Groupwork Project 1 - Group 6B
MScFE 650 - Portfolio Theory and Asset Pricing

Groupwork Members:

Hai Ninh Hoang (haininhhoang94@gmail.com)
Quyen Ho Thanh(thquyen11@hotmail.com)
Wei Hao Lew (lewweihao93@hotmail.com)
Indira Djambaeva (idjamboeva@mail.ru)

Submission 1

For this submission, complete the following tasks(use the data in the "GWP_PTAP_Data.xlsx" spreadsheet provided in the course room)

1. Calculate the expected return in the upcoming year. Use the Capital Asset Pricing Model ad the following information:

	XLE	XLI
Beta	1.07	1.06

- Risk-free rate of return (R_f): 2.25%
- Market return (R_m): 9%
- Market standard deviation: 15%

Calculate the daily and annualized standard deviation of returns for the prior year. Use the MS Excel spreadsheet provided titled "GWP_PTAP_Data.xlsx". When annualizing daily standard deviation, assume there are 252 trading days in a year.

1. Calculate the correlation (to two (2) decimal places) between each sector's return.

Explain the calculations required to accomplish each task

Answer

We convert the data from the Excel files ("GWP_PTAP_Data_2010.10.08.xlsx"), sheets XLE and XLI to two separate files ("XLE.csv" and "XLI.csv") for this assignment

In [1]:
```
# import library
# In this assignment, we will use Pandas and Numpy.
# Note that since in our course we haven't learnt Pandas yet, so using Pandas in this assignment
# only for Data Management and Data Viewer

import pandas as pd
import numpy as np
```

In [2]:
```
# Import the CSV data files we separate as we state above

XLE = pd.read_csv("Data/XLE.csv",
                    delimiter=',')
XLE['Date'] = pd.to_datetime(XLE['Date'])
XLE.set_index('Date', inplace=True)

XLI = pd.read_csv("Data/XLI.csv",
                    delimiter=',')
XLI['Date'] = pd.to_datetime(XLI['Date'])
XLI.set_index('Date', inplace=True)
```

In [3]:
```
# Check the data import

XLE.head()

# Head of XLE data
```

Out[3]:

	Closing_price
Date	
2017-11-27	67.19
2017-11-28	67.71
2017-11-29	68.08
2017-11-30	69.10
2017-12-01	69.68

In [4]:
```
# Check the data import

XLI.head()

# Head of XLI data
```

Out[4]:

Date	Closing_price
2017-11-27	71.53
2017-11-28	72.62
2017-11-29	73.26
2017-11-30	74.51
2017-12-01	73.59

1. Calculate the expected return in the upcoming year by using Capital Asset Pricing Model (CAPM):

- Calculate the cost of equity, or expected return in the next year, by Capital Asset Pricing Model (CAPM):

$$E(R_i) = R_f + \beta_i * (R_m - R_f)$$

which:
$E(R_i)$ is the expected return, or cost of equity
R_f is the Risk-free rate of return
R_m is the market return

In [5]:
```
# Import the return information

beta_XLE = 1.07
beta_XLI = 1.06

Rf = 2.25/100
Rm = 9/100
sigma_market = 15/100
```

In [6]:
```
# Function to calculate Expected Return by CAPM

def E_Rp_CAPM(Rf, beta, Rm):
    result = Rf + beta * (Rm - Rf)
    return result
```

In [7]:
```
# Calculate the Expected Return in the next year

return_XLE = E_Rp_CAPM(Rf, beta_XLE, Rm)
return_XLI = E_Rp_CAPM(Rf, beta_XLI, Rm)

print("The Expected Return in the next year calculate by CAPM of XLE i
s: {0:.4f}".format(return_XLE))
print("The Expected Return in the next year calculate by CAPM of XLI i
s: {0:.4f}".format(return_XLI))
```

```
The Expected Return in the next year calculate by CAPM of XLE is: 0.
0947
The Expected Return in the next year calculate by CAPM of XLI is: 0.
0940
```

Calculate the daily and annualized standard deviation of returns for the prior year.

For the purpose of this assignment, we will use the normal daily return for calculation. The formula for Normal Daily Return:

$$NormalDailyReturn = \frac{CurrentPrice - PreviousPrice}{PreviousPrice}$$

In [8]:
```
# Calculate daily return for both stocks

XLE["Daily_Return"] = (XLE['Closing_price'].diff())/XLE["Closing_price
"].shift(1)
XLI["Daily_Return"] = (XLI['Closing_price'].diff())/XLI["Closing_price
"].shift(1)

# Drop the NA data in case data missing
XLE.dropna(inplace=True)
XLI.dropna(inplace=True)
```

In [9]:
```
# View XLE
XLE.head()
```

Out[9]:

Date	Closing_price	Daily_Return
2017-11-28	67.71	0.007739
2017-11-29	68.08	0.005464
2017-11-30	69.10	0.014982
2017-12-01	69.68	0.008394
2017-12-04	69.65	-0.000431

In [10]:
```
# View XLI
XLI.head()
```

Out[10]:

Date	Closing_price	Daily_Return
2017-11-28	72.62	0.015238
2017-11-29	73.26	0.008813
2017-11-30	74.51	0.017063
2017-12-01	73.59	-0.012347
2017-12-04	74.21	0.008425

Calculate the daily standard deviation of return by applying the following formula:

$$\sigma_{daily} = \sqrt{\frac{\sum_{n=0}^{n} r^2}{n}}$$

where:
σ_{daily}: Standard Deviation
r: Normal Daily Return

In [11]:
```
# Calculate daily standard deviation of return by using Numpy library
# This method have been used by lecture notes

daily_return_std_XLE = np.std(XLE['Daily_Return'])
daily_return_std_XLI = np.std(XLI['Daily_Return'])

print("The Daily Standard Deviation of Daily Return of XLE is: {0:.4f}
".format(daily_return_std_XLE))
print("The Daily Standard Deviation of Daily Return of XLI is: {0:.4f}
".format(daily_return_std_XLI))
```

```
The Daily Standard Deviation of Daily Return of XLE is: 0.0127
The Daily Standard Deviation of Daily Return of XLI is: 0.0107
```

Calculate the Annualized standard deviation of return by applying the following formula (assume there are 252 trading days in a year):

$$\sigma_{annualized} = \sigma_{daily} * \sqrt{252}$$

In [12]:
```
annualized_return_std_XLE = daily_return_std_XLE * np.sqrt(252)
annualized_return_std_XLI = daily_return_std_XLI * np.sqrt(252)

print("The Annualized Standard Deviation of Daily Return of XLE is: {0
:.4f}".format(annualized_return_std_XLE))
print("The Annualized Standard Deviation of Daily Return of XLI is: {0
:.4f}".format(annualized_return_std_XLI))
```

```
The Annualized Standard Deviation of Daily Return of XLE is: 0.2019
The Annualized Standard Deviation of Daily Return of XLI is: 0.1699
```

2. Calculate the correlation (to two (2) decimal places) between each sector's return.

We use the following formula to calculate the Pearson product-moment correlation coefficient:

$$\rho_{xy} = \frac{Cov(x, y)}{\sigma_x * \sigma_y}$$

where:
ρ_{xy}: Pearson product-moment correlation coefficient
$Cov(x, y)$: covariance of variables x and y
σ_x, σ_y: standard deviation of x and y

And covariance will be calculate by:

$$Cov(x, y) = \frac{\sum(X_i - \overline{X}) * (Y_i - \overline{Y})}{n}$$

Since in the lecture we use Numpy as our library, we will use Numpy to calculate the correlation coefficient matrix, then take the Pearson product-moment correlation coefficient:

In [13]:
```
correlation_XLE_XLI = np.corrcoef(XLE['Daily_Return'],
                                   XLI['Daily_Return'])[0][1]
print("The Correlation Coefficient of Daily Return of XLE and XLI is:
{0:.2f}".format(correlation_XLE_XLI))
```

```
The Correlation Coefficient of Daily Return of XLE and XLI is: 0.66
```

In [ ]: