Capital Asset Pricing Model

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QF600: Asset Pricing

1 Introduction

The main task of this assignment is to estimate the intercept coefficient (α) and slope coefficient (β) for each of the ten industry portfolio using the market model, as described by the Capital Asset Pricing Model (CAPM), and perform the same regression on the mean monthly returns and the corresponding β's to plot the security market line (SML).

2 Market Model

Market return for each industry portfolio is given in the previous assignment, in the file titled Industry_Portfolio.xlsx. Excess monthly returns was calculated by deducting the risk-free rate of 0.13% from each entry. An Ordinary Least Square (OLS) regression was performed on the excess monthly returns from each industry portfolio with the excess return of the market portfolio, as given by the CAPM formula:

$$R_i - R_f = \beta_i(R_m - R_f) + \alpha_i$$

The intercept coefficients α and slope coefficients β of each industry portfolio are arranged in the table below:

Industry	Alpha (Intercept)	Beta (Slope)
NoDur	0.369	0.653
Durbl	-0.416	1.649
Manuf	0.160	1.170
Enrgy	0.502	0.970
HiTec	-0.064	1.133
Telcm	0.195	0.901
Shops	0.275	0.826
Hlth	0.238	0.673
Utils	0.445	0.538
Other	-0.387	1.207

Figure 1: Intercept and Slope Coefficients of the monthly excess returns of each industry portfolio against the market portfolio

2.1 Economic Significance and Pricing Implications

The intercept coefficient α represents the industry portfolio's return that cannot be explained by the market's excess returns. In other words, it is the excess returns independent of the market. A positive α suggests the portfolio may outperform the market on average, while a negative α indicates under-performance.

The slope coefficient β measures the sensitivity of the industry portfolio's excess returns to the market portfolio's excess returns. A β greater than 1 implies the portfolio is more volatile than the market (greater reactions to market changes), while a β less than 1 suggests less sensitivity.

3 Security Market Line

The SML shows the relationship between risk (measured by β) and expected return according to the CAPM. A portfolio's expected return is determined by its beta, with higher β portfolios offering higher returns to compensate for greater risk.

To plot the SML, the mean monthly return for each of the industry portfolios and the market portfolio is calculated. The beta for each portfolio is also concatenated to form the table below:

	Industry	Mean Return	Beta
0	NoDur	0.902833	0.652647
1	Durbl	0.733333	1.648536
2	Manuf	1.012833	1.169846
3	Enrgy	1.231167	0.969850
4	HiTec	0.766250	1.132969
5	Telcm	0.881417	0.900729
6	Shops	0.916333	0.826492
7	Hlth	0.783833	0.673036
8	Utils	0.907167	0.538086
9	Other	0.489083	1.207309
10	Market	0.748083	1.000000

Figure 2: Mean monthly returns for each industry portfolio, including the market portfolio. Note that the beta of the market portfolio is, by definition, one

Using the same OLS tools from above, the mean monthly returns were regressed with the corresponding β of each portfolio. The SML intercept coefficient was determined to be 1.033 and the SML coefficient is -0.185 (to 3 decimal places). The resultant plot of the SML and the positions of the eleven (industry and market portfolios) is as shown:

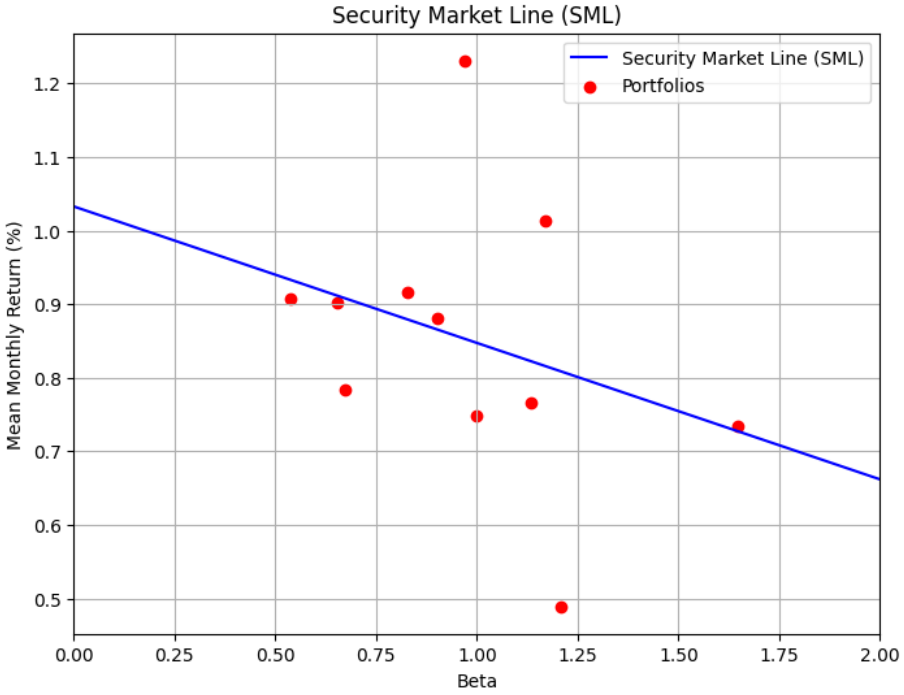

Figure 3: Security Market Line, with range of β from zero to two on the horizontal axis

3.1 Economic Significance and Pricing Implications

The intercept of the SML is the risk-free rate, which represents the return on an investment with no risk.

The slope of the SML reflects the market risk premium, which is the additional returns investors require for taking on market risk. A steeper slope would indicate a larger premium for taking on risk.

Portfolios that lie above the SML are considered underpriced because they offer higher returns for their level of risk, while portfolios below the SML are overpriced because they offer lower returns for their level of risk.

3.2 A Mysterious Result

In the plot above, we observe that the slope of the SML is negative, which is contrary to what we usually expect. A negative slope suggests that higher β portfolios offer lower returns than the risk-free rate, which is inconsistent with the results of CAPM.

A possible explanation is the presence of large pricing anomalies, especially

periods leading up to and during the 2008 subprime mortgage crisis, which disproportionately affected the returns of high β portfolios.

Another explanation is that the portfolio classification provided is not sufficiently fine-grained to offer meaningful interpretation. For example, some companies can be classified under multiple industries, while many others parked under 'Others' can be further segregated into other classifications.