

Final Project  
Digital Tools for Finance

Elena Ten 19-765-395,  
Elena Grigorenko 19-738-343

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## Contents

|   |           |
|---|-----------|
| <b>Introduction</b>                                   | <b>3</b>  |
| <b>Stock Price Analysis</b>                           | <b>3</b>  |
| Stock price of Lukoil . . . . .                       | 3         |
| Overview of Moving Averages of the industry . . . . . | 4         |
| Analysing Competitors Stocks . . . . .                | 5         |
| Stocks Returns Rate and Risk . . . . .                | 6         |
| Stock Price prediction . . . . .                      | 7         |
| <b>Cost of Capital</b>                                | <b>8</b>  |
| Risk-free rate . . . . .                              | 11        |
| Beta estimation . . . . .                             | 12        |
| Cost of Equity . . . . .                              | 13        |
| Findings and Conclusion . . . . .                     | 14        |
| <b>References</b>                                     | <b>15</b> |

## Introduction

The main objective of this report is to analyse the oil industry, focusing on the cost of capital and stock prices of the chosen companies. Nine biggest companies, representing the industry were chosen.

This report is aimed on the estimation of the cost of capital of the main players of the oil industry.

The first part of the report gives an overview of stock prices of the companies, including analysis, predictions, as well as returns rate and risks.

The second part of the report is dedicated to the estimation of the cost of capital.

## Stock Price Analysis

The evaluation of the stock prices of the oil companies was carried out in Python.

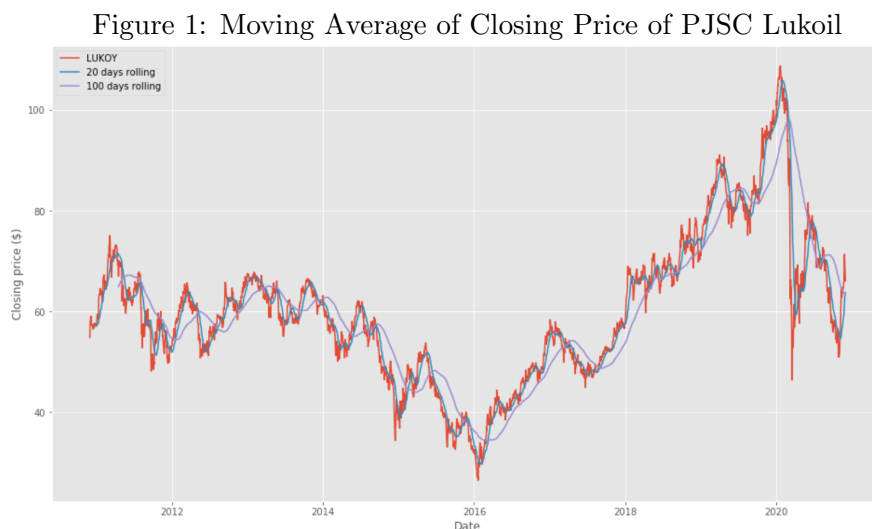
Lukoil company was chosen as a benchmark to evaluate and compare the stock price performance relative to the competitors.

The analysis is focused on closing prices, to provide a better understanding of the stock performance. we analyse stocks using two key measurements: Rolling Mean and Return Rate.

As the first step we study the stock prices of Lukoil.

### Stock price of Lukoil

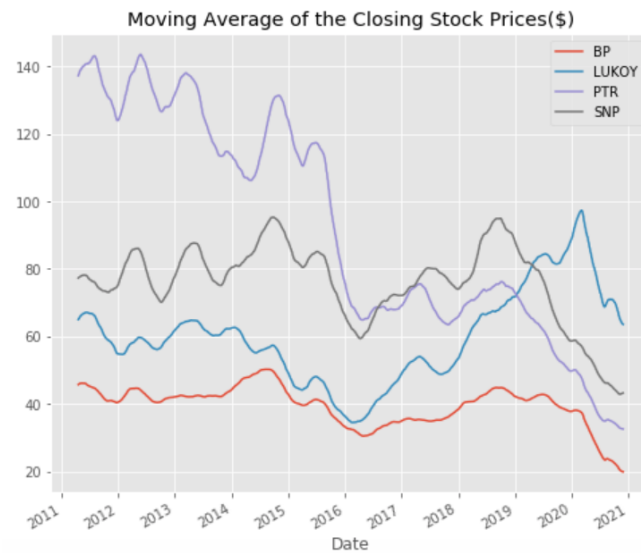
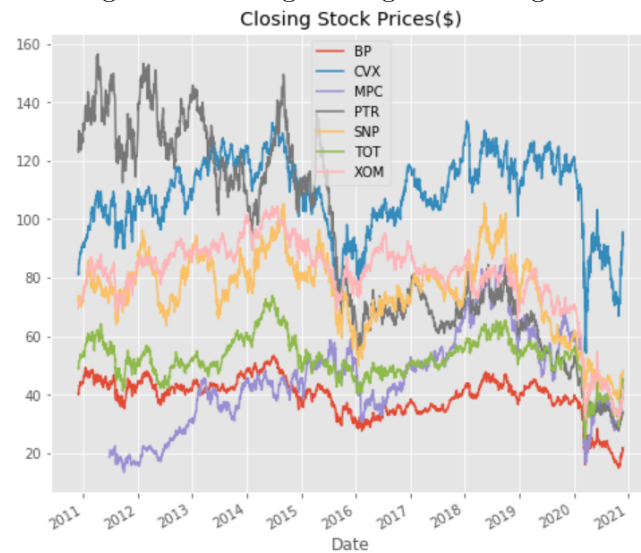
First, we plot Lukoil time-series. Then, we would like to assess how the stock behaves compared to a short and longer term moving average of its price.



## Overview of Moving Averages of the industry

For further analysis we decided to explore Moving Average of the companies, representing the industry.

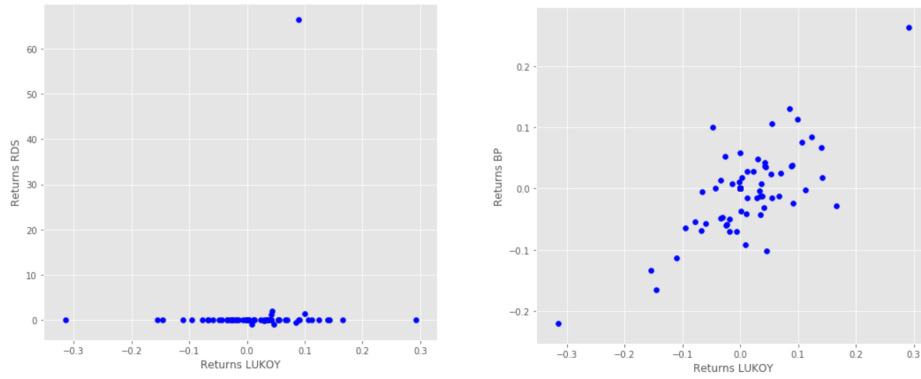
Figure 2: Moving Average of Closing Price



## Analysing Competitors Stocks

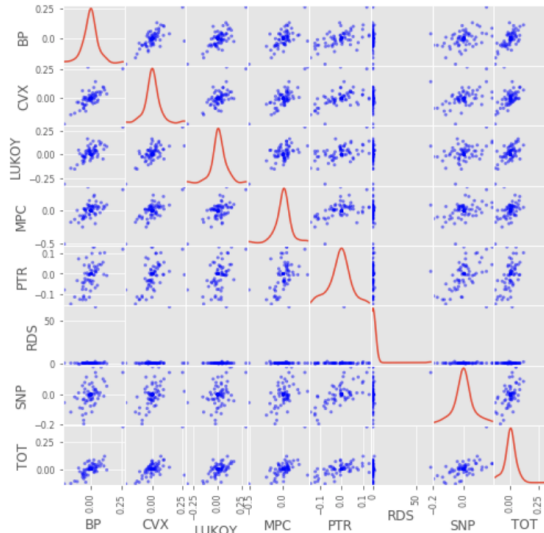
In this section, we analyse on how one company performs compared to the competitor. Based on the conducted an analysis, we conclude that there is no relationship between Lukoil returns and Royal Dutch Shell returns. On the other hand, there are positive correlations between Lukoil returns and BP return.

Figure 3: Returns of Lukoil and Competitors



To improve analysis we plot scatter matrix to visualise possible correlations, by running Kernel Density Estimate.

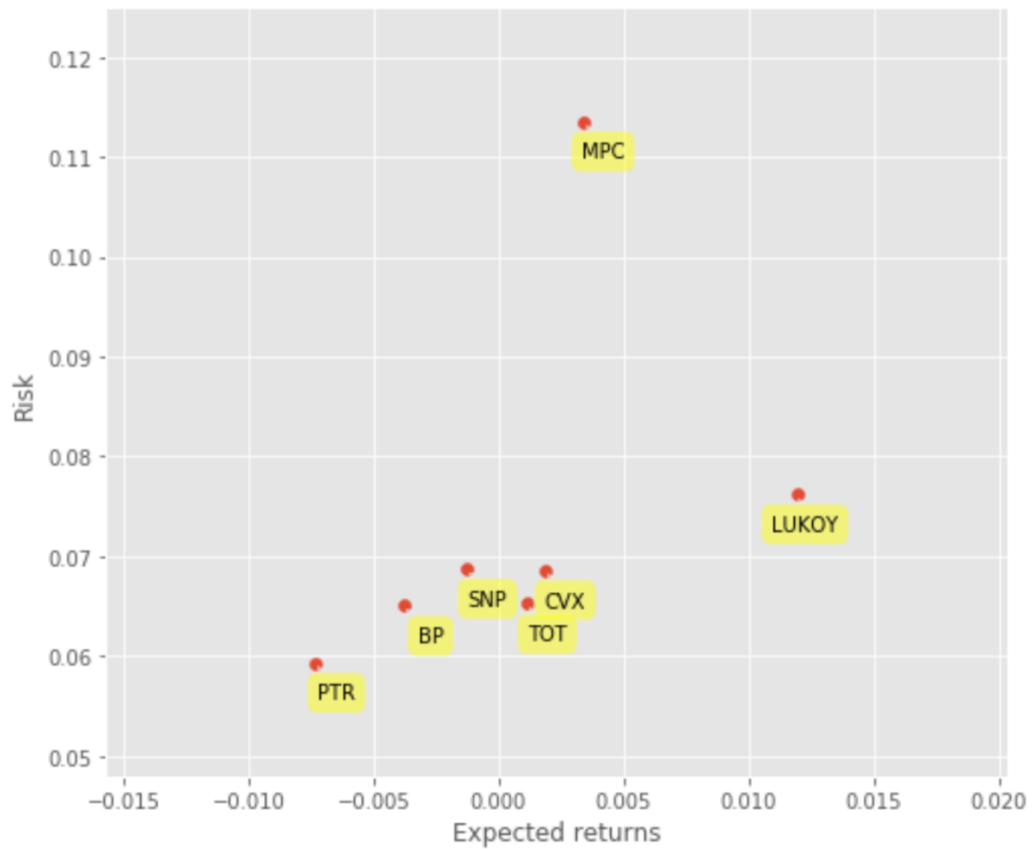
Figure 4: Chart of risk and return



## Stocks Returns Rate and Risk

Furthermore, we evaluate risks and returns. In this case risks are represented by standard deviation of returns and returns are represented by average of returns. Exclude RDS as it distorts the graph.

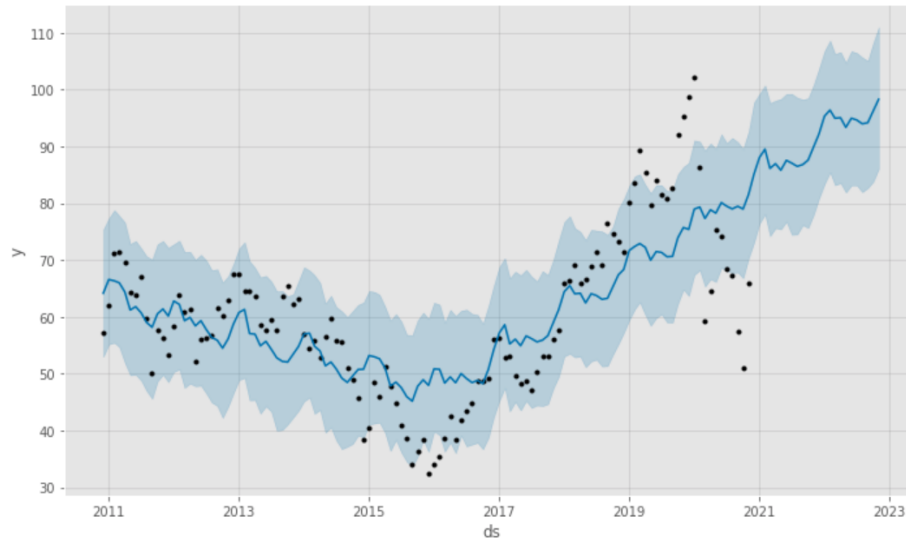
Figure 5: Risk vs Return



## Stock Price prediction

Finally we predict monthly stock prices of Lukoil for the next 2 years. We used an open-source "Prophet" in Python that is designed for making forecasts for univariate time series datasets.

Figure 6: Predicted Stock Prices for Lukoil



## Cost of Capital

According to Damodaran (2001) and Plenborg and Pimentel (2016), one of the most prominent methods in calculating the cost of equity is the CAPM model, that is being implemented in the current research. First, we consider dynamics of S&P 500 Index (Figure 7)

Figure 7: Dynamics of S&P Index



Further, in this section we consider descriptive statistics and the type of the returns' distribution of several companies, as recommended by Fishman and Parker (2015).



Table 1: Oil companies statistics

| Statistics | SNP     | PTR     | RDS     | BP      | XOM     | TOT     | CVX     |
|------------|---------|---------|---------|---------|---------|---------|---------|
| Min.       | −0.0676 | −0.0988 | −0.1717 | −0.1910 | −0.1222 | −0.1782 | −0.2212 |
| 1st Qu.    | −0.0125 | −0.0142 | −0.0168 | −0.0172 | −0.0178 | −0.0127 | −0.0148 |
| Median     | −0.0001 | −0.0023 | −0.0016 | −0.0031 | −0.0045 | −0.0007 | −0.0020 |
| Mean       | −0.0005 | −0.0010 | −0.0011 | −0.0017 | −0.0017 | −0.0001 | −0.0004 |
| 3rd Qu.    | 0.0108  | 0.0105  | 0.0138  | 0.0131  | 0.0111  | 0.0139  | 0.0122  |
| Max.       | 0.1026  | 0.1490  | 0.1967  | 0.2160  | 0.1268  | 0.1527  | 0.2274  |

Figure 8: Daily returns distribution of China Petroleum & Chemical

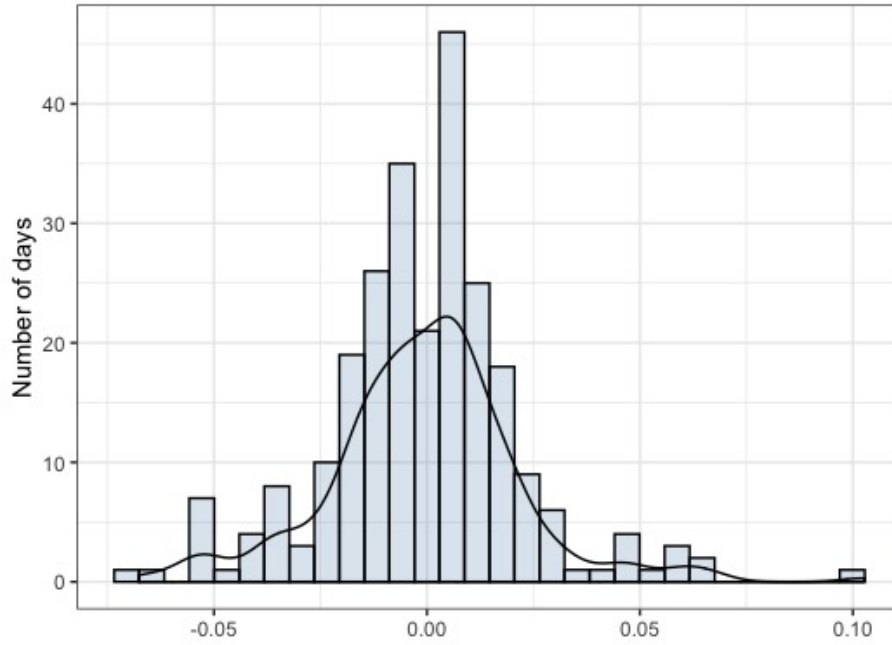
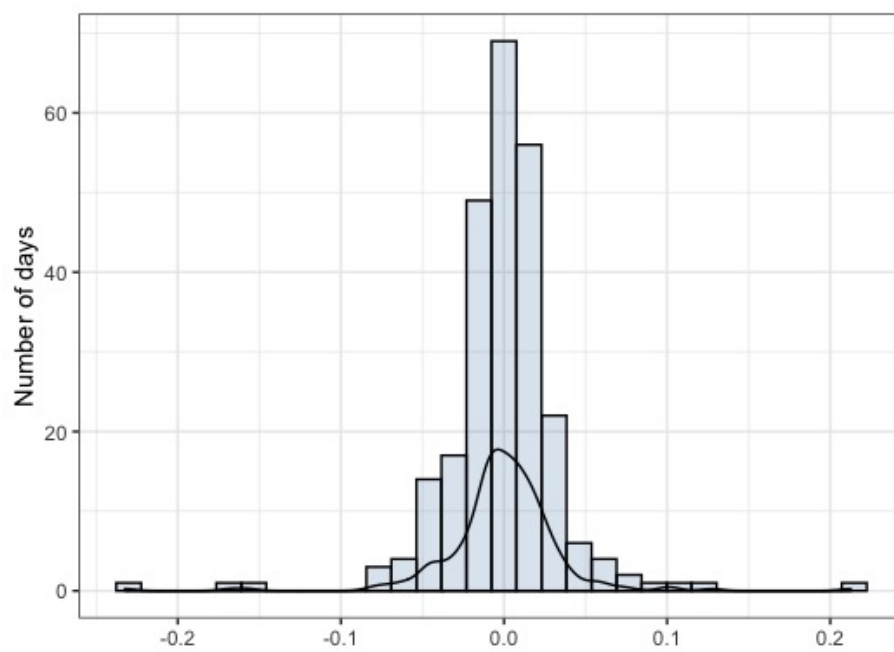
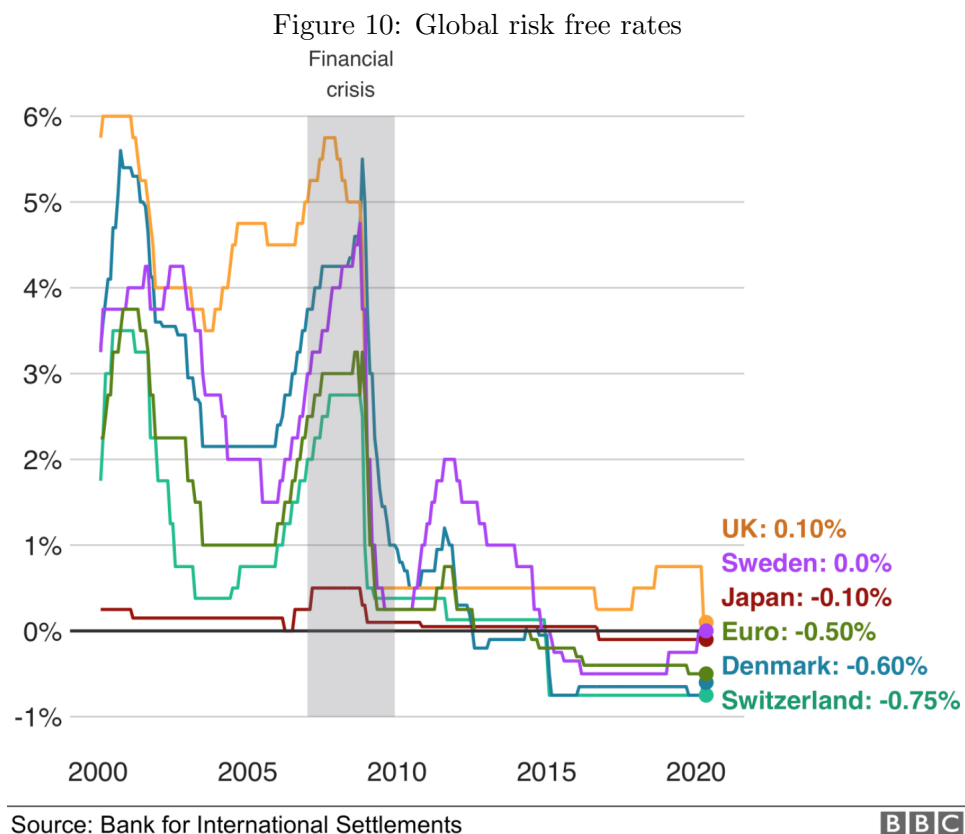


Figure 9: Daily returns distribution of PJSC Lukoil



## Risk-free rate

According to Anderson (2012), for the estimation of risk-free rates we considered global risk-free rates (Figure 10)



The risk free rate for the current project was accepted to be 0.

## Beta estimation

Companies' beta coefficients were calculated, using the methodology, described by Casey and Simon-Kerr (2015).

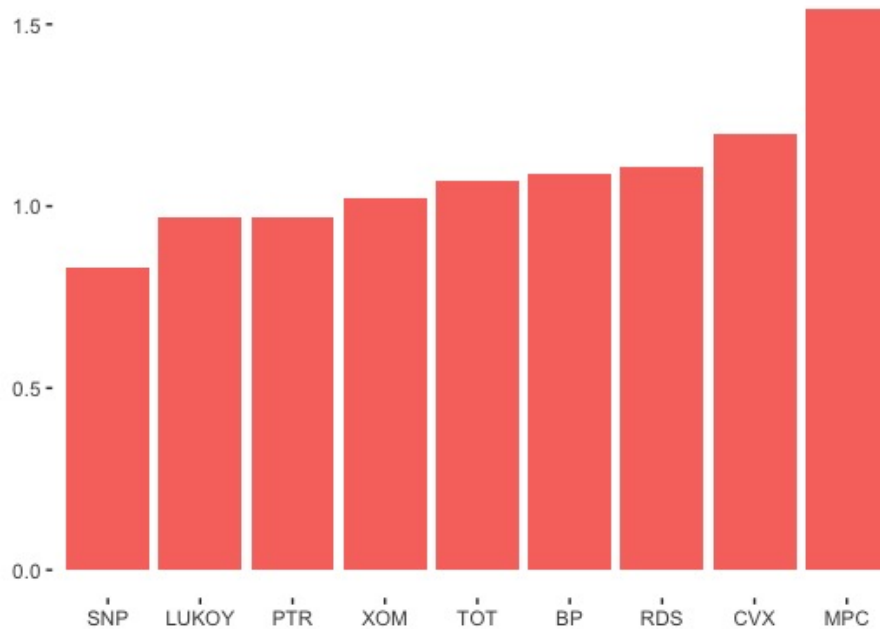
The 5 year time period was used for the estimation. The market index was represented by S&P 500.

The results are presented in Table 2.

Table 2: Beta coefficients

|   |                            |      |
|---|----------------------------|------|
| 1 | China Petroleum & Chemical | 0.83 |
| 2 | PetroChina                 | 0.97 |
| 3 | Royal Dutch Shell PLC      | 1.11 |
| 4 | BP PLC                     | 1.09 |
| 5 | Exxon Mobil Corp.          | 1.02 |
| 6 | Total SE                   | 1.07 |
| 7 | Chevron Corp.              | 1.20 |
| 8 | Marathon Petroleum Corp.   | 1.54 |
| 9 | PJSC Lukoil                | 0.97 |

Figure 11: Beta Coefficients



## Cost of Equity

Cost of equity was calculated with the CAPM method, using the following formula:

$$r_e = r_f + \beta(r_m - r_f)$$

The results of calculations are provided in Table 3.

Table 3: Cost of Capital

|   |                            |      |
|---|----------------------------|------|
| 1 | China Petroleum & Chemical | 0.15 |
| 2 | PetroChina                 | 0.17 |
| 3 | Royal Dutch Shell PLC      | 0.20 |
| 4 | BP PLC                     | 0.19 |
| 5 | Exxon Mobil Corp.          | 0.18 |
| 6 | Total SE                   | 0.19 |
| 7 | Chevron Corp.              | 0.21 |
| 8 | Marathon Petroleum Corp.   | 0.27 |
| 9 | PJSC Lukoil                | 0.17 |

## **Findings and Conclusion**

The conducted research allowed us to analyse oil industry from different aspects.

Having evaluated the stock prices, we conclude that the prices were at lowest in 2016 of all companies. At the same time there is a possible correlation between returns on stock prices of oil companies.

The returns of RDS are dramatically higher compared to other companies. Moreover, Marathon Petroleum stock prices has the highest risk and highest beta. On the other hand, Lukoil, chosen as benchmark company, has relatively low risk and beta and higher returns.

The predictive model also showed expected growth in stock prices of Lukoil.

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