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Financing Offshore Oil Platforms: Empirical Analysis and Suggestions for the Turkish Market

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Abstract: Offshore oil production constitutes roughly 30% of total oil production. Developing countries such as Turkey may benefit from offshore oil production especially seeing that the platforms can be locally produced and these countries have considerable amount of current account deficit. Much of this deficit is related to oil imports. These countries, however, need external financing to invest in this field. The ability to obtain these funds require the knowledge on financing alternatives and mitigating the risks. The funds may come from World Bank, international supplier Ex-Im related, capital markets equity or project/corporate bonds, asset finance and leasing, private equity, project finance or corporate finance with the involvement of financial, legal and technical consultancy. The major risks are safety and environmental issues, political risks, currency risks and the price of oil. The research in this study is the relationship between the price of oil and stock market value of major offshore oil operators. The variables used are British Petroleum plc, Royal Dutch Shell RDS-A, Total SA and United States Oil Fund (USO). The methodology used in the study includes Augmented Dickey Fuller and Philips Perron unit root tests, Vector Autocorrelation and Cointegration. The results indicate that there is no long term relationship between price of oil and stock market performance of operators in the research period between 10 April 2006 and 16 June 2015.

Key words: Offshore oil platforms, project finance, cointegration, USO, RDS

INTRODUCTION

Petroleum is a hydrocarbon that can be found in nature. It is a fossil source of oil and it is finite meaning the reserves are limited. Fossil fuels exist with the remains of animals and plants that were buried millions of years ago. The feasible amount of reserves is not known exactly but it is known to exist for considerable decades in the future with the advance in technology of extraction and increase in the price of oil. The reserves limited character also makes it a non-renewable energy source.

Petroleum is a very important energy source with its wide kinds of uses. The most well known use is in transportation primarily as gasoline with automobiles, although, it has also use in other kinds of transportation including ships, buses, trains and jet fuel. It has also use in detergents and plastics. The first usage of oil is with lighting. It can also be used in heating. There are also uses in many other industries such as medicine.

There are many different classifications with oil although most often used classification is as very light, light, medium and heavy. Jet fuel is a very light kind of oil. One of the most important kinds of light fuel is diesel. Light fuel has also its usage in the marine industry. Medium oil can be found most in the market whereas heavy oils can be very dangerous for the environment.

For trading purposes classifications rely on indexation but the most commonly used are Brent and WTI. WTI is American origin oil which is one of the best quality oil in the market. Brent is North Sea origin oil which is slightly less quality to WTI.

For producing oil suspected reservoirs are found and then drilled. Some kind of piping and valves are required to extract. Then, the oil should be processed chemically in refining process to produce oil that can be used in different industries.

Offshore platforms are needed to extract oil by drilling wells and storing in a platform. The platform should be also available for the use of staff. The platform can be fixed or floating. The process also has some risks that is dangerous for the staff and environment. Explosions may kill people and cause in oil leakage. Technical feasibility of the project results in difficulties in access to favorable financing. The process requires geographical surveys, drilling, production and decommissioning. Offshore oil roughly constitutes 30% of total oil production.

Financing offshore oil is a complicated process that will most likely involve legal and financial consultants, international financial institutions such as World Bank and supplier related solutions such as Ex-Im and loan insurances especially in international transactions. The platforms are often build in South Korea and China. There

are many different financial solutions available such as project financing, asset financing, leasing, along with bonds, corporate funding, private equity and partnerships and also capital market solutions such as bond issues and equity fundraising. However, project finance is the typical source in funding these projects. One should also have an assumption with the oil price when creating pro-forma cash flows of the project. However, the market is very volatile and this result in banks asking for more collateral and provide unfavorable conditions for the companies. Companies should also be ready to provide more capital when needed.

Literature review: Bradshaw analyze deeply on the Sakhalin Project in Russia where an offshore oil and gas development takes place. This is also important for the fact that this is also a green global project financing case. World Bank is the leading financial institution for development finance which has major goals to respect environment, build infrastructure and reduce poverty. However, it has been lately criticized for adverse ecological and human impacts. The examples include Pangue Dam in Chile in 1990s which is financed by IFC. Today large projects not only include technical and financial analysis but also environmental and social impact action plans. World Bank was also involved in the Chad-Cameron and Baku-Tiblisi-Ceyhan pipelines. There are also private commercial banks who agree on Equator principles to work on the environmental aspects.

EBRD was very active in Shakalin-II project by working on environmental and social issues with the operator to provide green financing to the project. Shakalin is a region in the North of Japan. For this reason, SODECO (Shakalin Oil and Gas Company) was introduced by Japan to finance the Shakalin project which will be paid back by the proceeds from the offshore production. The first attempt was the drilling of 25 wells. Local company Sakhalinmorneftegaz (SMNG) were later interested but it was lacking capital, technology and project management. An international tender was required for Sakhalin-II which was won by a consortium that comprised the US Companies Marathon Oil and McDermott International and the Japanese Mitsui (known as the 3-M Group). They then joined Shell to sign as Sakhalin Energy Investment Company (SEIC) the operator of the project. A Production Sharing Agreement (PSA) gives the investment company privileges a share of income from future production. According to Shell, the Sakhalin-II project is the largest integrated oil and gas project being developed in the world today. This is the result of a $20 billion project with the installation of two additional rigs offshore and construction of pipelines onshore. The projected income is $80 billion. The financers are EBRD and OPIC which is formed by the US Exim Bank and Japan's Exim Bank.

The environmental concerns were whale population, island ecology, construction activity and population's change of lifestyle. These risks were evaluated in the pre-project financing which led to additional costs for the operator. This together with State based pressure to fulfill environmental standards causes Gazprom to control the project (Bradshaw, 2007).

Zalik studies petroleum offshore in Niger Delta and Mexican Gulf. In Nigeria, the main concern is oil related violence that led to evacuation by the local residence where drilling structures were removed for sale. The problems involve political risks especially in transition economies. In Mexico, the concern was loss of livelihoods where Mexican governments offered finance to small scale fishers to compensate for the environmental effects in return that fisherman will not approach installations. The cases are important in order to understand offshore petroleum finance in transition economies where a regulatory change is required. International Maritime Organization advocates the developments to be in less contentious places. These companies are the largest oil providers to the US in Latin America and Sub Saharan Africa. In Nigeria, there is a dispute on oil revenue sharing despite the fact that Nigerian government holds the majority of revenue in joint ventures. Mexico traditionally a state monopoly in petroleum production is often giving away the control of revenues to foreign companies in offshore production. There is also pirate activities that need to be controlled off-shore. So, this also shows despite deregulation strong state control is often needed to avoid abuse of the system (Zalik, 2009).

Carano study the interesting case of Mexico which is the ninth largest producer of oil. PEMEX is the monopoly in petroleum production as the state owned company. However, in deepwater deposits it works with private companies to benefit from technical capability, experience and capital. PEMEX requires a bidding now to be able to extract offshore with private ownership. The requirements include adequate quality, compliance with local law, environmental considerations, infrastructure, anti-corruption, employment and bilateral and tax treaties.

The British offshore oil and gas industry is technology and R&D driven and is currently driven by multinationals, although, there are opportunities for startups with good ideas. An engineering start-up Viper sub-sea manages to obtain a conservative 65% growth in the market. The model was to invest in deep water dwelling with an equipment that can last 30 years. The

structure of the market is such that the companies are risk averse so that they prefer to work with large companies that they can trust. The startup however could secure a 250,000 deal with a Norwegian company. After also securing contracts with BP, Shell and Total the company is constantly growing with annual 2.3 million revenues. This success story is also a good example to show dynamics of the market.

Baird studies the role of British Clearing Banks in petroleum finance. The oil industry requires higher capital than the most of the other traditional industries. The capacity of financial and capital markets may be limited in some economic conditions. There is a difficulty in estimating the exact amount of funding needed for the projects since they involve serious risks. Risks are higher when there is a exploration project when compared with fields with proven oil reserves. Moreover, there are opportunities and threats that come with the international nature of the projects. Since, there are international suppliers and investors, there may be the need to use international markets. Since, US dollar is the major currency when trading oil, the projects face the currency risk especially when local currency appreciates and they borrow with local currency. This leads to an open position due to the asset liability mismatch of receivables being in dollar and liability being in local currency (Baird, 1980).

Yaylali and Lebe study the importance of oil prices on macroeconomics for the case of Turkey. Living in a global world the economic crisis often spread between countries. Therefore, it is sometimes difficult to obtain stable economic growth for a country. Especially for developing economies economical and political stability is required to attract FDI. The study is Vector Autoregression (VAR) testing and variance decomposition for the effect of crude oil prices on macroeconomic activities and inflation. The results reveal that crude oil prices effect monetary policy-especially money supply and inflation. It is also found that inflation is caused by the crude oil prices (Yaylali and Lebe, 2012).

Bayar *et al.* (2014) study determinants of current account deficit in Turkey. They suggest that current account balance is one of the important indicators for macroeconomic stability and welfare of a country. It has become one of the chronical problems of Turkey. This study investigates the relationship between current account balance and various macroeconomic indicators including crude oil prices. This is done 2000:Q4 and 2013:Q3 by using Granger causality, impulse response and variance decomposition. It is proven in this study that crude oil prices Granger cause current account deficit in Turkey (Bayar *et al.*, 2014).

MATERIALS AND METHODS

Wold's (1938) decomposition theorem states that a stationary time series process with no deterministic component has an infinite Moving Average (MA) representation. This, in turn can be represented approximately by a Finite Autoregressive Moving Average (ARMA) process.

Time series need to be appropriately differenced in order to achieve stationarity. From this comes the definition of integration. A variable Y_t is said to be integrated of order d (or Y_t-I(d)) if it has stationary, invertible non-deterministic ARMA representation after differencing d times. Thus, a time series integrated of order zero is stationary in levels while for a time series integrated of order one, the first difference is stationary. A white noise series and a stable first-order Auto Regressive (AR(I)) process are examples of 1(0) series while a random walk process is an example of an I(1) series.

Granger, Engle and Granger discuss the main differences between proccesses that are I(0) and I(1). They point out that an 1(0) series: has finite variance which does not depend on time has only a limited memory, tends to fluctuate around the mean has autocorrelations that deeline rapidly as the lag increases. For the case of an 1(1) series, the main features are: the variance depends upon time and goes to infinity as time goes to infinity, the process has an infinitely long memory it wanders widely and the autocorrelations tend to one in magnitude for all time separations.

Consider now two time series Y_t and X_t which are both I(d). In general any linear combination of Y_t and X_t will be also I(d). If however, there exists a vector (1, -(b)' such that the combination $Z_t = Y_t$-a-bxis I(d-b), b>O then Engle and Granger (1987) define Y_t and X_t as cointegrated of order (d, b)) (Dolado *et al.*, 1990).

RESULTS

The data used in this study is the stock market value of major offshore companies and price of oil. The companies selected for the study are BP plc from NYSE (New York Stock Exchange) or as commonly known British Petroleum (will be shortly named as "BP" in this study), Royal Dutch Shell plc RDS-A from NYSE (New York Stock Exchange) or as commonly known Shell (will be shortly named as "SHELL" in this study), Total SA from NYSE (New York Stock Exchange) or as commonly known total (will be shortly named as "TOTAL" in this study) and United States Oil Fund LP from NYSE (New York Stock Exchange) or as commonly

Table 1: Unit root tests for the variables

Variables	ADF test statistic	Critical values	PP test statistic	Critical values
BP	-2.9651	-2.8626	-2.8379	-2.8626
SHELL	0.0658	-1.9410	-1.9307	-2.8626
TOTAL	-2.5880	-2.8626	-2.4629	-2.8626
USOIL	-1.4342	-1.9410	-1.4114	-1.9410
D (BP)	-50.6885	-1.9410	-50.7501	-1.9410
D (SHELL)	-51.1005	-1.9410	-51.1947	-1.9410
D (TOTAL)	-50.2969	-1.9410	-50.3593	-1.9410
D (USOIL)	-52.0628	-1.9410	-51.9496	-1.9410

Table 2: Lag length selection criteria for VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-89601.58	NA	7.09e+28	77.78262	77.79259	77.78625
1	-66978.57	45147.83	2.13e+20	58.15848	58.20833*	58.17665*
2	-66949.94	57.02687	2.10e+20*	58.14752*	58.23724	58.18023
3	-66939.24	21.28568	2.11e+20	58.15212	58.28172	58.19937
4	-66925.68	26.91185	2.12e+20	58.15424	58.32372	58.21602
5	-66918.00	15.23408	2.13e+20	58.16146	58.37081	58.23778
6	-66904.63	26.44596	2.14e+20	58.16374	58.41298	58.25460
7	-66880.56	47.53289*	2.12e+20	58.15674	58.44585	58.26213
8	-66867.24	26.25899	2.13e+20	58.15906	58.48805	58.27900

VAR lag order selection criteria; Endogenous variables: USOIL TOTAL SHELL BP; Exogenous variables: C; Date: 06/18/15 Time: 17:24; Sample: 4/10/2006 6/16/2015; Included observations: 2304; *indicates lag order selected by the criterion; LR: sequential modified; LR test statistic (each test at 5% level); FPE: Final Prediction Error; AIC: Akaike Information Criterion; SC: Schwarz information Criterion; HQ: Hannan-Quinnin formation criterion

known USO (will be shortly named as "USOIL" in this study). The data is daily and the research period is between 10 April 2006 and 16 June 2015. Therefore, total number of data is 2.313 and the number of data is same for all variables.

The data is analyzed with Augmented Dickey Fuller (ADF) and Philips Perron (PP) methodology to check whether they are stationary. Table 1 summarizes the unit root test results for the variables. According to the results, all of the variables are not stationary in level because the test statistics are lower than the critical values. But the variables are stationary when they are first differenced I(1). This is because ADF statistics are higher than the critical values.

Table 2 explains the lag length criteria for Vector Autoregression Model. Principle of parsimony requires to choose most degrees of freedom. For this reason and as Schwarz and Hannan-Quinn suggests 1 lag will be used. The VAR(1) Model with inserted coefficients is presented below.

$$\begin{aligned}
USOIL &= 0.996076319857\times USOIL(-1)- \\
&\quad 0.00338863943251\times TOTAL(-1)+ \\
&\quad 0.000929406823189\times SHELL(-1)+ \\
&\quad 0.0140105904022\times BP(-1)-265.860460199 \\
TOTAL &= -0.00156992762531\times USOIL(-1)+ \\
&\quad 0.995528937361\times TOTAL(-1)- \\
&\quad 0.0111995110945\times SHELL(-1)+ \\
&\quad 0.000975957515228\times BP(-1)+297.257360009
\end{aligned}$$

Table 3: Stability test for VAR

Root	Modulus
0.998587	0.998587
0.994913-0.003460i	0.994919
0.994913+0.003460i	0.994919
0.987960	0.987960

Roots of characteristic polynomial; Endogenous variables: USOIL TOTAL SHELL BP; Exogenous variables: C; Lag specification: 11; Date: 06/18/15 Time: 17:38; No; root lies outside the unitcircle; VAR satisfies the stability condition

Table 4: Cointegration test results

Hypothesized No. of CE (s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**
Unrestricted cointegration rank test (trace)				
None	0.011576	52.65190	63.87610	0.3039*
At most 1	0.006728	25.75635	42.91525	0.7506*
At most 2	0.002944	10.16197	25.87211	0.9179*
At most 3	0.001450	3.350776	12.51798	0.8325*
Hypothesized No. of CE (s)	Eigenvalue	Max-eigen statistic	0.05 critical value	Prob.**
Unrestricted cointegration rank test (maximum eigenvalue)				
None	0.011576	26.89555	32.11832	0.1901*
At most 1	0.006728	15.59438	25.82321	0.5810*
At most 2	0.002944	6.811191	19.38704	0.9131*
At most 3	0.001450	3.350776	12.51798	0.8325*

Date: 06/18/15 Time: 18:36; sample (adjusted): 4/12/2006 6/16/2015; included observations: 2310 after adjustments; trend assumption: Linear deterministic trend (restricted); series: USOIL TOTAL SHELL BP; lags interval (in first differences): 1-1; Tarce and Max-eigenvalue test indicates no cointegration at the 0.05 level; *denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values

$$\begin{aligned}
SHELL &= -0.000187442637665\times USOIL(-1)+ \\
&\quad 0.000336791993085\times TOTAL(-1)+ \\
&\quad 0.994332690585\times SHELL(-1)- \\
&\quad 0.000263923674798\times BP(-1)+34.3589218034 \\
BP &= -0.00115421806216\times USOIL(-1)+ \\
&\quad 0.0078947107603\times TOTAL(-1)- \\
&\quad 0.0567628606019\times SHELL(-1)+ \\
&\quad 0.990434169639\times BP(-1)+375.937348979
\end{aligned}$$

The developed VAR Model should be stable to provide valid results. Table 3 shows stability test results for the VAR. Table 4 is then given to check the long run relationship between variables.

DISCUSSION

The variables are first checked to see whether they are stationary with unit root tests. The tests applied are Augmented Dickey Fuller (ADF) and Philips Perron (PP). According to the results the variables are stationary with first difference. In other words they are I(1). They are integrated to the same degree which means one can apply cointegration.

The variables are then modeled in a Vector Autocorrelation (VAR) Model. The lags required are chosen with the principle of parsimony in line with the

results of Schwarz and Hannan Quinn. The model is then tested for autoregressive roots where no roots lie outside the unit circle which means the model is reliable.

The variables are then checked for long term relationship. The literature on this field previously claim that price of oil is a vital element in the finance of offshore oil projects so, it should affect the stock value of these companies. However, for the research, no cointegration is detected. This rejects the hypothesis that there is a long run relationship between the price of oil and stock value of the companies. This is because large companies are selected for the study. The companies selected have large market shares in offshore operating business and they gave the ability to access more funds than smaller companies. Therefore, daily price of oil do not necessarily reflect in the stock market value in the long run. Or there are other market factors that contribute more to the stock market value. For further research one can develop models with more variables.

CONCLUSION

Petroleum is a vital energy source and its production affects various industries. The production of petroleum can be done onshore and offshore. Offshore petroleum production is roughly 30% of total petroleum production. The process of offshore production has well known risks which need to be controlled in financing. Financial institutions would first check the safety of the project which in explosions could result loss of lives of the project staff. In addition, Equator principles would require then banks to run a strict due diligence process for checking social and environmental aspects of the offshore platform before project finance. Therefore, the project sponsor should have plans to cover social and environmental risks as well as explosions.

Project company should be aware of various methods of project finance to finance the project with lowest cost of capital. Financing methods can bring equity to the project as well as debt. In tough economic situations the use of private equity can also be an alternative. The funding may come in conventional finance as well as there can be capital market solutions. The project company can raise equity and also corporate bonds or project bond which has long duration that matches the cash flows of the project. Asset financing and leasing based solutions are also available. The international structure of the project also allows the company to access international markets. This can be the use of Ex-Im mostly South Korea and China as the main producers of these platforms. World Bank is also active in offshore platform finance.

The price of oil is very volatile and it is the major risk because it is the only source of revenue in project cash flows. When the price of oil is low, it will be very difficult to finance oil platforms since there will be an increase in payback period. Therefore, companies should have reliable assumptions on the oil price during the life of the project.

In developing countries, there may be local protests for political or economic reasons. The security for the site is needed to be maintained and considering previous experience there should be safety plans especially in developing countries. There may be also protests from local people or fishermen in the region. The previous experience on this kind of protest is that governments offer favorable rights to the local people such as to offer favorable financing to fishermen in the region. The projects in these countries in most cases require foreign companies' involvement to benefit from their technical capability, experience and capital.

Oil is traded according to its quality and is often classified with indices such as WTI and Brent. The international official oil trade occurs mostly in US dollar. This is why companies need to make an asset liability management and need to be careful on any open positions. The problem is the company will have US dollar based revenues but liabilities such as payments to suppliers or loans in currencies other than the US dollar. Therefore, volatility in the value of these currencies may result in serious loss of wealth for project company.

For the Turkish experience, the country struggles a current account deficit mostly due to oil imports. Therefore, increasing oil prices is proven in many studies to cause inflation and current account deficit. The country is now willing to invest in offshore oil platforms which is important because increased oil production would lead to less imports and therefore less current account deficit. The problem in these projects is to obtain favorable financing. The alternatives and risk mitigation methods described in this study may help the sponsor to obtain lower cost of capital by securing international funding.

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