CAPM updated

June 30, 2020

[3]:
```
import pandas_datareader as pdr
from pandas_datareader import data, wb
from datetime import date
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd

risk_free_rate = 0.05

def capm(start_date, end_date, ticker1, ticker2):

        #get the data from Yahoo Finance
        stock1 = pdr.get_data_yahoo(ticker1, start_date, end_date)
        stock2 = pdr.get_data_yahoo(ticker2, start_date, end_date)

        #we prefer monthly returns instead of daily returns
        return_stock1 = stock1.resample('M').last()
        return_stock2 = stock2.resample('M').last()

        #creating a dataFrame from the data - Adjusted Closing Price is used as␣
↪usual
        data = pd.DataFrame({'s_adjclose' : return_stock1['Adj Close'],␣
↪'m_adjclose' : return_stock2['Adj Close']}, index=return_stock1.index)
        #natural logarithm of the returns
        data[['s_returns', 'm_returns']] = np.
↪log(data[['s_adjclose','m_adjclose']]/data[['s_adjclose','m_adjclose']].
↪shift(1))
        #no need for NaN/missing values values so let's get rid of them
        data = data.dropna()

        #covariance matrix: the diagonal items are the vairances - off␣
↪diagonals are the covariances
        #the matrix is symmetric: cov[0,1] = cov[1,0] !!!
        covmat = np.cov(data["s_returns"], data["m_returns"])
        print(covmat)

        #calculating beta according to the formula
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        beta = covmat[0,1]/covmat[1,1]
        print("Beta from formula:", beta)

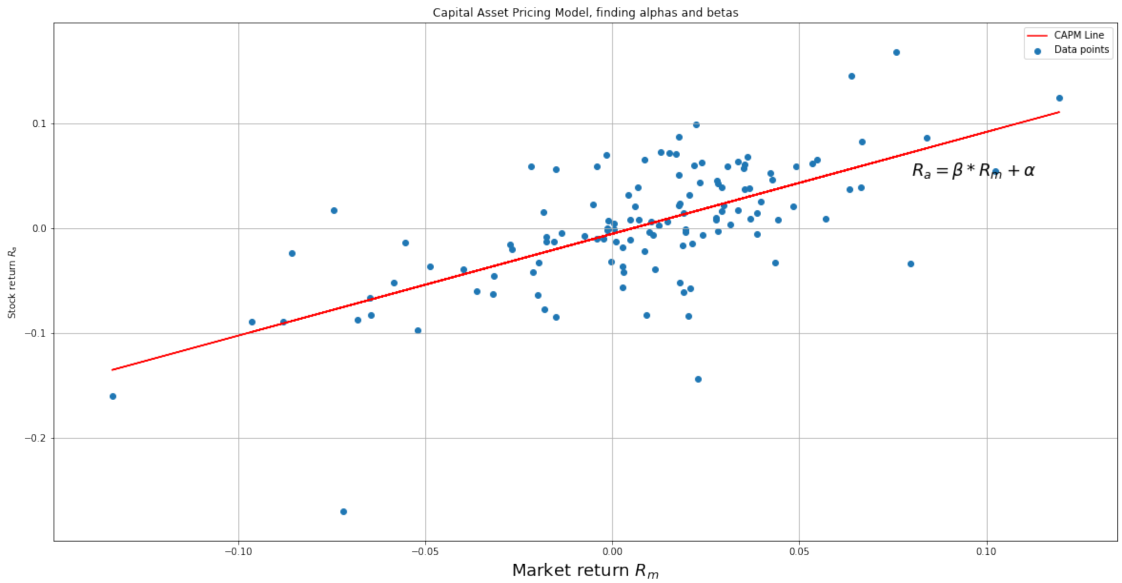
        #using linear regression to fit a line to the data [stock_returns,␣
 ↪market_returns] - slope is the beta
        beta,alpha = np.polyfit(data["m_returns"], data['s_returns'], deg=1)
        print("Beta from regression:", beta)

        #plot
        fig,axis = plt.subplots(1,figsize=(20,10))
        axis.scatter(data["m_returns"], data['s_returns'], label="Data points")
        axis.plot(data["m_returns"], beta*data["m_returns"] + alpha,␣
 ↪color='red', label="CAPM Line")
        plt.title('Capital Asset Pricing Model, finding alphas and betas')
        plt.xlabel('Market return $R_m$', fontsize=18)
        plt.ylabel('Stock return $R_a$')
        plt.text(0.08, 0.05, r'$R_a = \beta * R_m + \alpha$', fontsize=18)
        plt.legend()
        plt.grid(True)
        plt.show()

        #calculate the expected return according to the CAPM formula
        expected_return = risk_free_rate + beta*(data["m_returns"].
 ↪mean()*12-risk_free_rate)
        print("Expected return:", expected_return)

if __name__ == "__main__":
        #using historical data 2010-2017: the market is the S&P500 !!!
        capm('2010-01-01', '2020-06-29','IBM', '^GSPC')
```

```
[[0.0035266  0.00152343]
 [0.00152343 0.00156933]]
Beta from formula: 0.9707495612765603
Beta from regression: 0.9707495612765604
```




```
Expected return: 0.098842002414029
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