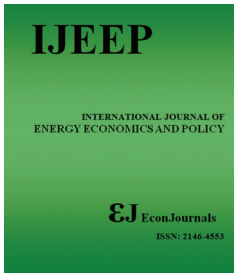


International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2017, 7(3), 300-307.

The Lebanese Pre-salt Oil and Gas Production Economic Challenges and Revenues

Hanadi Taher*

Beirut Arab University, Beirut, Lebanon. *Email: h.taher@bau.edu.lb

ABSTRACT

This paper examines the challenges for oil and gas production and its influence on the Lebanese economy. Lebanese economy expected to become a new oil and gas producer starting 2020. The oil and gas exploration and production in Lebanon faces different challenges mainly fiscal inefficiency; oil plenty, Dutch disease phenomena, Nigerian disease and resource curse. Managing the oil and gas production process with a convenient fiscal regime adjustment would cause an efficient economic reform. The data are from International Monetary and Funds Forecasted Lebanese economic data, Energy Information Administration forecasted oil, and gas international prices from 2017 to 2020. Based on the collected data beside our estimated scenarios for the annual oil and gas production capacity, the simulated sensitivity analysis showed a significant increase in the monetary value for the Lebanese oil and gas production and fiscal revenue although it varies according to the suggested scenarios.

Keywords: Gas and Oil Production in Lebanon, Lebanese Oil, Gas Production Challenges
JEL Classifications: Q43, Q47

1. INTRODUCTION

For an economy with a large public debt and several economic difficulties like Lebanon, the oil and gas production could be a great opportunity. After the deep water gas discoveries in the Lebanese near geological offshore, the Lebanese economic structure might change in few years starting in 2020. However, the Lebanese oil and gas exploration and production have many risks and challenges.

Oil revenue mismanagement changes the economy structure and make it oil dependent which may lead to fiscal inefficiency. Due to which, the government oil ownership alone does not guarantee economic development. Therefore, it is very important to control the management process during all the stages of production for better utility for oil discovery and production. This study discusses Lebanese practice in oil and gas revenue management, challenges, and presents different oil and gas production scenarios. Due to the absence of official strategy for oil and gas production, we estimate the oil and gas production based on our different scenarios applying sensitivity analysis for oil and gas prices for each scenario using Monte Carlo simulation. Hereby, econometric models would not apply due to which oil and gas production is new to the Lebanese economy with no historical data.

The energy consumption and economic growth relationship has been well studied in the literature. However, the relationship between the energy exploration or production and the GDP is not well covered. In this paper, we focus on the effect of the Lebanese oil and gas exploration and production monetary value on the Lebanese economy and its fiscal revenue. The importance of this research is to give the Lebanese policy maker a step forward to best use of the oil and gas revenues in pushing the Lebanese economy and best use of these resources.

This study addresses two main questions. The first one is to study what are the challenges the oil and gas production would hold for the Lebanese economy. The second question is to study what are the influence of the estimated oil and gas exploration and production monetary value and fiscal revue as estimation for the years 2017-2039 keep aside the other macroeconomic variables influence due to the availability of the estimated data problem. Accordingly, the paper divided into 5 parts. The first one is the theoretical part followed by the second and third part as an

overview on the Lebanese oil and gas exploration and production challenges and estimated monetary values. While, the fourth part is the methodology of research based on our scenarios of oil and gas production with the sensitivity analysis for oil and gas prices based on Monte Carlo simulation for each scenario starting from 2020 to 2039. Finally, we end up with conclusions.

2. THEORETICAL OVERVIEW

In general, the major problems of countries in process of oil production comes from oil production revenues management difficulties. Several studies showed a negative correlation between economic growth rate and primary products (mainly oil and gas) exports mainly for developing countries beside their social impacts (Sachs and Warner, 1995; 1997). Theoretically, oil production and exploration process faces several challenges and obstacles in pushing the economic growth:

1. Resource curse may occur due to several factors. According to Ross (2012), mineral dependence may increase poverty due to six different points. Four points are economic, and two are socio-political. First, oil dependence makes the economy more volatile to economic shocks to the oil price fluctuations. Second, oil production or exploration increases income inequality where it employs few workers mining produces although it provides a good revenue for the government. Third, oil production may increase the poverty because it may slower economic growth and thus hurts the poor level. Fourth, few working opportunities due to which Mining employs few workers and offers few employment opportunities for unskilled or semi-skilled employs. Fifth, civil war possibility and poverty rates may increase due to the mineral dependence. Sixth, mineral dependence makes countries less democratic due to the reduction of the government taxes dependence (Ross, 2003).
2. Dutch disease is a universally known as the deindustrialization enhance due to the discovery of the natural resources, which raised the value of the national currency. In other words, the Dutch disease is an appreciation of the exchange rate due to the huge foreign exchange inflow from the oil commodity exports (Holden, 2013).
3. Oil plenty can minimize the national agricultural exports leading to less export diversification (Ross, 2003).
4. Beside the Dutch disease model, there is the "Nigerian disease" model, which states that oil revenues wasted in governments that mismanage its oil production revenue. In this context, it's important to highlight on some African oil exporters like Nigeria, Angola, Gabon, Cameroon and Congo - were they could not neither reduce their poverty nor improve their economic growth mainly because of the absence of diversified investment beside the high level of corruption. In Nigeria, during the last 25 years oil production revenues failed to reduce the poverty and made the economic situation worse where the per capita income decreased to reach 1 US$ per day (Van der Ploeg, 2011).

Another example for the Nigerian disease is in Ecuador, where the exploration for oil had a great impact on the local population's historical owners of the territory. They were poor but had been able to sustain growth since long times. However, oil production attracted more investors that are external and made the local people to live in extreme poverty.

Normally the revenues from oil production lead to economic dependence and thus oil price fluctuation increases the risk on the economy. Moreover, an appreciation in the exchange rate due to the increase in foreign funds inflows, would affect the national trade (Shultz, 2004).

In general, to consider a country is dependent on certain resource it should represent the greatest part of its total exports mainly from 60% to 95% otherwise the resource exports represent a big part of the total domestic product. In the other side, United States Australia, Canada, and Norway considered as successful cases for oil revenues management are. Hereby, Norway is a very good example for the successful resource revenues management by establishing the Pension Fund where all net petroleum government revenues should transferred to it Holden (2013). Therefore, the excess in natural resources revenue could affects negatively the economic growth rates in case of institutional weaknesses (Mehlum et al., 2006).

3. LEBANESE OIL AND GAS EXPLORATION AND PRODUCTION CHALLENGES

Since the latest oil and gas discovery in the Middle East region in 2009, the Lebanese authorities have taken serious measures since the year 2010 to tap any potential oil and gas reserves in its exclusive economic zone. The oil and gas exploration and production in Lebanon might face different challenges starting from the theoretical and international experiences challenges:

1. Recourse curse: The big challenge for the Lebanese economy in oil and gas production is the resource curse due to different reasons. First, commodity prices volatility puts high pressure on the oil and gas exporter's economies mainly during international economic crisis. Lebanon's economic structure as oil-importer that depend on the service sector mainly banking services has been experienced for several years and accordingly it absorbed the oil shocks (increase of decrease of oil process). By shifting to become oil-dependent, the volatile nature of oil prices means that the Lebanese economic growth will be hostage to international markets changes. Therefore, the Lebanese government should use oil revenue to develop other sectors and keep improving the service sector. Second, inequitable distribution of oil revenues: Experiencing other cases as oil-producer countries the oil and gas industries would create limited jobs classified as their relevance to the national revenues, which create wealth inequality and allocating the benefits for the few, instead of the whole economy. Thus, structural development should be adopted in order to create jobs in different fields. Third, mineral extraction results in slower growth and thus disproportionately hurts the poor. The oil and gas revenue mismanagement and inequality distribution could lead to increase the poverty level in Lebanon. Fourth, weak coordination between mining and the

sectors of the economy. Usually, mining employs few workers which provides little employment opportunities. Lebanese oil and gas production could great few jobs opportunities and not necessarily form the Lebanese labor force. Fifth, Lebanon faced the civil war for about 15 years and having unstably security and political system. Mineral dependence may increase the likelihood of civil war, which can both increase poverty rates and differentially hurt the poor. Sixth, the level of democracy in Lebanon is relatively low and mineral dependence appears to make Lebanon less democratic through its reduction of the government's dependence on taxes.

2. Dutch disease: Dutch disease is the exchange rate appreciation due to of the high foreign exchange inflow resulting from the export of the commodity. Lebanon could face a high pressure on the Lebanese lira real exchange rate. However, due to the Lebanese efficient monetary policy since 1996 as other conventional fixed pegs to US dollar for the Lebanese lira as classified by International Monetary and Funds (IMF), the Lebanese monetary authority could face a big challenges coming from the Dutch disease problems which claims to deepen.
3. Oil plenty: Is the decrease in the national agricultural exports, which led less diversification in the country's exports. However, due to the Lebanese economic structure highly dependent on service, oil and gas sector could adversely affects other sectors of an economy. The Lebanese government should use revenues of oil and gas to fund the development of other sectors mainly with difficulties.
4. Nigerien disease: Lebanese economy may face the Nigerian disease due to high level of corruption in the public sector. Lebanon ranked as one of the 50 most corrupt nations worldwide in 2013 (Corruption Perception Index, 2013). The oil and a gas revenue would increase the corruption mainly with the mismanagement in the public sectors. Lebanese authority should improve the control system at the public sector and increase the role of the private sector.

In addition to the international challenges, changing the structure of the Lebanese economy from oil importer to oil producer economy could introduces some other challenges to the Lebanese economy:

1. Environmental risks: Thinking in sustainable development oil and gas extraction would be hold a negative impact on the water and soil contamination and air pollution. Accordingly, the policy makers should use funds from the oil and gas revenues to fund projects that serve the sustainable development in Lebanon and decrease pollution.
2. Cost of drilling and the sector's profitability: Given the ambiguity surrounding Lebanon's oil and gas resources, it is too early to quantify the exact cost of oil and gas extraction. The profitability of exploiting said reserves remains, thus, highly uncertain, and hence further exploration may be necessary to spot the exact location and depth of the country's offshore hydrocarbon resources, and estimate as such the associated extraction costs.
3. Management of the public revenues: Through creating the fund centers upon an efficient management of hydrocarbon revenues by a dynamic asset allocation. It is worth noting that similar funds created in many oil-producing countries to preserve the resources for future generations as in Abu Dhabi and Qatar. Public revenues emanating from oil and gas production can also geared towards reducing Lebanon's budget deficit, which may contribute to trimming down interest rates levels because of a lower public demand for liquidity and can possibly lead to an improvement in the country's sovereign ratings, stimulate private sector's investments, and boost real GDP growth. In the event interest rates paid on sovereign debt are higher than the expected yield generated by the sovereign fund, public revenues from oil and gas production should instead allocated towards reducing the budget deficit. The government could similarly opt to employ the revenues generated from oil and gas production to increase its expenditures and boost aggregate demand, either through redistribution policies or through public infrastructure expenses. This alternative could result in an increase in the country's inflation rate, shore up interest rate levels, hamper private investment and slow economic growth on the long run (World Bank, 2014).

After presenting the oil and gas challenges, we need to highlight on the benefits of this production on the Lebanese economic growth through studying the influence for oil and gas production on the economic growth and budget deficit.

4. LEBANESE OIL AND GAS PRODUCTION BASIC SCENARIO

Given the lack of official data concerning oil and gas reserves in Lebanon's territorial and offshore waters, we have based our estimation based on our scenario and some estimations by international organizations. Collecting data for a new subject and mainly in an emergent economy with low transparency could be the hardest point in this study. We collect data from the Lebanese government publication, IMF, Energy Information Administration (EIA) and World Bank studies. Accordingly, we have built our estimation for oil production based on a series of scenarios concerning the production horizon, the gross profit margin on offshore drilling, and the type of agreement between the government and the operating oil companies as depicted in the Table 1.

We can estimated the government revenue from the royalty, its share from the oil profit after estimating the total profit and off course form the income tax. In this context, we can notice the importance of adopting convenient legislation and fiscal regime adjustment. Therefore, in order to increase the government share we need to increase its share, its royalty, or its income tax keeping a good place for investors in order to motivate them.

4.1. Oil and Gas Production Monetary Value and the Lebanese Economy

The following section aims at quantifying the direct influence of oil and gas production on Lebanon's nominal GDP without taking the other macroeconomic variables impacts like employment, inflation due to the availability of data. For this purpose, GDP forecasts for

Table 1: Lebanese oil production assumption

Oil and gas production revenue distribution	Oil	Gas
Total reserves	Between 440 million and 675 million barrels[1] (average: 557.5 million barrels adopted)	Between 12 and 25 trillion cubic feet TCF[2] (quantity adopted: 20 TCF)
Production horizon	2020-2039[3]	
Gross profit margin on offshore drilling	60%[4]	
Government share of gross profits	60%	
Royalty fees[5]	Between 5% and 12% of total oil production (average: 8.5 adopted)	4% on gas production
Corporate income tax	15% (fixed rate assumed over the production horizon)	

Source: Bloomberg[1], EIA[2], World Energy Council[3], Ministry of Energy and Water[4]. EIA: Energy Information Administration

the years 2017-2019 based on IMF estimations. As far as GDP forecasts for the 2020-2039 period are concerned, we have projected the Lebanese nominal GDP by applying a static nominal GDP growth rate of 6% as 2-3% real GDP growth and 3-4% inflation rate. Our model also relies on the assumption that the country will embark on its hydrocarbon production journey by the year 2020. Accordingly, the scenario adopted based on a production horizon extending between the years 2020 and 2039, bearing in mind that the results bound by uncertainty given the lack of official data released by the government on the exact volume of hydrocarbon reserves in Lebanon's territorial and offshore waters. Our production scenario centers upon the average of the expected oil reserves interval, namely 557.5 million barrels, and on natural gas reserves of 20 trillion cubic feet (Lebanese Petroleum Administration, 2011). In this perspective, and when spreading the hydrocarbon production uniformly over a production horizon of 20 years, oil production is expected to average 76,370 barrels per day 22, or the equivalent of 27,875 thousand barrels per year. Natural gas production, on the other hand, will average 1 trillion cubic feet per annum if distributed uniformly over the production horizon.

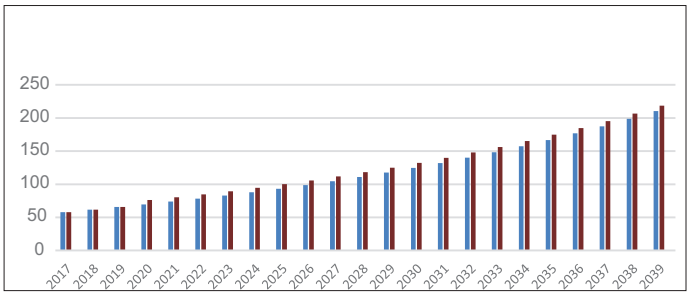
Furthermore, and according to EIA estimates, average oil prices expected to increase steadily during the hydrocarbon production horizon, and reach around $108 per barrel in the year 2039. In parallel, the EIA projected the international natural gas prices to increase from 2.99 in 2020 to 5.08 in 2039 as shown in Table 2.

As a result, the yearly oil and gas production monetary value increase expected to boost Lebanon's nominal GDP (Figure 1) keeping the influence of other macroeconomic variables due to the availability of data. This positive impact on GDP then expected to rise steadily and reach $218.6548 billion during the last year of extraction 2039 with 3.85% difference with nominal GDP without oil and gas production.

4.2. Oil and Gas Production Fiscal Revenue

The Lebanese government already benefits from revenues from hydrocarbon consumption. The section hereunder aims at projecting the additional public revenues that could generate from oil and gas production. We assume that the government's revenues from the exploitation of oil and gas will mainly stem from a 15% corporate income tax, a 60% profit share on hydrocarbon production, a royalty fee of 4% on gas production, and royalty fees ranging between 5% and 12% on oil production average of 8.5% adopted.

Figure 1: The Lebanese oil and gas production and its nominal GDP



Source: Our estimations based on Energy Information Administration projections and International Monetary and Funds estimations

It is worth noting, in this perspective, that the results on the following page based on a 60% gross profit margin from offshore oil drilling, bearing in mind that the profitability assumptions of oil and gas extraction in Lebanese territorial and offshore waters are highly dependent on the location and depth of Lebanese hydrocarbon resources. In an attempt to estimate future budget deficit when excluding oil and gas extraction, we have assumed a flat deficit to nominal GDP ratio of 10% over the forecast horizon, being the arithmetic mean of the said ratio over the past 10 years (Table 3 and Figure 2).

Based on the above results, at the first year of expected oil and gas production (2020) the government's revenues is expected to be $2,92 billion then to increase steadily over the next 20-years reaching $3,620 billion at 2039 (Figure 3). However, the government's deficit is expected to be about 4.21% points during 2020 and to become 8.28% points at 2039 (Figure 2) which is reflected in the overall economic growth and thus government spending. Therefore, it would be inefficient to reduce the currently applicable tax rate on oil consumption at the expense of the new income streams from oil and gas production.

5. METHODOLOGY OF RESEARCH

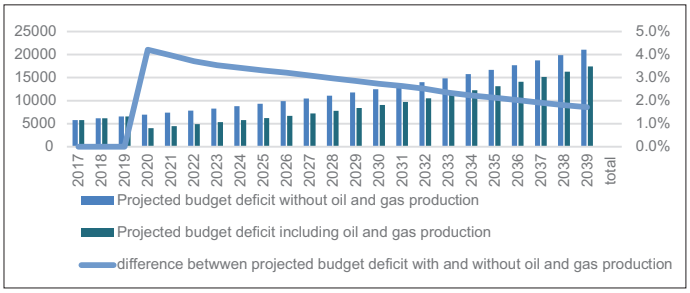
Lebanese expected oil and gas production as new discovery has no previous historical data to do some econometric models, thus we apply sensitivity analysis for oil and gas prices based on different scenarios for the oil and gas production. The simulation for Lebanese oil and gas production revenue and budget deficit has based on our three different production scenarios starting in 2020 due to absence of clear production strategy yet. The absence for other macroeconomic variable like employment and inflation

Table 2: The Lebanese oil and gas production monetary value on the Lebanese economy (as per our adopted scenario)

Year	Nominal GDP[2] ($ billion)	Volume (thousand barrels/year)	Oil prices forecast[1] ($/barrel)	Value ($ billion)	Volume (trillion cubic feet/year)	Natural gas prices forecast ($ billion/ TCF)*	Value ($ billion)	Nominal GDP including oil and gas	Difference between nominal GDP with and without oil and gas (%)
2017	57.986	-	49.915	-	-	2.9959	-	57.9860	-
2018	61.699	-	63.042	-	-	3.4032	-	61.6990	-
2019	65.651	-	70.373	-	-	3.9648	-	65.6510	-
2020	69.59	27.875	74.817	2.0855	1	4.5050	4.5050	76.1806	9.47
2021	73.765	27.875	78.147	2.1783	1	4.3914	4.3914	80.3348	8.91
2022	78.191	27.875	80.712	2.2498	1	4.2557	4.2557	84.6965	8.32
2023	82.883	27.875	82.280	2.2935	1	4.2810	4.2810	89.4575	7.93
2024	87.856	27.875	83.717	2.3336	1	4.4135	4.4135	94.6031	7.68
2025	93.127	27.875	86.232	2.4037	1	4.5056	4.5056	100.0364	7.42
2026	98.715	27.875	88.554	2.4684	1	4.6414	4.6414	105.8248	7.20
2027	104.638	27.875	89.997	2.5087	1	4.7524	4.7524	111.8991	6.94
2028	110.916	27.875	90.677	2.5276	1	4.8633	4.8633	118.3069	6.66
2029	117.571	27.875	92.072	2.5665	1	4.9620	4.9620	125.0995	6.40
2030	124.625	27.875	94.524	2.6349	1	5.0045	5.0045	132.2644	6.13
2031	132.103	27.875	96.815	2.6987	1	5.1054	5.1054	139.9071	5.91
2032	140.029	27.875	99.528	2.7743	1	5.1065	5.1065	147.9098	5.63
2033	148.431	27.875	99.649	2.7777	1	5.0293	5.0293	156.2380	5.26
2034	157.336	27.875	101.455	2.8281	1	5.0041	5.0041	165.1682	4.98
2035	166.777	27.875	102.150	2.8474	1	5.0910	5.0910	174.7154	4.76
2036	176.783	27.875	104.994	2.9267	1	5.0714	5.0714	184.7811	4.52
2037	187.39	27.875	105.518	2.9413	1	5.0717	5.0717	195.4030	4.28
2038	198.634	27.875	106.672	2.9735	1	5.0543	5.0543	206.6618	4.04
2039	210.552	27.875	108.386	3.0213	1	5.0816	5.0816	218.6548	3.85

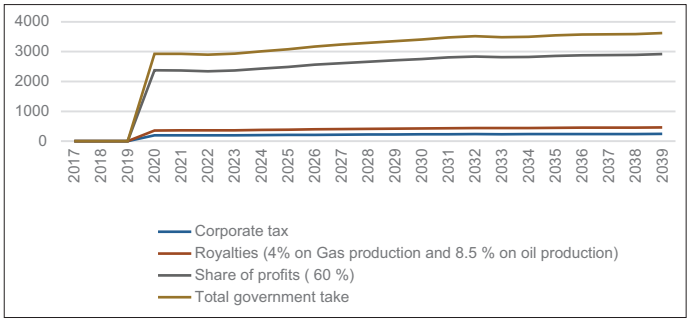
Source: Our estimation, EIA[1], IMF[2], IMF: International Monetary and Funds, EIA: Energy Information Administration

Figure 2: Lebanese projected budget deficit with and without oil and gas production ($ million) 2017-2039



Source: Our estimations based on Energy Information Administration projections and International Monetary and Funds estimations

Figure 3: Government revenues from oil and gas production ($ million)



Source: Our estimations based on Energy Information Administration projections and International Monetary and Funds estimations

and some indirect factors affecting the budget deficit limit this research to the tested variables. We refer to Monte Carlo simulation sensitivity analysis for oil and gas prices for each scenario of the three for random simulation.

5.1. Production Scenarios

We build up hypothetical three adopted scenarios based on our estimation for the oil and gas production. The three scenarios are the following:

1. The first scenario: We propose equal production value for oil and gas for all the expected years of production starting in 2020-2039 by 27,875 thousand barrel per year for oil and 1 trillion cubic feet per year as shown in Table 4.
2. The second scenario: We propose annual consecutive increase by 5% for each of oil production starting by 16860 thousand barrel in 2020 to end up with 42605 thousand in 2039. Similarly, for gas production starting with 0.605 trillion cubic feet in 2020 to end up with 1.526 in 2039.
3. The third scenario: We propose annual consecutive decrease by 5% for each of oil production stating by 43451.89 thousand barrel in 2020 to reach 16396.73 thousand barrel in 2039. Similarly, for gas production starting with 1.5589 trillion cubic feet in 2020 to reach 0.588257 trillion cubic feet in 2039 as shown in Table 4.

5.2. Sensitivity Analysis (Monte Carlo Simulation)

We use sensitivity analysis for each of the above three scenarios as a tool to determine how oil and gas production and price variation as estimation for the monetary value for the oil and gas production and fiscal revenue. We refer to Monte Carlo simulation that give a wide range of possible outcomes and probabilities. We show sample of 50 random oil and gas prices changes in our analysis see Table 5. We suggested that the expected minimum

Table 3: The Lebanese oil and gas production fiscal revenue (as per our adopted scenario)

Year	Projected budget deficit without oil and gas production		Production ($ million)			Government revenues from oil and gas production ($ million)				Projected budget deficit including oil and gas production		Difference between projected budget deficit and oil and gas production
	Value ($ million)	% of nominal GDP	Oil	Natural gas	Sector's gross profits	Corporate tax	Royalties (4% on gas production and 8.5% on oil production)	Share of profits (60%)	Total government take	Value ($ million)	% of nominal GDP	% of nominal GDP
2017	5.799	10	0	0	0	0.0	0	0	0	5.799	10.00	0.00
2018	6.170	10	0	0	0	0.0	0	0	0	6.170	10.00	0.00
2019	6.565	10	0	0	0	0.0	0	0	0	6.565	10.00	0.00
2020	6.959	10	2.085	4.50	3956	197.8	357.47	2373	2.928.3	4.031	5.79	4.21
2021	7.377	10	2.178	4.39	3943	197.2	360.82	2366	2.923.6	4.453	6.04	3.96
2022	7.819	10	2.249	4.25	3905	195.2	361.46	2342	2.899.2	4.920	6.29	3.71
2023	8.288	10	2.293	4.28	3946	197.3	366.19	2367	2.930.8	5.357	6.46	3.54
2024	8.786	10	2.333	4.41	4050	202.5	374.90	2429	3.006.8	5.779	6.58	3.42
2025	9.313	10	2.403	4.50	4147	207.4	384.54	2488	3.079.8	6.233	6.69	3.31
2026	9.871	10	2.468	4.64	4268	213.4	395.47	2560	3.168.9	6.702	6.79	3.21
2027	10.464	10	2.508	4.75	4358	217.9	403.33	2615	3.235.8	7.228	6.91	3.09
2028	11.092	10	2.527	4.86	4436	221.8	409.38	2661	3.292.5	7.800	7.03	2.97
2029	11.757	10	2.566	4.96	4519	225.9	416.63	2711	3.353.4	8.404	7.15	2.85
2030	12.463	10	2.634	5.00	4585	229.3	424.15	2751	3.404.2	9.059	7.27	2.73
2031	13.210	10	2.698	5.10	4684	234.2	433.61	2810	3.477.9	9.732	7.37	2.63
2032	14.003	10	2.774	5.10	4730	236.5	440.08	2838	3.514.3	10.489	7.49	2.51
2033	14.843	10	2.777	5.02	4686	234.3	437.28	2811	3.482.7	11.360	7.65	2.35
2034	15.734	10	2.828	5.00	4701	235.1	440.55	2820	3.495.7	12.238	7.78	2.22
2035	16.678	10	2.847	5.09	4765	238.2	445.67	2858	3.542.3	13.136	7.88	2.12
2036	17.678	10	2.926	5.07	4801	240.0	451.63	2880	3.571.6	14.106	7.98	2.02
2037	18.739	10	2.93	5.07	4810	240.5	452.88	2885	3.578.6	15.160	8.09	1.91
2038	19.863	10	2.973	5.05	4819	240.9	454.92	2891	3.586.4	16.277	8.19	1.81
2039	21.055	10	3.021	5.08	4864	243.2	460.07	2918	3.620.9	17.434	8.28	1.72

Source: Our calculation based on our estimations, EIA projections and IMF estimations, IMF: International Monetary and Funds, EIA: Energy Information Administration

changes in oil price by 20% (0.8) and the maximum by 50% (1.5). While for the minimum expect gas change by 30% (0.7) and the maximum by 30% (1.3) as sample of 50 random simulations for oil and gas prices with respect to the three adopted scenarios shown in Table 5. Afterwards, we show another two 50 random simulations as shown in Table 5 to better judge the estimated results. The simulation results would change once we change the random possibilities.

We can notice from the results shown in Table 5 that the third scenario always recording the highest values with respect to the first two, which is obvious where it has associated with reduction in production. Although the minimum, maximum and standard deviation recorded for the averages of GDP and budget deficit differences with and without oil and gas production vary form one simulation to another.

The Lebanese policy maker might follow one of the proposed scenarios or none of them based on their own estimations. Although this study gives them an estimation for the possible production scenarios and thus price changes possibilities. We support the third scenario as a reduction of 5% in production due to which it gives the highest monetary value for the production and fiscal revenue mainly at the beginning of the production period. This should directly help in treating the high Lebanese government debt problem and could push the economic growth further at the short term.

Despite the benefits of the oil and gas production in all scenarios, the Lebanese policy makers should be aware of the possible Dutch disease problems which it claims to deepen. Facing the oil and gas price fluctuation, the Lebanese policy makers would have to decide on several points. First, Lebanese government needs to construct appropriate laws and regulations to better collected and invest the revenue potential from exploration and production of oil and gas that should addressed by a number of objectives: The government should receive an appropriate share of the economic rents from exploiting and producing oil and gas. The tax rules for the extracting industries should be adjusted in a way to fix out clearly in legislation, thus to have a convenient fiscal arrangements. The fiscal regime should increase investment incentives, especially in the initial production stages. The government should build a clear and strict fiscal regime law in a way to motivate the extracting industries. Government should

Table 4: Oil and gas reserve production adopted scenarios

Year	Scenario one		Scenario two		Scenario three	
	Oil production	Gas production	Oil production increase of 5%	Gas production 5% increase	Oil production decrease of 5%	Gas production decrease 5%
2020	27875	1	16860.25	0.605	43451.89	1.5589
2021	27875	1	17703.26	0.63525	41279.3	1.480955
2022	27875	1	18588.43	0.667013	39215.33	1.406907
2023	27875	1	19517.85	0.700363	37254.56	1.336562
2024	27875	1	20493.74	0.735381	35391.84	1.269734
2025	27875	1	21518.43	0.77215	33622.24	1.206247
2026	27875	1	22594.35	0.810758	31941.13	1.145935
2027	27875	1	23724.06	0.851296	30344.08	1.088638
2028	27875	1	24910.27	0.893861	28826.87	1.034206
2029	27875	1	26155.78	0.938554	27385.53	0.982496
2030	27875	1	27463.57	0.985481	26016.25	0.933371
2031	27875	1	28836.75	1.034755	24715.44	0.886702
2032	27875	1	30278.59	1.086493	23479.67	0.842367
2033	27875	1	31792.52	1.140818	22305.68	0.800249
2034	27875	1	33382.14	1.197859	21190.4	0.760237
2035	27875	1	35051.25	1.257752	20130.88	0.722225
2036	27875	1	36803.81	1.320639	19124.34	0.686113
2037	27875	1	38644	1.386671	18168.12	0.651808
2038	27875	1	40576.2	1.456005	17259.71	0.619217
2039	27875	1	42605.01	1.528805	16396.73	0.588257
Total reserve	557500	20	557500.3	20.0049	557500	20.00113

Source: Our estimation

Table 5: 150 random changes summery for oil and gas prices for the three scenarios

Three 50 random oil and gas prices changes simulation	First scenario	Second scenario	Third scenario
First 50 random simulations			
GDP difference			
Minimum (%)	5.99	5.20	6.01
Maximum	7.14	7.11	8.22
Average	6.60	6.21	7.17
Standard deviation	0.002581	0.00486	0.00562
Government revenue			
Minimum	2.66	2.33	2.68
Maximum	3.21	3.18	3.67
Average	2.95	2.78	3.20
Standard deviation	0.001226	0.00216	0.00250
Second 50 random simulations			
GDP difference			
Minimum (%)	5.98	5.15	5.94
Maximum (%)	7.15	7.02	8.11
Average (%)	6.61	6.14	7.09
Standard deviation	0.0025	0.00416	0.0048
Government revenue			
Minimum (%)	2.66	2.32	2.97
Maximum (%)	3.21	3.13	3.61
Average (%)	2.96	2.75	3.17
Standard deviation	0.0012	0.00184	0.0021
Third 50 random simulations			
GDP difference			
Minimum (%)	6.16	5.22	6.03
Maximum (%)	7.38	7.10	8.19
Average (%)	6.68	6.21	7.17
Standard deviation	0.002679	0.00471	0.00544
Government revenue			
Minimum (%)	2.74	2.34	2.70
Maximum (%)	3.32	3.18	3.67
Average (%)	2.99	2.78	3.20
Standard deviation	0.0012731	0.0020994	0.0024247

Source: Our calculation

avoid tax leakage and work to attract International competitiveness (David et al., 2003). The Lebanese policy maker should keep fiscal arrangements transparent and consistent. Second, fiscal policy should anchor in a saving strategy. Multiple objectives and principles typically require multiple fiscal instruments for royalty, income or profit-based taxes, and oil production income taxes. Third, strong institutional arrangements should considered as the basic issue in fiscal management in order to explore the knowledge with transparent and comprehensive presentation of oil revenue, sustainable long-term fiscal and transparent mechanisms for selection of investment projects, to ensure long-term economic development.

6. CONCLUSIONS

Lebanese policymakers should be aware of the main benefits of the oil and gas production to their economy in order to better invest from this discovery since the early stages. Therefore, an urgent economic planning should start accompanied with the fiscal regime adjustment project. Based on the estimated scenarios for production using sensitivity analysis for each, we notice that the third scenario adopted is the most convenient scenario. As

an emergent economy with high public debt with respect to its GDP accompanied with other economic difficulties, the oil and gas high revenues at the beginning period in the third scenario could be the solution. Through starting with 43451.89 thousand barrel of oil and 1.5589 trillion cubic feet of gas in 2020 and with annual consecutive decrease of 5% to end up in 2039 with 16396.73, thousand barrel of oil and 0.588257 trillion cubic feet of gas. The benefits of oil and gas production are paved with risk and challenges thus the Lebanese government is recommend to study these challenges. Lebanon needs to adopt transparent process to preserve a balance between the government expected revenues and the exploration industries. Moreover, Lebanon needs a completely new established infrastructure facing the major risk of resource curse, Dutch disease and Nigerian disease. Although, strong implementation of a clear legislative and fiscal framework is recommend to ensure a sustainable development of Lebanon's oil and gas sector. In this context, the government need to reformulate its fiscal framework to take into account potential revenue from oil and gas production. Strong institutional arrangements need to adopt several points: Adopting a fiscal responsibility law; clear goals and instruments with a strong enforcement mechanism; monitoring and communication; broad coverage of fiscal activities; and legally binding framework.

REFERENCES

Bloomberg. (2013), Lebanon Set to Join East Mediterranean Race for Oil and Gas. Available from: https://www.bloomberg.com/news/articles/2017-01-04/lebanon-set-to-join-race-in-exploration-for-offshore-oil-and-gas.

Corruption Perceptions Index. (2013), Corruption Perceptions Index in; 2013. Available from: http://www.transparency-se.org/I.-CPI2013_map_english_embargoed-3-Dec.pdf.

David, J., Ossowski, R., Fedelino, A. (2003), Fiscal Policy Formulation and Implementation in Oil-Producing Countries. Washington, D.C: International Monetary Fund.

EIA. (2017), Annual Energy Outlook; 2017. Available from: http://www.eia.gov/outlooks/aeo/data/browser/#/?id=1AEO2017&cases=ref2017&sourcekey=0.

Holden, S. (2013), Avoiding the resource curse: The case Norway. Energy Policy, 63, 870-876.

Lebanese Petroleum Administration. (2011), National Contingency Plan. Available from: http://www.lpa.gov.lb/pdf/Vol%202%20National%20Contingency%20Plan%20%20SEA%20for%20Petroleum%20Activities.pdf.

Mehlum, H., Karl, M., Ragnar, T. (2006), Institutions and the resource curse. Economic Journal, 116(508), 1-20.

Ministry of Energy and Water. (2010), Offshore Petroleum Resources Law. Policy Paper for the Electricity Sector. Government of Lebanon.

Ross, M.L. (2003), How Does Mineral Wealth Affect the Poor? Technical Report. UCLA Department of Political Science. Available from: http://www.sscnet.ucla.edu/polisci/faculty/ross/minpoor.pdf.

Ross, M.L. (2012), The Oil Curse: How Petroleum Wealth Shapes the Development of Nations. USA: Princeton University Press.

Sachs, J.D., Warner, A. (1997b), Sources of slow growth in African economies. Journal of African Economics, 6(3), 335-380.

Sachs, J.D., Warner, A.M. (1995), Natural Resource Abundance and Economic Growth. NBER Working Paper 5398.

Shultz, J. (2004), Follow the Money: A Guide to Monitoring Budgets and Oil and Gas Revenues. New York: Open Society Institute.

Van der Ploeg, F. (2011), Natural resources: Curse or blessing? Journal of Economic Literature, 49(2), 366-420.

World Bank. (2012), Using Lebanon's Large Capital Inflows to Foster Sustainable Long-Term Growth, Report No. 65994-LB. World Bank.

World Bank. (2014), Lebanon Economic Monitor: A Sluggish Economy in a Highly Volatile Environment. Washington: World Bank.

World Energy Council. (2013), World Energy Resources. Available from: https://www.worldenergy.org/wpcontent/uploads/2013/09/Complete_WER_2013_Survey.pdf.