

FNCE 3010 (Durham)
HW 14 (CAPM)

1. Is it possible that a risky asset could have a beta of zero? Explain. Based on the CAPM, what is the expected return on such an asset? Is it possible that a risky asset could have a negative beta? What does the CAPM predict about the expected return on such an asset? Why might an investor be willing to hold such an asset?

Solution:

A risky asset can have zero beta if its returns are not correlated with the market. In other words, it has only idiosyncratic risk. Its expected return should be equal to the risk-free rate. It is possible to have a negative beta if the asset's returns are negatively correlated with the market. The expected return would be less than the risk-free rate. Investors might be willing to hold such an asset because of its value as a diversification instrument.

2. Is it possible to eliminate idiosyncratic risk by carefully choosing a portfolio? Is it possible to eliminate systematic risk? What are the implications for expected returns in either case.

Solution:

Idiosyncratic risk can be eliminated by choosing a broadly diversified portfolio. Since idiosyncratic risk is not priced, the expected return depends only on the portfolio's beta and is not reduced by eliminating idiosyncratic risk.

Market risk can be eliminated by constructing a portfolio with zero beta. But, the expected return on such a portfolio will be equal to the risk-free rate.

3. Suppose that XYZ Inc.'s stock has an expected return of 8% and a standard deviation of 12%. ABC Inc.'s stock has an expected return of 10% and a standard deviation of 15%. The returns of these two companies have a correlation of 0.3. Compute the expected returns and standard deviations for the portfolios constructed using the weights below. Assuming a riskfree rate of 4%, what is the Sharpe ratio for each portfolio? Which portfolio has the highest expected return? The least risk? the best Sharpe ratio?

w_{XYZ}	w_{ABC}	$E(R_p)$	σ_p	Sharpe ratio
-0.5	1.5			
-0.2	1.2			
0	1			
.2	.8			
.4	.6			
.6	.4			
.8	.2			
1	0			
1.2	-0.2			
1.5	-0.5			

Solution:

w_{XYZ}	w_{ABC}	$E(R_p)$	σ_p	Sharpe ratio
-0.5	1.5	0.110	0.215	0.326
-0.2	1.2	0.104	0.174	0.367
0	1	0.100	0.150	0.400
.2	.8	0.096	0.129	0.433
.4	.6	0.092	0.114	0.456
.6	.4	0.088	0.107	0.450
.8	.2	0.084	0.109	0.404
1	0	0.080	0.120	0.333
1.2	-0.2	0.076	0.138	0.261
1.5	-0.5	0.070	0.173	0.173

4. Given a series of monthly returns for Snazzle Juice, Inc. and the S&P 500, suppose that we estimate the CAPM relationship

$$R_A - R_f = \beta(R_M - R_f) + \epsilon$$

and obtain $\beta = 3.0$, and the standard deviation of the residuals is 1.2.

- Using a market risk premium of 8% and risk-free rate of 5%, what is Snazzle's risk premium? What is Snazzle's expected return?
- If the market goes up by 2% next month, what is the expected change in Snazzle's stock?
- If Snazzle actually goes up by 4%, what is Snazzle's idiosyncratic return for that period?
- If the standard deviation of the monthly market return is 4%, what are Snazzle's systematic risk, idiosyncratic risk, and total risk (expressed as monthly standard deviations)?
- What range would I expect Snazzle's monthly return to fall within 95% of the time?
- Given \$1000, describe how to construct a portfolio with a beta of 2 comprised of Snazzle stock and the risk-free asset. What is the expected annual return for this portfolio?

Solution:

- Risk premium = $3 \times 8 = 24\%$. Expected return = $5 + (3 \times 8) = 29\%$.
- $5/12 + 3 \times (2 - 5/12) = 5.17\%$
- Snazzle's idiosyncratic return was $4 - 5.17 = -1.17\%$.
- Systematic risk = $3 \times 4 = 12$. Idiosyncratic risk = 1.2. Total risk = $\sqrt{(12^2 + 1.2^2)} = 12.06$
- Between $29/12 - (2 \times 12.06) = -21.70$ and $29/12 + (2 \times 12.06) = 26.54$
- Put 2/3 in Snazzle and 1/3 in the risk-free asset.

5. What is the efficient frontier and why might investor's want to hold a portfolio on the efficient frontier? What determines which portfolio on the efficient frontier a given investor would wish to hold?

Solution:

The efficient frontier is the set of portfolios with maximum expected return for a given level of risk. Investors wish to hold portfolios on the efficient frontier because they are risk averse. The particular portfolio an investor would hold depends upon her degree of risk aversion.