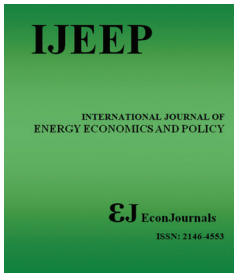

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Modeling the Impact of the Oil Sector on the Economy of Sultanate of Oman

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ABSTRACT

This study constructs and analyses a simple macroeconomic model that specifically tailored to model the impact of oil sector on the economy of Sultanate of Oman. The constructed model of the study measures the impact of oil sector on the Oman economy for the last three decades and also provides some forecasting for the major macroeconomics indicators related to the Oman economy. Model simulations indicate that the oil sector has large and positive impact on Oman gross domestic product and its influence spills over to all other non-oil sectors of Oman economy. The study found that largest influence of oil was on the gas sector and the least economic sector influenced by oil was agricultural sector. The findings of the study suggest that Oman economy is far from being diversified and that the proposed model helps the policy makers in Oman to identify and forecast the impact of oil on other components of the Oman economy.

Keywords: Macroeconomic Modeling, Oil, Oman
JEL Classifications: C51, C53, E17, N15, Q43

1. INTRODUCTION

Oman is a high-income economy that is heavily dependent on oil revenues. Crude oil accounts for 59% of total export earnings, 84.7% of Government revenues and contributing about 49% to the gross domestic product (GDP) (National Center for Statistics and Information, 2012). The crude oil sector is the major contributor to the GDP of the Sultanate with a 42.2% contribution in 2012, as compared to the other sectors – manufacturing (9.7%) and, wholesale and retail trade (7.8%). This shows that oil is the most important factor in the Omani economy and it is the oil sector that catalyst for growth in its GDP.

According to a report by World Bank (2010) titled "Oman Energy Sector Review," Oman is facing a challenge in terms of the trial of increasing the oil production where difficult-to-extract crude oil as well as maturing fields led to a dwindling of Oman's oil resources and based on the current oil production rates, 20-25 years is the predicted lifespan for Omani oil resource, unless new major discoveries are made. This is consistent with the earlier report based on British Petroleum's statistical review (2009) which mentioned that the proven oil reserves in Oman has declined from 6.2 to 5.6 billion barrels during the period from 1996 to 2008, which is significantly lower than its neighbors' reserves (British Petroleum, 2009).

Due to that fact, the Omani Government has initiates economic diversification plans to minimize the effect of the oil sector on the economy. As a result, the Omani Government has embarked on a number of long-term strategies for income diversification. The "Vision 2020" and "Vision 2040" plans (plus a modification plan that is estimated to be applied in 2016) are the two long-term development strategies which aim to diversify the economy to the non-oil sectors. The "Vision 2020" sets ambitious target for economic diversification: "Focuses on creating a diversified national economy, mainly based on renewable resources, which is highly efficient and integrated with the world economy." The vision also includes the following: (1) Raising the relative share of non-oil sectors, including natural gas, to 91% of GDP by 2020; (2) increasing the value added of exported natural resources; and

(3) replacing oil exports with non-oil exports in such a way that their share will increase from 9.4% of GDP in 1995, to about 13% in 2020.

It is important to investigate the effects of oil sector on macroeconomics variables of Oman economy. Therefore, the main aim of this study is two folded: Firstly, to measure the impact of the oil sector on Oman's economy during the period 1980-2012 and secondly, to forecast the future of Oman's economy under the influence of the oil sector. Each individual subsector[1], some other economic indicators such as trade balance (export minus import), Government total revenues, and numbers of non-Omani residents (expatriates) will be the main variables of the study. A macro-econometric model is then used to measure this impact.

To the best of our knowledge that, there is no specialized macro econometric models in Oman. The Government of Oman typically uses the data and technical reports from international organizations such as the International Monetary Fund and the World Bank in their analysis. These models are good predictor at the aggregated level of the macroeconomics variables but not for detailed variables. Therefore, developing comprehensive model in this study will help policy maker in Oman to better understanding of Oman's economy and give more prediction accuracy than the aggregated models that are in use.

The organization of the paper proceeds as follows. Section 2 reviews the relevant literature data descriptions and methodological framework are detailed in Section 3. Section 4 presents the empirical estimation and results. The concluding remarks are presented in the final section of the paper.

2. BRIEF RELEVANT LITERATURE

There are a numerous number of studies that have employed various forms of mace-econometric modeling in investigating the impact of oil on a wide range of macroeconomic variables (e.g. Hamilton, 2003; 2009; 2011; Kilian, 2010; Mohammad, 2010). These studies have mainly focused on the impact of oil price shocks on different macroeconomic activities through supply side (production costs) and demand side (income transfer). Whilst most of the research conducted pertains to the impact of oil prices on GDP, the relationship between oil prices and other macroeconomics variables such as inflation and unemployment have also been examined. The pass-through effect of a positive oil price shocks into inflation has been clearly observed in empirical studies (e.g. Fuhrer, 1995; Hooker, 2002; LeBlanc and Chinn, 2004). The empirical studies of oil effects on macroeconomic variables have also examined the relationship between unemployment and oil price shocks include (e.g. Loungani, 1986; Darby, 1982; Gisser and Goodwin, 1986).

Although studies on oil impact of macroeconomic variables is quite comprehensive, the focus was on the developed economies and oil importing countries, with little attention has been paid on the oil exporting developing countries such Oman. With respect to oil exporting countries the following results have been observed. A recent study by Bouchaour and Al-Zeaud (2012) investigated the impact of oil price fluctuation on five macroeconomic variables (i.e., real GDP, unemployment, inflation, money supply, real exchange rate) during 1980 to 201, the study employed a vector error correction model and found that oil prices have no important impact on the most variables during the short-term with the exception that they have a positive effect on inflation and negative effect on real effective exchange rate. Another study by Iwayemi and Fowowe (2011) on Nigeria found that oil price shocks do not have a major impact on most macroeconomic variables in Nigeria over the period from 1985 to 2007. The results of the Granger-causality tests, impulse response functions; and variance decomposition analysis all showed that different measures of linear and positive oil shocks have not caused output; government expenditure; inflation; and the real exchange rate. Further, a study by Ito (2008) examined the impact of oil prices on the levels of inflation; real effective exchange rate and real GDP for Russia from 1995 to 2009 using the vector autoregression model. The result show that the oil prices fluctuations contributes to the growth (decline) in real GDP in the long run. Likewise; the study found that in the short run (four quarters) rising oil prices not only stimulate inflation and economic growth negatively and positively; respectively; but also induce real effective exchange rate appreciation.

There is no empirical study existed as of yet on the impact of oil on macroeconomic indicators for the case of Oman; furthermore, there are only two studies in the literature on the Middle Eastern countries are found to be closest to the case of Oman. The first study is by Karnik and Fernandes (2009). Their study was to analyze the impact of the oil sector on the UAE Economy, the study consists of microeconomic models that focus on four economic sectors. They have published details of a 25 equations model which is modeled on the oil sector alone, and they have also attempted to observe the impact of oil on the economy. The study employs the "counter-factual and policy" experiment and for analysis of the impact of the oil sector, it uses the "instruments-targets" approach. One of the main findings of the study was that the UAE is fairly dependent on the oil sector, despite its efforts in income diversification. In addition, the study has concluded that there is a positive relationship between the oil prices and oil production from the site of oil sectors and the government's welfare activities and its subsidies and transfer (ST). For instance, if oil prices go down or oil production starts to dwindle, that will lower the government's welfare activities; in addition, ST will also decline accordingly; the study concluded that diversifying the UAE economy is vital.

Another Middle-Eastern study is by Arabi and Abdalla (2013). Their study aims to provide an analytical tool to clarify the mechanisms of

1 The statistics yearbooks divide the Omani economy into three main non-oil sectors in the Sultanate: Agriculture and fishing, industry activities, and service activities where the main source of their growth is the oil sector. These main sectors are divided into 18 sub-sectors which are: Crude petroleum, manufacturing, wholesale and retail trade, public administration and defense, transport, storage and communication, building and construction, real estate and business activities, financial intermediation, education, natural gas, health, electricity and water supply, other community, social and personal services, agriculture, hotels and restaurants, fishing, private household with employed persons, and mining and quarrying.

the Sudan economy by building a macro-econometric model based on Keynesian economic theory. They used 12 macroeconomic variables to create six simultaneous equations that estimated by the least squares method in an error correction model framework. The study focused on certain areas: Private consumption, demand for money and prices, current account in addition to gross domestic saving, and investment. It concluded that the models that they developed are in harmony with economic theories (according to the paper's empirical results). In addition, the study found that the effects short-run influence more than the long-run, the exchange rate in Sudan has the main role in the economy through prices and money supply, and the policy of the exchange rate currently harms the economy and should be modified to achieved its goal.

In summary, while the existing literature highlights the importance of oil on economic growth and other macroeconomic indicators, it has also suggested that there could be important differences on how oil may impact macroeconomic variables across countries depending on, inter alia, mechanisms of the transmission and share of oil in the structure of the economy among other factors.

3. DATA DESCRIPTION AND METHODOLOGY

3.1. Data Description

The data are drawn from the published historical data from the statistical year-books published by the National Centre for Statistics and Information of Oman. All these statistics are macro-econometric indicators (variables) over three decades (1980-2012). The selection of these indicators was based on the existing literature of oil and economic growth there are used as possible determinants of measuring the impact of oil on Oman economy, Appendix 1 contains a list of these macro-econometric variables with some relevant details.

The class of all macro-econometric variables is numeric except the *Year* variable which is integer. Using boxplot method to our dataset, we found that there are only two variables (*Agriculture_GDP* and *Oil_Daily_Production*) that do not have any outliers, while other variables have some outliers due the fluctuation of oil prices across time. Therefore, the formation of the macro-econometric models has to use the full set of the previous data in each variable in order to simulate the past scenario in such a model so it can be used to predict the future or calculate the impact in cases of change. The R x64 3.0.3 software computer application system is used to describe, evaluate and analyze the variables' data, and build the macro-econometric models.

3.2. Methodology

The main two objectives of this paper is to forecast the future of Oman's economy under the influence of the oil sector, as well as to measure the impact of the oil sector on Oman's economy. Therefore, in order to reach these two objectives and based on the existing literature we employed 25 model equations.

The total GDP spilt into two parts (petroleum and non-petroleum) to reflect the paramount importance of the oil sector in the economy. Therefore, there will be three model equations, each of them with one independent variable (X) which is the *Year_ser* variable. The values of *Year_ser* variable are falling within the integers from 1 to 33 (1 represents 1980 and 33 represents 2012). The form of the model equations are:

- $Total\_GDP = \beta_0 + \beta_1 Year\_ser + Errors$
- $Petroleum\ ACT\_GDP = \beta_0 + \beta_1 Year\_ser + Errors$
- $NonPetroleum\ ACT\_GDP = \beta_0 + \beta_1 Year\_ser + Errors$

To measure the impact of the oil sector on Oman's economy, there will be 22 model equations. All of them will have one independent variable (X). This variable denotes the effect of the oil sector in the economy such as *CrudePetroleum_GDP*, *Oil_Price*, *Oil_Daily_Production*, *Oil_Revenues*, and *CrudeOil_Exports*, while, the dependent variables (Y) in the equations are going to be the macro-econometric variables which need to be checked to assess the impact of the oil sector on them. Therefore, these model equations will be as follows:

1. $Total\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
2. $NaturalGas\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
3. $Agriculture\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
4. $Fishing\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
5. $Mining\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
6. $Electricity\_WaterSupply\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
7. $Building\_Construction\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
8. $Wholesale\_Retail\_Trade\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
9. $Hotels\_Restaurants\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
10. $Transport\_Storage\_Communication\_GDP = \beta_0 + \beta_1$ Crude Petroleum$_GDP + Errors$
11. $Financial\_Intermediation\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
12. $RealEstate\_BusinessAct\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
13. $PublicAdministration\_Defence\_GDP = \beta_0 + \beta_1$ Crude Petroleum $GDP + Errors$
14. $Education\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
15. $Health\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
16. $OtherCommunity\_Social\_PersonalSer\_GDP = \beta_0 + \beta_1$ Crued Petroleum $GDP + Errors$
17. $PrivateHousehold\_GDP = \beta_0 + \beta_1 CrudePetroleum\_GDP + Errors$
18. $Total\_Revenues = \beta_0 + \beta_1 Oil\_Revenues + Errors$
19. $Expatriates = \beta_0 + \beta_1 Oil\_Revenues + Errors$
20. $GPI = \beta_0 + \beta_1 Oil\_Revenues + Errors$
21. $Trade\_Balance = \beta_0 + \beta_1 CrudeOil\_Exports + Errors$

The selection of the above macro-econometric variables in the above model equations was made with the aim of measuring the impact of oil on most elements of Oman's economy and are in line with other studies such as in the studies by Karnik and Fernandes (2009); and Arabi and Abdalla (2013).

When considering linear regression models, it is important to check the linearity and normality assumptions by examining residual versus fitted value plots, normal Q-Q, scale-location, and

residual versus leverage. As an example, the following scatterplots in Figure 1 show the non-linearity and non-normality of the first model, *Total_GDP* and *Year_ser*.

Plotting all 25 regression models do not meet the linearity features. Therefore, we have transformed all responses (dependent variables) in the 25 model equations to logarithms of *Y* (Log *Y*) and run the linear models (lm) in R again. By plotting the scatterplots of each model equation, we have discovered that the regression lines in all scatterplots are straight sloping lines and at the center of the observed values. This implies that the variation of the observations (*Y*) around the regression line (the residual standard error) is constant. This is known as homoscedasticity.

For example, we transformed *Total_GDP* to log*Total_GDP* in Model 1 and *Petroleum ACT_GDP* to log*Petroleum ACT_GDP* in Model 2, and plotted these models as shown in Figure 2.

The shape of the regression line in the scatterplots for the other remaining 23 models is similar to the log-transformed Model 1 and 2. Most plots of the log-transformed models show straight lines that cross the middle of the data points (linear models). Only a few plots show non-linear models but are closer to some extent to linear models (such as the plot of the log-transformed Model 2 in Figure 2). Therefore, we assume that all 25 log-transformed models are linear.

Additionally, we checked the goodness of fit for all 25 log-transformed models by running a summary for each model. The coefficient of the intercept (β_0) and the coefficient of the independent variable (β_1) for all models show a high significance at the 5% level where all t-values are larger than $t_{0.025,n-1}$ and $P < 0.05$ (close to zero for all models). In addition, the multiple R^2 values ranging from 0.539 (Model 6) to 0.9614 (Model 3), as shown in Figures 3 and 4. The multiple R^2 is the percentage of variation in the dependent variable (*Y*) explained by the model. The square root of R^2, or also known as multiple R is the correlation between the observed and predicted values of dependent variable (*Y*). Therefore, a model having a high value of multiple R^2 is considered to be well-fitted model and can be used for prediction.

4. EMPIRICAL ESTIMATION AND RESULTS

In order to forecast the future of Oman's economy under the influence of the oil sector, we used the log linear regression model equations of *Total GDP*, *Petroleum ACT_GDP* and *NonPetroleum ACT_GDP*. The fitted values for these models showed a positive relationship between the years and total GDP, total petroleum activities' GDP, and total non-petroleum activities' GDP. The fitted values were calculated by using the following model equations:

- $\log \hat{Total\_GDP} = 7.514176 + 0.074132\, Year\_ser$
- $\log \hat{Petroleum\ ACT\_GDP} = 6.764983 + 0.071088\, Year\_ser$
- $\log \hat{NonPetroleum\ ACT\_GDP} = 6.881409 + 0.077629\, Year\_ser$

Through the period 2013-2020, we forecast values for the total GDP, contribution to GDP by petroleum and non-petroleum activities. The results for forecasting using the model equations above are shown in Figure 5 and Table 1.

Figure 1: Scatterplots for Model 1, *Total_GDP* and *Year_ser*

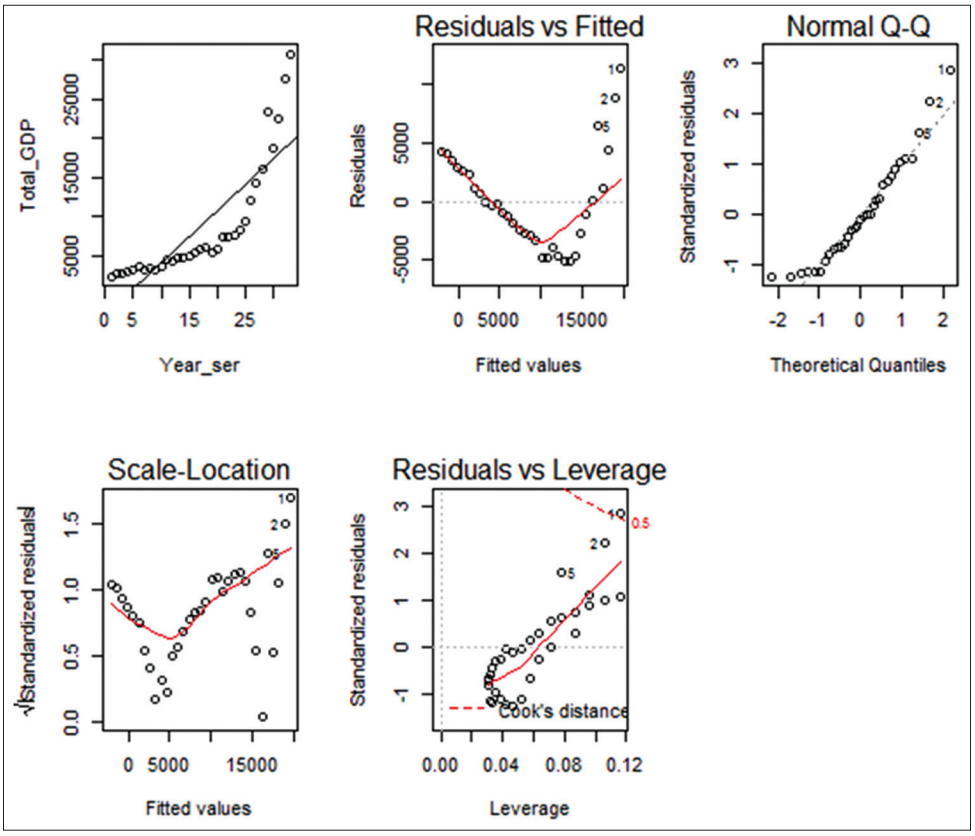

Figure 2: Scatterplots for the log-transformed Model 1, log*Total_GDP* and for the log-transformed Model 2, log*Petroleum ACT_GDP*

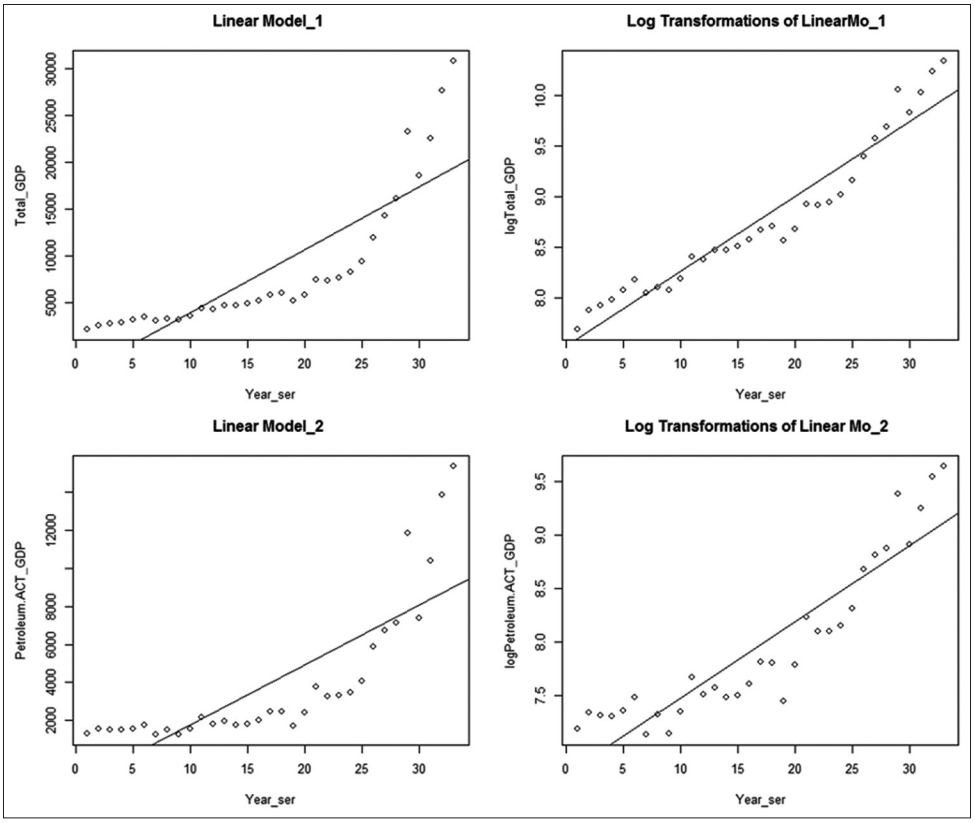

Figure 3: A summary of Model 3 shows that the multiple $R^2 = 0.9614$ indicates a very strong model

```
> summary(Model_3_TLM)

Call:
lm(formula = logNonPetroleum.ACT_GDP ~ Year_ser)

Residuals:
     Min       1Q   Median       3Q      Max
-0.25335 -0.14431  0.02118  0.10603  0.24286

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 6.881409   0.054452  126.38   <2e-16 ***
Year_ser    0.077629   0.002795   27.78   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1529 on 31 degrees of freedom
Multiple R-squared:  0.9614,    Adjusted R-squared:  0.9601
F-statistic: 771.6 on 1 and 31 DF,  p-value: < 2.2e-16
```

Figure 4: A summary of Model 6 shows that the multiple $R^2 = 0.539$ indicates a weak model

```
> summary(Model_6_TLM)

Call:
lm(formula = logAgriculture_GDP ~ CrudePetroleum_GDP)

Residuals:
     Min       1Q   Median       3Q      Max
-0.95990 -0.32350  0.02248  0.33561  0.82409

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)       3.732e+00  1.258e-01   29.67  < 2e-16 ***
CrudePetroleum_GDP 1.485e-04  2.466e-05    6.02 1.16e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4897 on 31 degrees of freedom
Multiple R-squared:  0.539,     Adjusted R-squared:  0.5241
F-statistic: 36.24 on 1 and 31 DF,  p-value: 1.158e-06
```

Figure 5: Forecasting results on the total gross domestic product (GDP), total petroleum activities' GDP and total non-petroleum activities' GDP

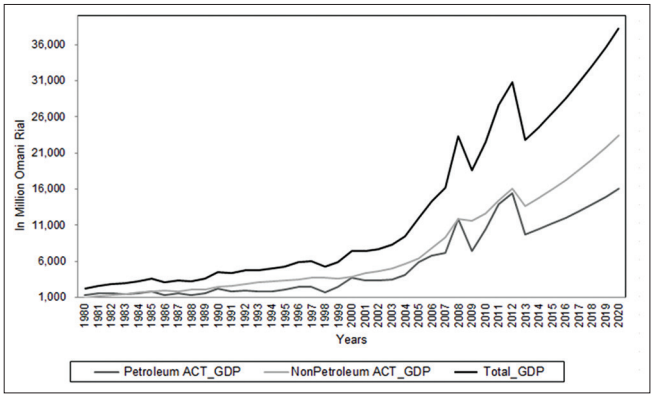

Table 1: Detailed results on the forecasting of total GDP, total petroleum activities' GDP and total non-petroleum activities' GDP

Year	Million Omani Rial		
	Total petroleum activities' GDP	Total non-petroleum activities' GDP	Total GDP
2013	9720	13,640	22,803
2014	10,436	14,742	24,558
2015	11,205	15,931	26,448
2016	12,031	17,218	28,483
2017	12,917	18,607	30,675
2018	13,869	20,109	33,035
2019	14,891	21,733	35,577
2020	15,988	23,487	38,315

GDP: Gross domestic product

Detailed results on the forecasting are presented in Table 1, which shows the future of Oman's economy under the influence of the oil sector.

The forecast results in Table 1 suggest that the total petroleum activities' GDP is about 42.63% of the total GDP of Oman in year 2013. There are only slight reductions in percentage from year 2013 to 2020, being about 40.50% in year 2020. In comparison with data during the period 1980 to 2012, the total petroleum activities' GDP counted for, on average, 42.31% of the total GDP of Oman. Therefore, these forecasting results indicate that without any strategies for economic diversification, Oman's economy continues to heavily depend on the oil sector.

We then measured the impact of the oil sector on Oman's economy using the following log linear regression model equations:

1. $\log \hat{Total\_GDP} = 8.034 + 0.000197\ CrudePetroleum\_GDP$
2. $\log \hat{NaturalGas\_GDP} = 4.264 + 0.000242\ CrudePetroleum\_GDP$
3. $\log \hat{Agriculture\_GDP} = 3.732 + 0.000149\ CrudePetroleum\_GDP$
4. $\log \hat{Fishing\_GDP} = 3.005 + 0.000166\ CrudePetroleum\_GDP$
5. $\log \hat{Mining\_GDP} = 2.242 + 0.000201\ CrudePetroleum\_GDP$
6. $\log \hat{Manufacturing\_GDP} = 5.505 + 0.000226\ Crude\ Petroleum\_GDP$
7. $\log \hat{Electricity\_WaterSupply\_GDP} = 3.608 + 0.000190\ Crude\ Petroleum\_GDP$
8. $\log \hat{Building\_Construction\_GDP} = 4.793 + 0.000216\ Crude\ Petroleum\_GDP$
9. $\log \hat{Wholesale\_Retail\_Trade\_GDP} = 5.550 + 0.0001889\ Crude\ Petroleum\_GDP$
10. $\log \hat{Hotels\_Restaurants\_GDP} = 3.217 + 0.000186\ Crude\ Petroleum\_GDP$
11. $\log \hat{Transport\_Storage\_Communication\_GDP} = 5.171 + 0.0001889\ Crude\ Petroleum\_GDP$
12. $\log \hat{Financial\_Intermediation\_GDP} = 4.937 + 0.000187\ Crude\ Petroleum\_GDP$
13. $\log \hat{RealEstate\_BusinessAct\_GDP} = 5.124 + 0.000166\ Crude\ Petroleum\_GDP$
14. $\log \hat{Education\_GDP} = 4.952 + 0.000182\ CrudePetroleum\_$
15. $\log \hat{Education\_GDP} = 4.952 + 0.000182\ CrudePetroleum\_GDP$
16. $\log \hat{Health\_GDP} = 3.982 + 0.000179\ CrudePetroleum\_GDP$
17. $\log \hat{OtherCommunity\_Social\_PersonalSer\_GDP} = 3.739 + 0.000166\ Crude\ Petroleum\_GDP$
18. $\log \hat{PrivateHousehold\_GDP} = 2.570 + 0.000163\ Crude\ Petroleum\_GDP$
19. $\log \hat{Total\_Revenues} = 7.104 + 0.0002678\ Oil\_Revenues$
20. $\log \hat{Expatriates} = 5.736 + 0.0001733\ Oil\_Revenues$
21. $\log \hat{GPI} = 4.561 + 0.00003907\ Oil\_Revenues$
22. $\log \hat{Trade\_Balance} = 5.964 + 0.0003356\ CrudeOil\_Exports$

The results show that there are positive signs in all model equations imply that each of the above dependent variables (Y) is affected by the same impact of its independent variable (X). The results of this analysis are provided in Appendix 2. The first log linear regression model equation of *Total GDP* shows that the total GDP of Oman is affected by the performance of the oil sector. A one million increase in the crude petroleum's GDP will increase the total GDP of Oman by 1.000197 million Omani Rial. In the absence of the crude petroleum's GDP, the Oman's total GDP is estimated at 3086.05 million Omani Rial.

$$\log \hat{Total\_GDP} = 8.034 + 0.00019724\ (0)$$

$$Total\_GDP = e^{8.034} = 3086.05$$

The largest impact of the oil sector is in the natural gas sector. Result shows that a one million increase in the crude petroleum's GDP will increase the natural gas' GDP by 1.000242 million Omani Rial. Without the crude petroleum's GDP, the Oman's total GDP is expected to be 71,094 million Omani Rial. The agriculture sector is the least sector influenced by the oil sector. A one million increase in the crude petroleum's GDP will increase the agriculture's GDP by 1.000149 million Omani Rial, whereas in the absence of the crude petroleum's GDP, the Oman's total GDP is estimated at 41.76 million Omani Rial.

The models also measured the impact of the oil sector on other macro-econometric variables that might be affecting Oman's economy, such as the impact of the oil revenues on the total Government revenues, number of expatriates in Oman and the General Price Index (GPI). The results show that a one million Omani Rial increase in oil revenue will increase the total Government revenue by 1.000268 million Omani Rial, the number of expatriates by 173 people and the GPI by 39 points. Additionally, we measured the impact of crude oil exports on the balance of trade, where a one million Omani Rial increase in crude oil exports will lead to an increase by 1.000336 Omani Rial in the balance of trade.

5. CONCLUDING REMARKS

The main thrust of this study is to measure the impact of the oil sector on Oman's economy over the last three decades and also to forecast the future of Oman's economy under the influence of the oil sector till the year of 2020, which is the last year of Oman Strategic vision known as Oman 2020.

This study has developed, for the first time, a simple macro-econometric model that can help policy makers in Oman to predict the future of Oman's economy and to measure the impact of the oil sector on the rest of sectors. This study has employed 25 model equations, three of them are for forecasting purposes and 22 of these equations are for measuring purposes.

The study has found that oil sector has significant and positive effects on all sectors included in the study such as mining, fisheries, education, health, real estates, etc. However, the impact do vary from one sector to the others, more specifically, a one million increase in the crude petroleum's GDP will increase the total GDP of Oman by 1.000197 million Omani Rial. The study has also found that the largest impact of the oil sector is on the natural gas sector; however, the least influenced sector by oil was found to be the agriculture sector.

The forecast results of the study suggest that the total petroleum activities' GDP is about 42.63% of the total GDP of Oman in year 2013 and forecasted to fall to 40.50% in year 2020.

Overall, it can be inferred from the study that Oman economy is still far from being diversified, therefore, Oman government is recommended to uses its current oil revenues to develop the other key economic non-oil sectors in order to reduce its dependency on the petroleum sector and to enhance its level of competitiveness of in the world economy.

Finally, further research may look at the mechanisms and the extents of how oil sector influence non-oil sectors in Oman and how the government may diversity its economy.

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APPENDIX

Appendix 1: The macro-econometric variables used in the study

Field's name	Variable description	Measurement unit
Year	Year	Million Omani Rial
Petroleum ACT_GDP	The current total petroleum activities GDP	Million Omani Rial
NonPetroleum ACT_GDP	The current total non-petroleum activities GDP	Million Omani Rial
CrudePetroleum_GDP	The current crude petroleum GDP	Million Omani Rial
NaturalGas_GDP	The current natural gas GDP	Million Omani Rial
Agriculture_GDP	The current agriculture GDP	Million Omani Rial
Fishing_GDP	The current fishing GDP	Million Omani Rial
Mining_GDP	The current mining and quarrying GDP	Million Omani Rial
Manufacturing_GDP	The current manufacturing GDP	Million Omani Rial
Electricity_WaterSupply_GDP	The current electricity and water supply GDP	Million Omani Rial
Building_Construction_GDP	The current building construction GDP	Million Omani Rial
Wholesale_Retail_Trade_GDP	The current wholesale and retail trade GDP	Million Omani Rial
Hotels_Restaurants_GDP	The current hotels and restaurants GDP	Million Omani Rial
Transport_Storage_Communication_GDP	The current transport, storage and communication GDP	Million Omani Rial
Financial_Intermediation_GDP	The current financial intermediation GDP	Million Omani Rial
RealEstate_BusinessAct_GDP	The current real estate and business activities GDP	Million Omani Rial
PublicAdministration_Defence_GDP	The current public administration and defence GDP	Million Omani Rial
Education_GDP	The current education GDP	Million Omani Rial
Health_GDP	The current health GDP	Million Omani Rial
OtherCommunity_Social_PersonalSer_GDP	The current other community, social and personal services GDP	Million Omani Rial
PrivateHouseholdGDP	The current private household with employed person GDP	Million Omani Rial
Total_GDP	The current total GDP	Million Omani Rial
Omani	Number of Omanis	1000 people
Expatriates	Number of expatriates	1000 people
Population	Total population	1000 people
GPI	General price index	Ratio
Inflation	Inflation rate	Percentage
Oil_Price	Annual average price of crude oil	US$/BBL
Oil_Daily_Production	Crude oil daily average production	1,000 BBL
Oil_Annual_Production	Crude oil annual production	Million BBL
Total_Revenues	Total revenues	Million Omani Rial
Oil_Revenues	Oil revenues	Million Omani Rial
Merchandise_Imports	Merchandise imports	Million Omani Rial
Merchandise_Exports	Merchandise exports	Million Omani Rial
CrudeOil_Exports	Crude oil exports	Million Omani Rial
RefinedOil_Exports	Refined oil exports	Million Omani Rial
Trade_Balance	Trade balance	Million Omani Rial
TotalTrade_Exchange	Total trade exchange	Million Omani Rial

Appendix 2: The results of the analysis

Model	Y	X	β_0	β_1	Y when X=0	Increase in Y when X=1	Measurement unit
4	Total_GDP	CrudePetroleum_GDP	8.034	0.00019724	3086.046	1.000197	Million Omani Rial
5	NaturalGas_GDP	CrudePetroleum_GDP	4.264	0.00024160	71.094	1.000242	Million Omani Rial
6	Agriculture_GDP	CrudePetroleum_GDP	3.732	0.00014850	41.763	1.000149	Million Omani Rial
7	Fishing_GDP	CrudePetroleum_GDP	3.005	0.00016570	20.188	1.000166	Million Omani Rial
8	Mining_GDP	CrudePetroleum_GDP	2.242	0.00020070	9.412	1.000201	Million Omani Rial
9	Manufacturing_GDP	CrudePetroleum_GDP	5.505	0.00022570	245.918	1.000226	Million Omani Rial
10	Electricity_WaterSupply_GDP	CrudePetroleum_GDP	3.608	0.00019010	36.892	1.000190	Million Omani Rial
11	Building_Construction_GDP	CrudePetroleum_GDP	4.793	0.00021640	120.663	1.000216	Million Omani Rial
12	Wholesale_Retail_Trade_GDP	CrudePetroleum_GDP	5.55	0.00018880	257.238	1.000189	Million Omani Rial
13	Hotels_Restaurants_GDP	CrudePetroleum_GDP	3.217	0.00018630	24.953	1.000186	Million Omani Rial
14	Transport_Storage_Communication_GDP	CrudePetroleum_GDP	5.171	0.00018530	176.091	1.000185	Million Omani Rial
15	Financial_Intermediation_GDP	CrudePetroleum_GDP	4.937	0.00018680	139.352	1.000187	Million Omani Rial
16	RealEstate_BusinessAct_GDP	CrudePetroleum_GDP	5.124	0.00016630	168.006	1.000166	Million Omani Rial
17	PublicAdministration_Defence_GDP	CrudePetroleum_GDP	5.628	0.00017430	278.137	1.000174	Million Omani Rial
18	Education_GDP	CrudePetroleum_GDP	4.952	0.00018190	141.458	1.000182	Million Omani Rial
19	Health_GDP	CrudePetroleum_GDP	3.982	0.00017910	53.624	1.000179	Million Omani Rial
20	OtherCommunity_Social_PersonalSer_GDP	CrudePetroleum_GDP	3.739	0.00016640	42.056	1.000166	Million Omani Rial
21	PrivateHouseholdGDP	CrudePetroleum_GDP	2.570	0.00016310	13.066	1.000163	Million Omani Rial
22	Total_Revenues	Oil_Revenues	7.104	0.00026780	1216.825	1.000268	Million Omani Rial
23	Expatriates	Oil_Revenues	5.736	0.00017330	309.823	1.000173	1,000 People
24	General Price Index	Oil_Revenues	4.561	0.00003907	95.679	1.000039	Ratio
25	Trade_Balance	CrudeOil_Exports	5.964	0.00033560	389.164	1.000336	Million Omani Rial

GDP: Gross domestic product