

Capital asset price model project

Expected return calculation of the Microsoft stock using the CAPM formula

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Introduccion

The objective of this project is to carry out the calculation of the expected return of a Microsoft stock through the use of the del capital asset price model (CAPM) formula.

In **section 1** (Data) The data used in this project, its source and the period analized will be explained., in **section 2** (methodology) We will give a brief summary of the capital asset price model theory and we will explain one of the many methods that exist to determine the beta, which we will use here (linear regression). In **section 3** (results) the results of the CAPM formula will be displayed.

This project was programmed and developed in the python language, but for simplicity purposes, this pdf was written and its purpose is to give a summary illustration of what the project is. Those people who are interested in the technical details of programming and coding of data analisis and financial analysis, can see it at the following

link: <https://github.com/Mijail-Dragowski/Capital-asset-price-model-project/blob/main/CAPM-CODE.ipynb>

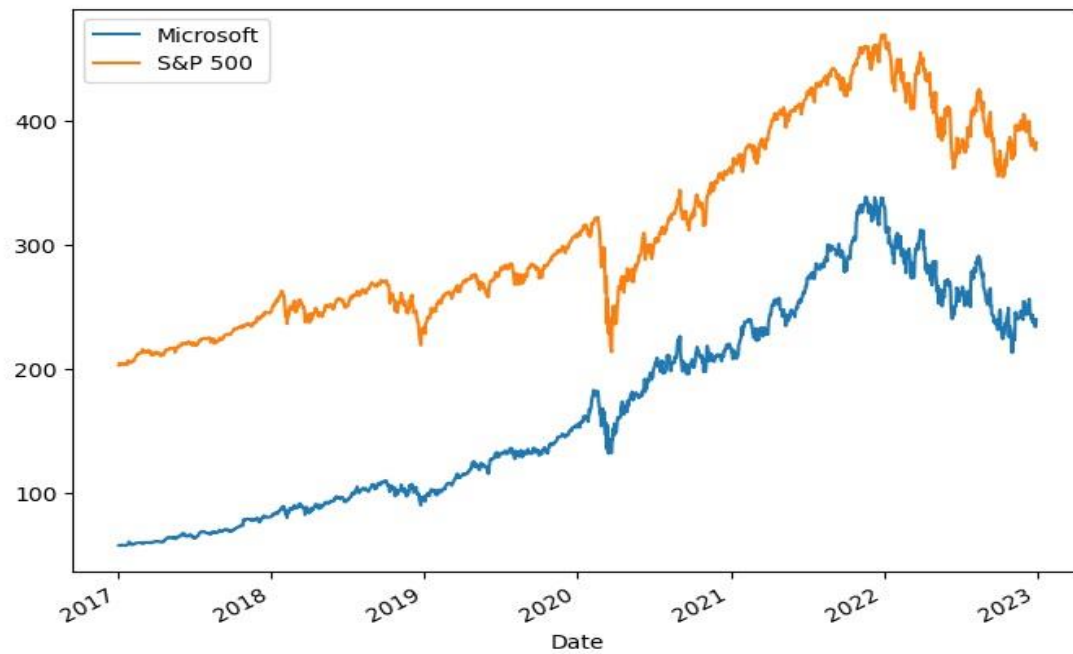
1. Data

The data used to carry out this project cover the period from 2017-01-01 to 2022-12-31.

The company chosen to calculate their stock expected return was Microsof, and from it the adjusted closing price will be used to make all the necessary calculations. The capital asset price model requires comparing the return of an individual stock with the return of the market. the SPY ETF will be used as a proxy for the S&P 500 to represent the market and calculate the market return.

all Microsoft and S&P 500 financial information needed for the project was extracted from (<https://finance.yahoo.com/>).

Adjusted closing price time series chart



Cumulative return graph



2. Metodology

2.1 CAPM.

The Capital Asset Pricing Model (CAPM) is a financial model used to estimate the expected return of an asset based on the risk-free rate, market risk premium, and the asset's beta (systematic risk) compared to the market.

The CAPM formula is as follows:

Expected Return = Risk-Free Rate + Beta x Market Risk Premium

Where:

Risk-Free Rate: The return an investor can earn from a risk-free investment, such as a government bond, that has no default risk.

Beta: A measure of a stock's or asset's systematic risk, or how much its returns move in relation to the market. A beta of 1 means that the asset has the same level of risk as the overall market. A beta of less than 1 means that the asset is less risky than the market, while a beta of greater than 1 means that the asset is more risky than the market.

Market Risk Premium: The additional return that an investor expects to earn for taking on the risk of investing in the stock market compared to a risk-free investment.

The CAPM model assumes that investors are rational and that they only require compensation for the systematic risk of an asset, as opposed to its unsystematic risk (company-specific risk). The model also assumes that investors have homogeneous expectations about the future and that the market is efficient.

2.2 Beta calculation.

There is more than one way to calculate the beta from the CAPM formula. In this project, it was decided to carry out a linear regression to estimate the beta using ordinary least squares (OLS).

Ordinary least squares (OLS) is a statistical technique used to find the line of best fit for a data set. This technique is commonly used in linear regressions.

The goal of OLS is to minimize the sum of the squares of the differences between the observed values and the values predicted by the line of best fit. In other words, a line is sought that minimizes the vertical distance between the points and the regression line.

The formula to find the line of best fit using OLS is very similar to the CAPM formula, which is why its use is convenient. The formula is:

$$y = b_0 + b_1x$$

Where:

- y is the dependent variable (the variable you want to predict)
- x is the independent variable (the variable that is used to predict y)
- b_0 is the intercept (the value of y when x equals zero)
- b_1 is the slope (the change in y for each unit change in x)

3. Results

Carrying out the regression explained in the previous section, (for more details, check the notebook with the code) a $\beta = 1.23$ was found. This means that with a 1% increase in the market return, the return of Microsoft stocks increases by an average of 1.23%, leaving everything else constant.

The market return found in the period was approximately 88.5%. For the risk free rate, the US 5 year Treasury Yields were used, which is, at the time of writing, 4.18% (this data was taken from <https://www.bloomberg.com/markets/rates-bonds/government-bonds/us>)

Finally, applying these data to the CAPM formula ($\text{Expected return} = \text{Risk free rate} + \beta * (\text{Market return} - \text{Risk free rate})$), The expected return of the stock for a period as long as the one analyzed is approximately 108%