empirically, that temporary increase in income plays a counter cyclical role on debt in the US, and also that there is an expected positive effect of infl tion on debt. Eichengreen and Portes (1986) using the data for 16-23 countries for the period 1930-1938 performed both cross-section and panel data analysis. The studied indicated that there is insignificant effect of export instability and degree of openness on external debt. Only the log of gross domestic product (GDP) per capita was found to have significant effect on external debt. On panel data regression, all variables except export variability turned out to be statistically significant. In their study, they identified the problem of potential simultaneity, which requires the attention of the future studies.

Hajivassiliou (1987), used the data for 79 developing countries for the period 1970-1982 to estimate the determinants of demand for and supply of loans. The author addressed the problem of heterogeneity by introducing an error-components structure in the model. The effect of total debt service to export ratio, import to GDP ratio, interest and principal to export ratio was positive on demand for borrowing, while the effect of real GDP per capita was negative. The study identify that the existing foreign exchange reserves can serve as an alternative to external debt. It is also pointed out by the study that high debt obligations are accompanied by high demand for new funds.

Tiruneh (2004) conducted a panel data study for sixty heavily indebted poor countries and non-heavily indebted less-developed countries to explore the demand for external borrowing in the 1980s and 1990s. The estimation results of random and fixe effects model for pooled data of 1982-1998 showed that capital flight, debt service payments, the imports to GDP ratio, income per capita, and the growth rate of GDP are the key determinants of the demand for external borrowing. The cross-section pooled time-series analysis for heavily indebted poor countries indicated that sluggish economic growth, high past debt service payments, income instability and demand for foreign exchange to finance their import bills, are the main reasons for external borrowing. The author suggested for debt relief for poor nations and sound debt management strategy to avoid debt crisis.

Colombo and Longoni (2009) analyzed the determinants of long term external debt for a large sample of developing countries. The study included 61 developing countries, some of them were HIPC, and covered the period 1970-2000. In addition to the standard economic variables, the study also included the socio-political factors in the model to explain the level of external debt of the developing countries. The study found that external debt is positively correlated to the level of economic development, the degree of openness and the level of education. The external debt is also found higher in those countries that have more flexible exchange rate system. The financial depth and inflation have positive effect on external debt. It is also found that a higher degree of institutional quality allows developing countries to take on more external debt. The open and competitive electoral system has the positive effect on external debt. This shows that higher transparency of the electoral system and higher political stability are rewarded by international financial markets

Forslund et al. (2011) identified the determinants of public debt in a large sample of developing and emerging market-countries. The data set consists of an unbalanced panel of 1558 observations covering 104 countries for the 1990-2007 period. The study found that financial deepening and GDP have significant positive effect on public debt, while past debt and real exchange rate depreciation have significant negative effect on public debt. The study did not find any signifi ant effect of infl tion, current account, bank crisis, default, openness, debt contraction, and debt explosion on public debt in the full sample. However, there was a change in the results for the presence of capital controls.

In a recent study Bittencourt (2013) investigated the determinants of external debt in South America, covering the period 1970-2007. The estimation results of principal component and dynamic panel data analysis confirmed that economic growth has the ability to significantly reduce the debt in the region. The other important determinants as suggested by the literature, such as infl tion, inequality or executive (better checks and balances) did not present the expected nor clear-cut estimates on external debt. However, the authors come up with the conclusion that these results cannot be generalized.

3. THE MODELING FRAMEWORK

For a sustainable solution to the debt problem, it is important to focus upon the elements in the economy that generate the need to borrow. There are several frameworks in which the debt can be analyzed; however, the econometric models of this study are based on the emerging literature on the two gap model (Chenery and Strout, 1966) and the three gap model (Bacha, 1990)[1]. These gap models identified three possible sources for accumulation of debt, which includes the saving-investment gap, foreign exchange gap and fiscal-constraint gap. The fiscal constraint gap is particularly important to this study keeping in view the samples of oil and gas exporting and importing countries. For oil and gas exporting countries, the foreign-exchange gap is less important but for oil and gas importing countries, this is very important in addition to the saving-investment gap.

There are at least four ways to finance a deficit in budget. Printing money, running down resources, domestic borrowing and/or external borrowing. The budget constraint can be represented as:

$$T_t + (D_t - D_{t-1}) = G_t + r\, D_{t-1} \qquad (1)$$

Where T_t is the government revenue, D_t and D_{t-1} is the current and past debt respectively, G_t is government expenditure, and r is the interest on accumulated debt. Thus, from the fiscal side debt accumulation, after simplification can be represented as

$$D_t = G_t - T_t + (1+r)\, D_{t-1} \qquad (2)$$

1　For a critical review of the gap models and other theoretical frameworks Waheed (2007).

Where $G_t - T_t$ is the primary budget deficit. An increase in government expenditure or interest on debt will increase current debt, while government revenue reduces the need for borrowing and ultimately the debt. From the balance of payment perspective, debt can be accumulated as follows:

$$CAB = X_t - M_t - r\,D_{t-1} \qquad (3)$$

$$KAB = (D_t - D_{t-1}) + (R_t - R_{t-1}) \qquad (4)$$

Where current account balance (CAB) is the CAB and KAB is the capital account balance. X_t is exports of goods and services, and M_t is the imports of goods and services. R is the international reserve. Since the CAB+KAB = 0, thus debt accumulation from balance of payment side can be represented as:

$$D_t = M_t - X_t + (1+r)\,D_{t-1} - \Delta R \qquad (5)$$

The debt accumulation from saving-investment gap can be represented as:

$$S_t + (D_t - D_{t-1}) = I_t + r\,D_{t-1} \qquad (6)$$

Where S_t is the saving and I_t is the investment. The re-arrangement of (6) will result following debt identity:

$$D_t = I_t - S_t + (1+r)\,D_{t-1} \qquad (7)$$

Thus, the main factors that affect the debt of a nation from (2), (5) and (7) can be listed as government expenditure, government revenue, interest on debt, export of goods and services, imports of goods and service, international reserve, investment and savings. These are the factors that are identified by the economic theory. In empirical analyses some additional variables are also identified as potential determinants of external debt. Inflation is an important variable that affect external debt and extensively used in empirical studies (Barro, 1979; Forslund et al., 2011; Bittencourt, 2013). Several empirical studies found that economic growth measured by GDP or GDP per capita is also an important variable that significantly affect external debt (Hajivassiliou, 1987; Selami, 2004; Tiruneh, 2004). Instead of using imports and exports separately, the empirical studies used CAB (Forslund et al., 2011) or trade balance (Colombo and Longoni, 2009; Selami, 2004). In the same way instead of using government expenditure and government revenue separately the budget deficit variable is used in empirical studies as potential determinants of external debt (Bader and Magableh, 2009; Awan et al., 2011). Benedict et al. (2014) identified Foreign direct investment (FDI) as significan determinant of external debt. Sachs and Berg (1998) believed that in many countries the main reason for accumulation of external debt is the more reliance on external borrowing rather than raising the taxes.

Keeping in view the economic theory and findings of the previous empirical studies, and region specific conditions, two different econometric models are used for oil and gas exporting and importing countries. Following model is used to explore the determinants of external debt in oil and gas exporting countries.

$$ED_{it} = \propto_0 + \propto_1 GDP_{it} + \propto_2 CAB_{it} + \propto_3 GGR_{it} + \propto_4 GGE_{it} + \propto_5 INF_{it} + \propto_6 POIL_{it} + \propto_7 RES_{it} + \propto_8 INV_{it} + \mu_{it} \qquad (8)$$

The description of all above variables is available in Appendix Table 1. The parameters $\propto_2$, $\propto_4$, $\propto_5$ are expected to be positive while $\propto_1$, $\propto_3$, $\propto_6$, $\propto_7$ are expected to be negative. The sign of $\propto_8$ is an empirical issue. The μ_{it} is the error term.

The determinants of external debt of oil and gas importing countries is estimated using following model.

$$ED_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 TB_{it} + \beta_3 GGR_{it} + \beta_4 POIL_{it} + \beta_5 RED_{it} + \beta_6 FDI_{it} + \beta_7 GDS_{it} + \beta_8 INV_{it} + \omega_{it} \qquad (9)$$

The description of all above variables is available in Appendix Table 1. The parameters β_2, β_4, and β_5 are expected to be positive. The parameters β_1, β_3 and β_7 are expected to be negative. The sign of the parameters β_6 and β_8 is an empirical issue. The ω_{it} is the error term.

4. ESTIMATION RESULTS

4.1. Data and Preliminary Analysis

The data set covers the period 2004-2013. The sample consists of 12 oil and gas exporting countries and 12 oil and gas importing countries. The list of countries included within the study is given in Appendix Table 2. The variables used to measure external debt is the gross external debt to GDP ratio, which is obtained from Regional Economic Outlook of International Monetary Fund (IMF). The other macroeconomic data are collected from the World Development Indicators of the World Bank and the International Financial Statistics of IMF. Table 1 in the appendix provides the description of each variable used in the model and the sources of data.

Table 1 indicates that the oil and gas importers are lagging behind the oil and gas exporters in economic growth, CAB, government expenditure and revenue, and foreign exchange reserve. The external debt accumulation is high in oil and gas importing countries, while the average rate of investment and inflation are almost same in both groups of countries during 2004-2013. The

Table 1: Selected economic indicators (average 2004-2013)

Economic indicator	Oil and gas exporters	Oil and gas importers
Real GDP growth (%)	6.37	4.97
Current account balance (% of GDP)	22.65	-2.03
External debt (% of GDP)	47.41	61.64
General government expenditure (% of GDP)	35.37	29.05
General government revenue (% of GDP)	42.05	23.34
Foreign exchange rescue (Billion US$)	64.06	8.33
Gross fixed capital formatio (% of GDP)	26.96	26.19
Inflation rat (%)	7.50	7.33

Source: Author's estimation, GDP: Gross domestic product

current decline in international oil prices may reverse the trend as the oil and gas exporters are experiencing a sharp decline in their revenue. This may results in a slowdown in economic growth, increase in external debt and inflation rate

Figure 1 shows the trend of external debt to GDP ratio of oil and gas exporting countries. The ratio has been very high as 60% in 2004, and then it decreases to 40% in 2006. After that it had a fluctuating trend between 30% and 50%, and finally it was at the level of little above then 30% in 2013. For oil and gas importing countries, Figure 2 shows that the external debt to GDP ratio was as high as 80% in 2004, but it had a declining trend after that, and it reached to the level of 50% in 2008. After that, the external debt to GDP ratio has a rising trend and in 2013, it was more than 60%. It seems that the external debt problem is more serious in oil and gas importing countries than the oil and gas exporting countries. However, the current decline in international oil prices may reverse the trend as oil and gas export is a major source of foreign exchange earnings for oil and gas exporting countries. On the other hand, the decline in international oil prices may benefit oil and gas importing countries, as it is the major component in their import bill.

Tables 2 and 3 provide the cross correlation of different variables for oil and gas exporting and importing countries. It is clear from Table 4 that GDP, CAB, price of oil and foreign exchange reserves are negatively correlated with external debt in oil and gas exporting countries, while government expenditure, revenue, inflation and investment are positively correlated with external debt.

For oil and gas importing countries, Table 2 shows that GDP, trade balance, and domestic savings are negatively correlated with external debt, while government revenue, price of oil, interest on debt, FDI and investment are positively correlated with external

debt. Basically, these preliminary correlations suggest that the relationship between macroeconomic variables and external debt is weak in most of the cases. However, there is a negative relationship between external debt and economic growth in both regions, which is in accordance with economic theory. Furthermore, the external debt is positively correlated with price of oil in oil and

Figure 1: Trends in external debt of oil and gas exporting countries
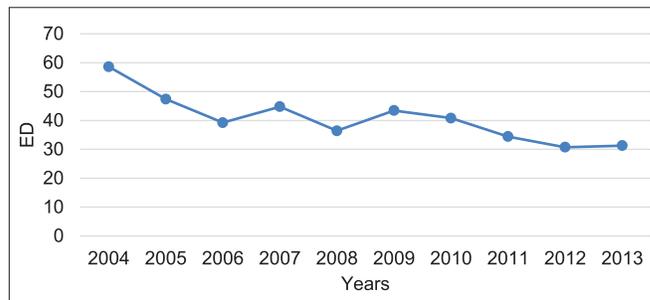
Source: Author's estimation

Figure 2: Trends in external debt of oil and gas importing countries
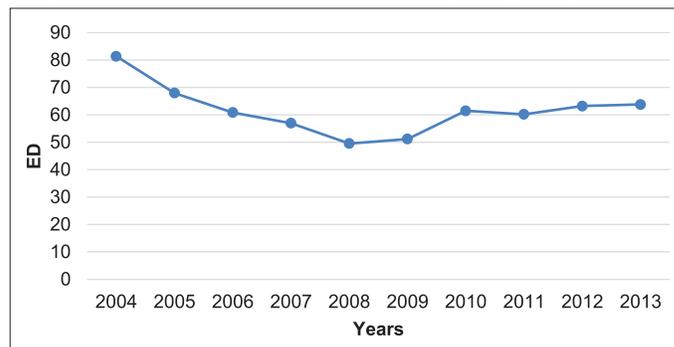
Source: Author's estimation

Table 2: Cross correlation matrix for oil and gas exporting countries, (2004-2013)

	ED	GDP	CAB	GGR	GGE	INF	POIL	RES	INV
ED	1								
GDP	−0.155	1							
CAB	−0.183	0.750	1						
GGR	0.187	0.078	0.330	1					
GGE	0.556	−0.016	−0.052	0.667	1				
INF	0.191	0.029	−0.136	−0.035	0.114	1			
POIL	−0.124	0.301	0.246	0.032	0.003	0.055	1		
RES	−0.162	0.756	0.717	0.194	0.115	−0.073	0.215	1	
INV	0.011	−0.100	−0.037	−0.201	−0.267	−0.194	−0.163	0.056	1

Source: Author's estimation, GDP: Gross domestic product, CAB: Current account balance, GGE: General government expenditure, FDI: Foreign direct investment

Table 3: Cross correlation matrix for oil and gas importing countries, (2004-2013)

	ED	GDP	TB	GGR	POIL	RED	FDI	GDS	INV
ED	1								
GDP	−0.362	1							
TB	−0.181	0.501	1						
GGR	0.131	−0.320	−0.237	1					
POIL	0.079	0.208	−0.172	0.096	1				
RED	0.685	−0.294	−0.202	0.215	−0.116	1			
FDI	0.435	−0.396	−0.423	0.311	−0.153	0.328	1		
GDS	−0.126	0.271	0.837	−0.002	−0.118	−0.231	−0.112	1	
INV	0.196	−0.402	−0.257	0.437	0.065	−0.012	0.573	0.290	1

Source: Author's estimation, GDP: Gross domestic product, CAB: Current account balance, GGE: General government expenditure, FDI: Foreign direct investment

Table 4: Model estimation results

Oil and gas exporting countries				Oil and gas importing countries			
Variable	Coefficient	t-statistic	P	Variable	Coefficient	t-statistic	P
Constant	50.434	1.427	0.156	Constant	47.422	2.713	0.008
GDP	−0.131	−3.742	0.000	GDP	−0.159	−2.726	0.007
CAB	0.933	3.111	0.002	TB	5.607	4.490	0.000
GGR	−2.758	−3.198	0.002	GGR	−1.538	−2.383	0.019
GGE	4.041	5.183	0.000	POIL	0.240	1.878	0.063
INF	1.344	2.825	0.006	RED	19.083	8.523	0.000
POIL	−0.179	−1.993	0.049	FDI	1.750	2.622	0.010
RES	−0.113	−3.388	0.001	GDS	−5.157	−4.204	0.000
INV	−0.682	−1.702	0.092	INV	5.352	4.320	0.000
Adjusted-R²	0.52	F-Statistic	16.90	Adjusted-R²	0.60	F-Statistic	22.92
DW Statistic	0.45	P (F- statistic)	0.00	DW Statistic	0.58	P (F- statistic)	0.00

Source: Author's estimation, GDP: Gross domestic product, CAB: Current account balance, GGE: General government expenditure, FDI: Foreign direct investment

gas importing sample, while it is negatively correlated with oil and gas exporting sample of countries. This is another important find ng, which will be further analyzed in the econometric models, that takes care of causation.

4.2. Model Estimation Results

The models for both oil and gas exporters and importers are estimated employing the panel least square method. There are several advantages of panel data analysis over the cross-section and time-series data analysis. According to Baltagi (2005), in panel data analysis, there is a possibility of less co-linearity among variable and more degrees of freedom. The panel data analysis can better detect and measure effects, which simply cannot be observed in cross-section or time-series data analysis. The parameter heterogeneity is a typical short coming of regression analysis based upon a sample of the large set of countries. To control this full sample is divided into oil and gas exporting countries and oil and gas importing countries that takes care of the level of development. The estimation results for both groups of countries are given in Table 4.

Theoretically, if a country has more income, it may not require external funding and reduce the chances of borrowing. On the other hand, a higher income is an indicator of credit worthiness and may get more loan, resulting higher borrowing and debt. Essentially in both models the coefficients of GDP variable are negative and highly significant, which highlight the effectiveness of economic growth in reducing external debt in the region.

The coefficients of variable CAB and TB represent the predicted positive sign and these are statistically significant. This suggests that increase in current account or trade deficit will stimulate external debt in the region.

There is an important role of general government revenue (GGR) and expenditure in external debt. Increase in government expenditure has a positive effect on external debt if local markets are shallow. On the other hand, an increase in government revenue, reduces the need for further borrowing. Bader and Magableh (2009) confirmed the significant positive effect of the budget defici on external debt. Awan et al. (2015) also found that fiscal deficit is a significant determinant of external debt. The coefficient of general government expenditure (GGE) is statistically significant

and positive in the sample of oil and gas exporting countries, while it was insignificant in oil and gas importing countries (that's why not included into the model). This indicates that reduction in GGE can decrease external debt of these countries. The coefficient of GGR is negative and highly significant in both models, but its magnitude is higher in oil and gas exporting countries compared to oil and gas importing countries.

The international price of oil is also playing an important role in external debt of oil and gas exporting and importing countries. As expected the coefficient of POIL is negative for oil-gas exporting countries but positive for oil-gas importing countries. This shows that an increase in international price of oil is expected to reduce the external debt of oil and gas exporting countries but worsen the debt burden in oil and gas importing countries.

The inflation is also contributing to external debt in the region, particularly in oil and gas exporting countries. Because most of these countries are following fixed exchange rate system, an increase in the inflation rate put the pressure on exchange rate and to maintain the fixed rate, these countries need foreign exchange, which can be met through foreign borrowing that may result in accumulation of external debt.

The effect of investment on external debt is very high in the region. This effect is more in oil and gas importing countries compare to oil and gas exporting countries. The investment is affecting external debt positively in oil and gas importing countries, and negatively in oil and gas exporting countries. The domestic saving has expected negative effect on external debt of oil and gas importing countries. Since oil and gas importing countries have very low saving rate, this force them to borrow abroad extensively. The increase in domestic saving will decrease their external debt by a large amount.

Foreign exchange reserves are another source of external finance just like external debt. High foreign exchange reserve may result in reduced willingness to borrow. On the other hand, an increase in reserve, may indicate an enhanced ability to manage the debt, which may result increase borrowing to build up reserves. The coefficient of RES is negative and highly significant in oil and gas exporting countries. The foreign exchange reserves of most of the

countries in this region are very low. An effort to increase foreign exchange reserve will lower the external debt burden.

The results presented in Table 4 have been subjected to several robustness checks. The validity of these results are confirme by comparing them with the results obtained in the previous studies, using different estimation methods and different sample sizes. The two models results are good based on the adjusted-R^2 and F-statistic. The explanatory power of all models is between 50% and 60%, and these models are overall highly statistically significant. The bias proportion and variance proportions were also reasonable in both models, showing their good forecast ability.

5. CONCLUSION AND POLICY IMPLICATIONS

In this study, the determinants of external debt are explored in oil and gas exporting and importing countries. The results from the study confirmed that the determinants of external debt, and their effects are different in oil and gas exporting and importing countries.

The panel data estimation results for oil and gas exporting countries show that increased economic growth, foreign exchange reserves, GGR, price of oil, and domestic investment are the important factors in reducing external debt. The current account deficit, GGE and inflation are accumulating external debt of these countries. The policy makers in these countries should focus on particularly current account defi it and infl tion for reduction of external debt. Moreover, these countries need to increase the GGR and cut expenditures as this has the strong effect in reducing external debt.

The estimation results of oil and gas importing countries are slightly different than the oil and gas exporting countries. The increase in economic growth, GGR, and gross domestic savings (GDS) are important factors in reducing external debt in oil and gas importing countries. The increase in trade defi it, international price of oil, interest payment on external debt, FDI and domestic investment are resulting in higher external debt in oil and gas importing countries. The policy makers in these countries are needed to pay special attention in reducing trade deficit and findin the new sources of government revenue and providing incentive to domestic savers to boost the domestic saving.

The future research can be extended in many directions. First the sample can be extend to include other oil and gas exporting and importing countries in the rest of the Asia or even the rest of the world. Second, the study focused only economic factors, which can be further extended to include administrative and uncertainty related factors. Finally, the external debt variable can be disaggregated to short-term and long term and into different currency compositions.

The core lesson learnt from this study is the importance of avoiding particular generalization for external debt accumulation. It is necessary for the policy makers to know the importance and effect of each factor that are responsible for external debt accumulation. This will help policy makers to handle the issue properly and to avoid any possible crisis.

6. ACKNOWLEDGMENT

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APPENDIX

Appendix Tables

Table 1: Definition of variables and sources of data

Variable	Definition	Data source
ED	Gross external debt	Regional economic outlook-IMF
GDP	Gross domestic product	World development indicators-WB
CAB	Current account balance	Regional economic outlook-IMF
GGR	General government revenue	Regional economic outlook-IMF
GGE	General government expenditure	Regional economic outlook-IMF
INF	Inflation rat	Regional economic outlook-IMF
POIL	Price of oil	Organization of petroleum exporting countries
RES	Foreign exchange reserve	Regional economic outlook-IMF
INV	Gross capital formation	World development indicators-WB
TB	Trade balance	World development indicators-WB
RED	Interest on external debt	World development indicators-WB
FDI	Foreign direct investment	World development indicators-WB
GDS	Gross domestic savings	World development indicators-WB

GDP: Gross domestic product, CAB: Current account balance, GGE: General government expenditure, FDI: Foreign direct investment, Data Sources: IMF(2015-2006) and world bank (2015).

Table 2: List of Countries

Oil exporters	Oil importers
Algeria	Egypt
Bahrain	Jordan
Iran	Lebanon
Iraq	Mauritania
Kuwait	Morocco
Oman	Pakistan
Qatar	Sudan
Saudi Arabia	Tunisia
United Arab Emirates	Oil and gas importers
Oil and gas exporters	Armenia
Azerbaijan	Georgia
Kazakhstan	Kyrgyz Republic
Uzbekistan	Tajikistan