How Oil and Gas stocks perform in India?
Empirical evidence from CAPM and French & Fama Three Factor Models

Giriraj Loya, Emil T Joseph & Pawan Kumar Avadhanam
Institute of Public Enterprise, Hyderabad

Abstract
The Oil and Gas Industry is one of the six core industries in India, it has a very significant role to play in the growth of the Indian economy. India is expected to be one of the largest contributors to non-OECD petroleum consumption growth globally. The study consists of 10 largest companies from Oil and Gas Industry operating in India by market share. Out of the total 10 companies 8 are State owned whereas 2 are from Private sector. Ten years data (2006-2016) has been taken for the analysis purpose. The reason for taking these 10 particular years for study is to see the impact of 2007-08 financial crises on Oil and Gas Industry and to see how Oil and Gas Sector reacted to it. The calculated values using asset pricing models shows that the most of the companies are Over-Priced in the market. Further from the calculated values it can be seen that there are no observations which are closer to the calculated value, so we can say that empirical results do not fully support asset pricing models.

Introduction:
The Oil and Gas Industry is one of the six core industries in India, it has a very significant role to play in the growth of the Indian economy. The petroleum and natural gas sector which includes transportation, refining and marketing of petroleum products and gas constitutes over 15 per cent of the country's gross domestic product (GDP). Exports from petroleum are the highest in terms of the foreign currency amassed and accounts for 17% of the total exports. SO, it becomes important to study this sector.

India is expected to be one of the largest contributors to non-OECD petroleum consumption growth globally. Total oil imports rose 4.24 per cent year-on-year to US$ 86.45 billion in April-March 2016-17. India’s oil consumption grew 8.3 per cent year-on-year to 212.7 million tonnes in 2016, as against the global growth of 1.5 per cent, thereby making it the third-largest oil consuming nation in the world. Oil and Gas industry is totally dominated by the state owned enterprises like Oil and Natural Gas Corporation (ONGC), Indian Oil Corporation Limited (IOCL), BPCL, HPCL, Oil India Limited and Gas Authority of India Limited (GAIL) while there are some private players also, such as Reliance Industries, Vedanta Limited (previously Cairn India), Essar Oil Limited etc. According to data released by the Department of Industrial Policy and Promotion (DIPP), the petroleum and natural gas sector attracted FDI worth US$ 6.86 billion between April 2000 and March 2017 which was quite higher than the other related industries.

In recent years Oil and Gas industry have experienced its highest ever Oil price crash, the price per barrel in the international market had fallen from about $115 per barrel in mid-2014, Brent crude oil prices fell to a 12-year low of close to $28 by January 2016, before settling around $50 per barrel. The biggest driver behind this major crash has been the surge in the US oil production as a result of the so-called ‘shale revolution’, whereby improved productivity and increased efficiency in extracting oil from shale rock formations boosted US’ recoverable oil reserves. As a result, the US crude oil output almost doubled from around 5 million barrels per day (mbpd) in 2008 to a record 9.6 mbpd in 2015, turning the country into one of the world’s top-three oil producers alongside Russia and Saudi Arabia, and reducing its reliance on oil imports. The paper is divided into 4 segments. The first deals with introduction, the second with review of literature, the third with analysis and fourth with conclusion.

Review of Literature
Akhtar, Samreen (2017) in their study re-examines the single-factor market model and the Fama-French three-factor model to check the robustness of the models, the tests are carried out for seven
different time periods. The results report a negative relation between size and average return and a positive relation between average return and value irrespective of size. The results suggest the Fama-French factors are not adequately priced and they leave abnormal returns to the portfolios. A joint test of the intercepts also confirms the results, so, the model stands rejected for the Indian stock market.

Chaudhary, Pankaj(2017), The results of their test find that though CAPM is able to capture the cross section of average returns both in India and US, still the three factor model with size and value factor can do the job better and hence is useful in pricing the financial assets of both developed and developing countries.

Balakrishna (2016) examine whether asset pricing models capture mean excess returns on portfolios constructed based on size–value and size–momentum factors. Capital asset-pricing model (CAPM) does not capture average returns on portfolios. Hence, size, value and momentum factors continue to exist in Indian stock market and they are found to be profitable investment strategies which would maximize invested the wealth of the investors.

Ender Demir(2016) The existing literature demonstrates that under a general equilibrium model, the performance of the Capital Asset Pricing Model (CAPM) can be improved significantly by using conditional consumption and market return volatilities as factors. While the earlier studies used panel data to test CAPM, They used portfolios sorted by size and book-to-market equity (BE/ME) ratio. They found that conditional volatility has a limited effect on firms with large capitalization but a significant impact on small-growth and small-value firms.

Shabir Ahmad Hakim(2016) in his paper opines that asset pricing models, originally designed for the US market, assume sufficiency of the local market in capturing systematic market risk in the stock returns. The models were extended to other developed markets that are fully integrated with the US market by replacing the local market with the global market. To customise in this regard extend Koedijk et al. model by replacing global instruments with the global market portfolio to propose a two-factor CAPM, and Fama& French three-factor model by adding global market portfolio as the fourth factor. Hence, they concluded that incorporation of local and global markets in asset pricing in emerging markets in necessary to insure against inaccuracies in the stock return estimates.

Jarrow (2016) opines that all existing multiple-factor asset pricing models, including the inter-temporal CAPM and Ross' APT, are special cases of this formulation. First, similar to the standard models, a traded asset's expected return is linear in a finite number of traded risk-factor returns. Second, positive alphas imply arbitrage opportunities or the existence of dominated securities, and not just abnormal expected returns. This generalization is consistent with many of the observed discrepancies between existing multiple-factor asset pricing models and the empirical evidence.

Nader(2016) opines that the selection of the market is motivated by the typical setting wherein few firms dominate the total market capitalization and small numbers of stocks are listed. The paper observes that Carhart (1997) model produces the smallest pricing errors across all the tested specifications although with different significant risk for equally weighted (EW) and value weighted (VW) test portfolios. The author suggest for more cautious analyses for markets that have peculiar features instead of generalizing to standard evidence.


Sehgal Sanjay(2012) In this article we employ data for 12 commodities, four commodity indices and one stock market proxy from July 2006 to February 2011 for India. They found that the return distributions for commodities as well as for indices do not seem to follow a random walk. Capital Asset Pricing Model (CAPM) seems to be a better descriptor of asset pricing in commodity markets when one uses commodity index instead of stock market index to represent market portfolio.
Scope
The study consists of 10 largest companies from Oil and Gas Industry operating in India by market share. Out of the total 10 companies 8 are State owned whereas 2 are from Private sector. The reason behind taking more state owned enterprises is their dominance in the industry. In the upstream segment total crude oil production in FY16 stood at 36.95 Million tonnes out of which about 25.50 million tonnes was produced by State Owned Enterprises. While coming to downstream sector state owned companies dominates downstream sector as well. Out of total 22 refineries in India 19 are owned by public sector and 3 are owned by private sector.

Ten years data (2006-2016) has been taken for the analysis purpose. The reason for taking these 10 particular years for study is to see the impact of 2007-08 financial crises on Oil and Gas Industry and to see how Oil and Gas Sector reacted to it.

Methodology:
Capital Asset Pricing Model (CAPM)

Building on the Markowitz framework, Sharpe (1964), Lintner (1965) and Mossin (1966) independently developed what has come to be known as the Capital Asset Pricing Model (CAPM).

\[ (R_j) = R_f + \beta_j [R_m - R_f] \]

Where, \( R_f \) = Treasury bill rate 
\( R_m \) = Return from the market 
\( \beta \) = systematic risk / Non- diversifiable risk of individual security 

For the calculation of \( R_m \), daily log returns are computed for the period of 1998-2017 for market proxy BSE Sensex taking April 1st to 31st March as a period of one year.

\[(\ln p_1-\ln p_0) \ast 100\]

Further, daily log returns are annualized using \( r_1+r_2+r_3+\ldots+r_n \)

These annualized returns are taken as \( R_m \) and Treasury bill rate as \( R_f \). For the purpose of calculation of \( \beta \) (slope of the regression line), BSE Sensex Return is taken as independent and individual security return as dependent variables.

French and Fama Model:
To calculate return with Fama and French Model, we need to calculate betas and values of three independent variables. The equation used for calculating expected return in in Fama and French is as under:

\[ E(R) = R_f + \beta_1(Rm - Rf) + \beta_2(SMB) + \beta_3(HML) \]

(Rm-Rf)* This is the annual risk premium on market portfolio. Simply add up all the monthly Rm-Rf value and you will get the annual Rm-Rf.

(SMB) ** this is the annual size premium which can be obtained by adding up all the SMB values in all the years

(HML) *** This is B/M ratio premium and can be obtained by adding up the HML values of all the years.

Table 1 CAPM returns for all the years

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil India</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>27.471</td>
<td>3.274</td>
<td>-3.851</td>
<td>3.049</td>
<td>15.183</td>
<td>21.600</td>
<td>-5.768</td>
<td>2.422</td>
<td>5.762</td>
</tr>
</tbody>
</table>
From the above Table, AMR is the annualized market return, CAPM is the expected return for the company, whereas Alpha shows the difference between market return and expected return. If the annualized market return is more than that of CAPM return then it is said that that stock is overpriced and if the annualized market return is less than that of expected return then it is said that the stock is under-priced.

From the table it can be seen that the margin of difference is most in case of Indraprastha Gas amounting to 17.679 whereas it is lowest in case of ONGC amounting to -16.277, that means Indraprastha Gas shares are performing over and above expectations whereas ONGC is performing way behind the expectations. It can also be seen that GAIL and Reliance are performing as per expectations i.e. there is not much difference between market return and expected return for these shares. From the above list Indian oil, ONGC and OIL India are underpriced whereas BPCL, HPCL, Castrol India, Petronet CNG, Reliance are overpriced.
The actual market return and calculated returns using CAPM and French and Fama are given. A share is overvalued if expected return as calculated with the models CAPM or French and Fama is greater than the actual market return and vice versa. From the above Table it is observed that Petronet CNG Limited is having the highest return over the study period according to French and Fama method at the rate of 12.431 and the CAPM is 10.006. From the table it can be seen that there are no observations which are closer to the calculated value, it shows that empirical results do not fully support asset pricing models. Accordingly for ONGC is the only company which has negative annual market return while CAPM and French and Fama shows the higher expected return.

Findings & conclusion:

From the CAPM and French and Fama computations it is found that most of the companies are Over-Priced in the market. From the CAPM table it can be seen that there are no observations which are closer to the calculated value, so we can say that empirical results do not fully support asset pricing models. ONGC is the only company which has negative annual market return while CAPM and French and Fama shows the higher expected return.
References


