CAPM and SML

Problem Statement:

Market_Portfolio.xlsx contains monthly nominal (net) returns (expressed as percentages) for the market portfolio, over the ten-year period from Jan 2004 through Dec 2013. Assume that the (net) risk-free rate is 0.13% per month.

Market Model

1. Estimate the intercept coefficient (α) and slope coefficient (β) for each of the ten industry portfolios using the market model: regress the monthly excess returns for each industry portfolio on the monthly excess returns for the market portfolio. Create a table showing the intercept and slope coefficients for the ten industry portfolios.
2. Briefly explain (in words, without mathematical equations or formulas) the economic significance and pricing implications of the intercept and slope coefficients.

Security Market Line (SML)

1. Regress the mean monthly returns of the ten industry portfolios and the market portfolio on the corresponding β's. This will give you the intercept and slope coefficients for the SML. (Note that the results may be very different from what you would expect!)
2. Use the estimated intercept and slope coefficients for the SML to plot the SML in the range of β from zero to two on the horizontal axis. Also plot the positions of the ten industry portfolios and the market portfolio. (You are NOT required to label the individual portfolios.)
3. Briefly explain the economic significance and pricing implications of the SML.

Solution:

1. The entire analysis was done on Python. The Alphas (Intercept coefficient) and Betas (Slope coefficients) were calculated. Durables, HiTec and Other indsutries had a negative alpha, which indicate losses.

	Industry	Alpha (Intercept)	Beta (Slope)
0	NoDur	0.369443	0.652647
1	Durbl	-0.415599	1.648536
2	Manuf	0.159771	1.169846
3	Enrgy	0.501719	0.969850
4	HiTec	-0.064020	1.132969
5	Telcm	0.194691	0.900729
6	Shops	0.275492	0.826492
7	Hlth	0.237841	0.673036
8	Utils	0.444585	0.538086
9	Other	-0.387135	1.207309

As we can see:
- Durables, HiTec, and Other industries had a negative alpha, which indicate poor performance relative to the market.
- Energy, Utilities and Non-Durables had the highest alphas, which indicates good performance relative to the market.
- The Betas are the lowest for Utilities, Non-Durables and Health, which indicate lower market risk compared to the market.
- The Betas are the highest for Durables, Others and Manufacturing industries.
- The conclusion can be made that the Durables industry is probably the poorest value for money as we take on higher market risk, for a considerably lower return compared to the market. Similarly, Non-Durables and the Energy sectors seem to have the best value for money as they represent the lowest risk for the highest possible returns.

2. The intercept (alpha) represents the portfolio's return that is independent of market movements, often interpreted as the portfolio's excess return or the impact of unique factors. A positive alpha indicates outperformance, while a negative alpha suggests underperformance.
The slope (beta) measures the portfolio's sensitivity to market risk. A higher beta means the portfolio is more volatile than the market, and a lower beta indicates less volatility. In pricing, alpha identifies whether a portfolio is mispriced, while beta shows how much market risk affects its return.
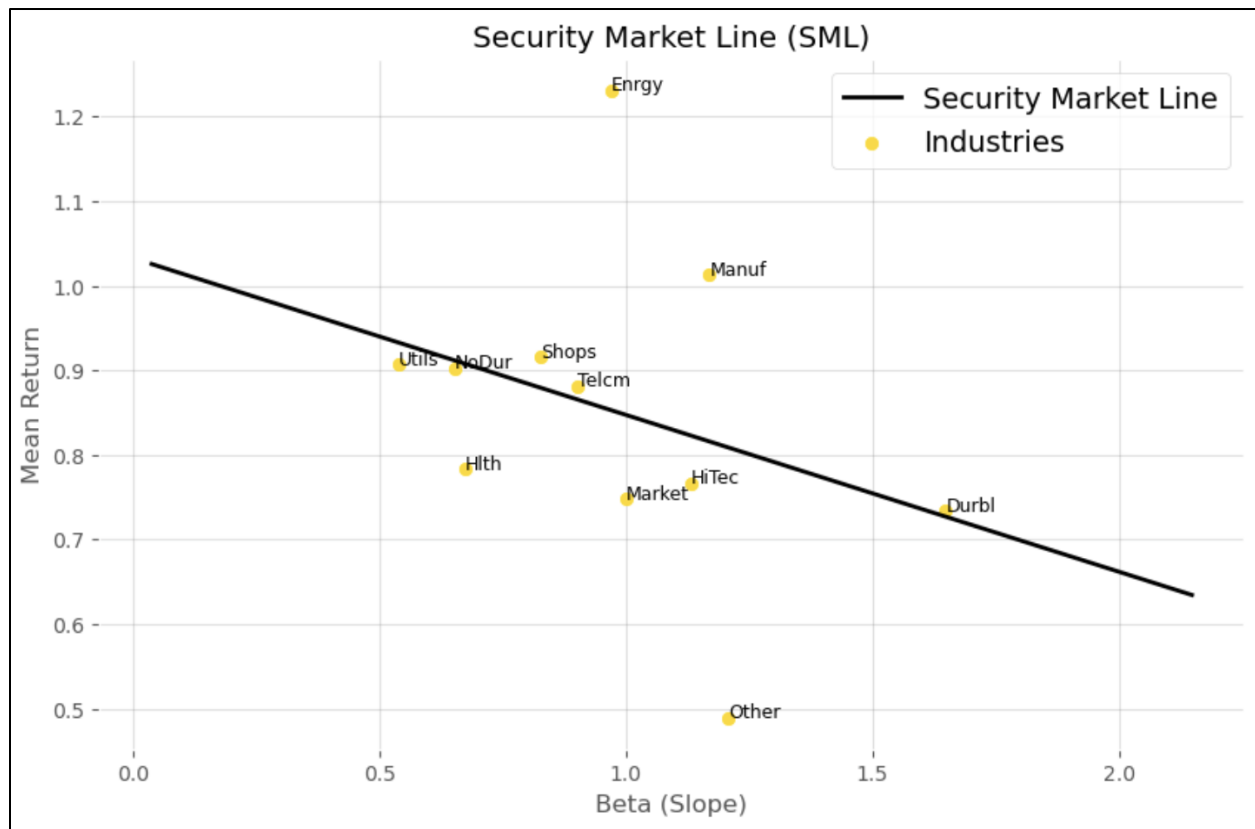
Security Market Line (SML)

1. The mean returns were calculated and regressed with the Betas for each industry along with the Market portfolio was regressed to predict the alpha and the Beta for the Security Market Line.

	Mean_Return
NoDur	0.902833
Durbl	0.733333
Manuf	1.012833
Enrgy	1.231167
HiTec	0.766250
Telcm	0.881417
Shops	0.916333
Hlth	0.783833
Utils	0.907167
Other	0.489083
Market	0.748083

Industry	Beta (Slope)
NoDur	0.652647
Durbl	1.648536
Manuf	1.169846
Enrgy	0.969850
HiTec	1.132969
Telcm	0.900729
Shops	0.826492
Hlth	0.673036
Utils	0.538086
Other	1.207309
Market	1.000000

Line	SML Alpha (Intercept)	SML Beta (Slope)
Security Market Line	1.032768	-0.185467

2. The Security Market line was then plotted alongside the various industry portfolios and the market portfolio.
   - As you can see, Energy, Manufacturing, Shops, Telecome and Durables fall above the SML, which indicate that these indsutries are undervalued.

Security Market Line (SML)

3. The Security Market Line (SML) is a graphical representation of the relationship between a portfolio's risk and its expected return, based on the Capital Asset Pricing Model (CAPM). It has significant implications for understanding the pricing of portfolio:

1. **Economic Significance:**
   • The SML shows the required return for any given level of risk, represented by the portfolio's beta (its sensitivity to market movements). It sets the benchmark for the risk-return tradeoff in the market.
   • It reflects how investors are compensated for taking on additional risk beyond a risk-free investment. The intercept of the SML is the risk-free rate, and the slope represents the market risk premium, indicating how much extra return is required for each additional unit of risk.

2. **Pricing Implications:**
   • The SML is used to assess whether a portfolio is fairly priced. If a portfolio expected return lies above the SML, it is underpriced and offers a higher return for its level of risk, making it an attractive investment. Conversely, if the portfolio's expected return is below the SML, it is overpriced and offers a lower return for its risk, making it less attractive.
   • The SML helps investors determine whether they are being adequately compensated for taking on risk and guides them in making investment decisions based on whether their portfolios are offering returns that match or exceed their risk level.

Overall, the SML provides a framework for evaluating the relationship between risk and return, helping to ensure that assets are priced appropriately in relation to their risk.