



# *Review and examples*

Chapters 9, 10 and 12.

## Quick (and non-complete) review

$$\bar{R} = E[R] = R_1 \cdot prob_1 + R_2 \cdot prob_2 + R_3 \cdot prob_3 + \dots$$

$$\begin{aligned} Var(R) = \sigma^2 &= E\left[\left(R - \bar{R}\right)^2\right] \\ &= \left(R_1 - \bar{R}\right)^2 \cdot prob_1 + \left(R_2 - \bar{R}\right)^2 \cdot prob_2 + \left(R_3 - \bar{R}\right)^2 \cdot prob_3 + \dots \end{aligned}$$

$$\begin{aligned} Cov(R_A, R_B) = \sigma_{AB} &= \left(R_{A1} - \bar{R}_A\right) \cdot \left(R_{B1} - \bar{R}_B\right) \cdot prob_1 + \\ &+ \left(R_{A2} - \bar{R}_A\right) \cdot \left(R_{B2} - \bar{R}_B\right) \cdot prob_2 + \left(R_{A3} - \bar{R}_A\right) \cdot \left(R_{B3} - \bar{R}_B\right) \cdot prob_3 + \dots \end{aligned}$$

$$Corr(R_A, R_B) = \rho_{AB} = \frac{Cov(R_A, R_B)}{SD(R_A) \cdot SD(R_B)}$$

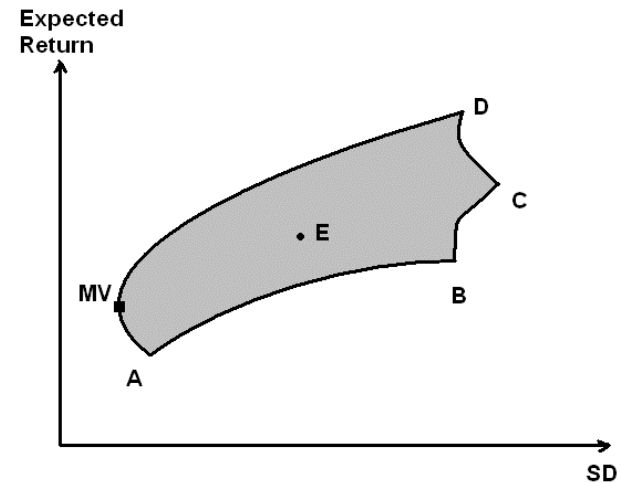
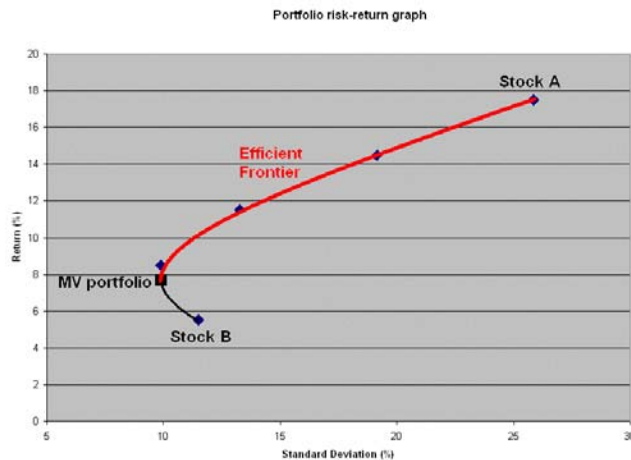
# Review continued

$$\overline{R}_{portfolio} = X_A \overline{R}_A + X_B \overline{R}_B$$

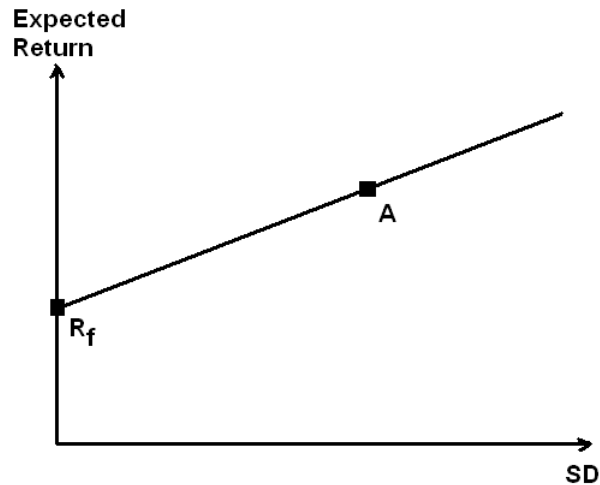
$$\sigma_{portfolio}^2 = X_A^2 \sigma_A^2 + 2X_A X_B \sigma_{AB} + X_B^2 \sigma_B^2$$

$$\sigma_{portfolio}^2 = X_A^2 \sigma_A^2 + 2X_A X_B \rho_{AB} \sigma_A \sigma_B + X_B^2 \sigma_B^2$$

$$\sigma_{portfolio} = \sqrt{\sigma_{portfolio}^2}$$

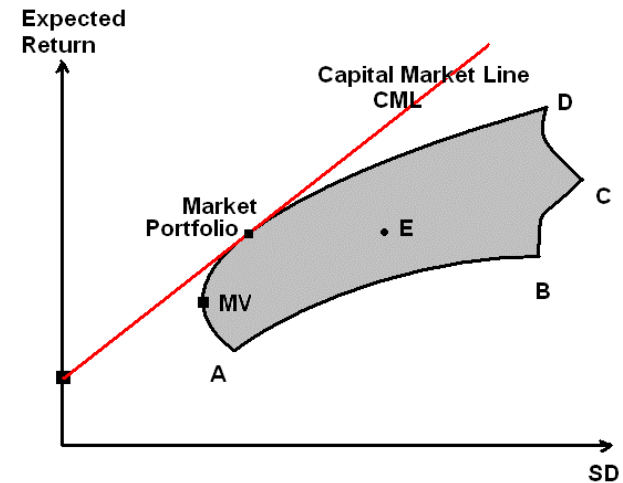
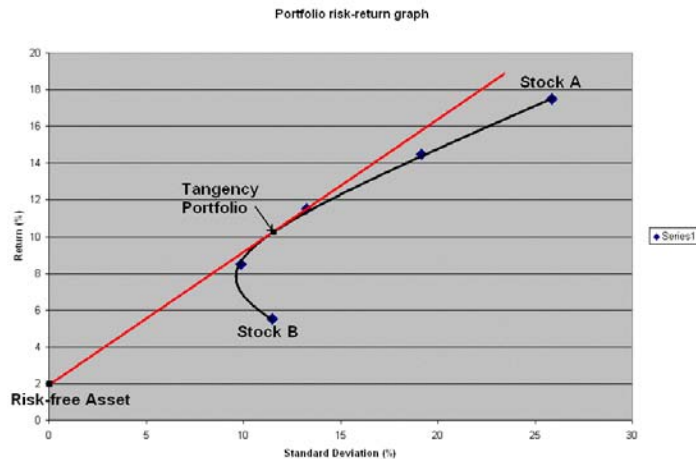


# Review (risk-free assets)



$$\overline{R}_{port} = X_A \overline{R}_A + X_{Rf} \overline{R}_{Rf}$$

$$\sigma_{port} = X_A \sigma_A + X_{Rf} \sigma_{Rf}$$



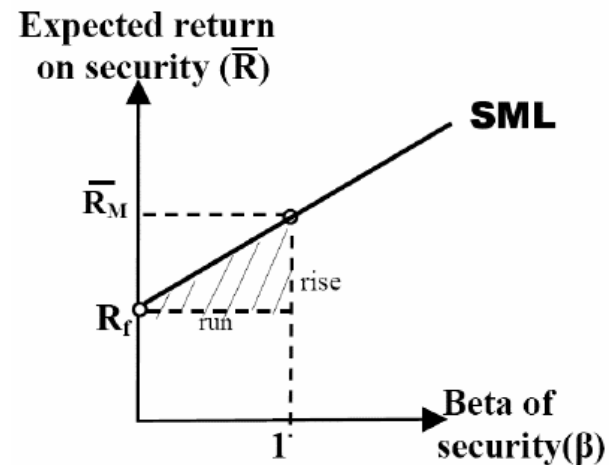
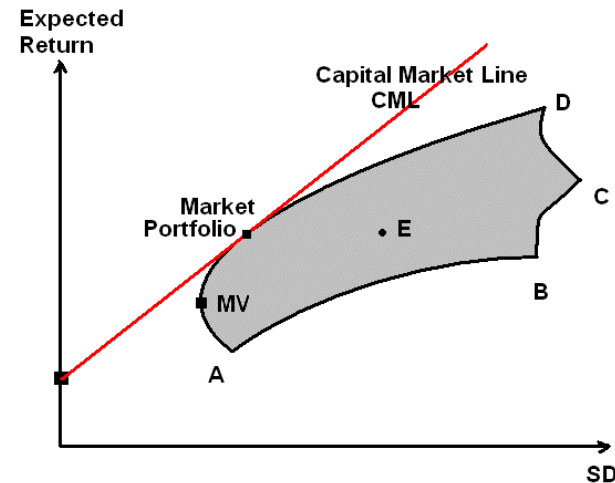
# Review (Last)

$$\text{CML} : \bar{R}_i = R_{rf} + \text{EMRP} \cdot \frac{\sigma_i}{\sigma_M}$$

$$\beta_i = \frac{\text{Cov}(R_i, R_M)}{\text{Var}(R_M)}$$

CAPM : (SML)

$$\bar{R}_i = R_{rf} + (\bar{R}_M - R_{rf})\beta_i$$



# One more Review sheet (on Beta)

$$\beta_{\text{assets}} = \frac{\text{Equity}}{\text{Debt} + \text{Equity}} \beta_{\text{equity}} + \frac{\text{Debt}}{\text{Debt} + \text{Equity}} \beta_{\text{debt}}$$

$$\begin{aligned} \beta_{\text{assets}} &= \frac{E}{D+E} \beta_{\text{equity}} + \frac{D}{D+E} \beta_{\text{debt}} = \frac{E}{D+E} \beta_{\text{equity}} + \frac{D}{D+E} \cdot 0 \\ &= \frac{E}{D+E} \beta_{\text{equity}} \end{aligned}$$

Rearranging,

$$\beta_{\text{equity}} = \beta_{\text{assets}} \frac{D+E}{E} = \beta_{\text{assets}} \left( 1 + \frac{D}{E} \right)$$

$$r_{\text{WACC}} = \frac{S}{S+B} r_S + \frac{B}{S+B} r_B (1 - T_C)$$

## *Sample Midterm (From Fall, 2004)*

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Suppose that the return on the risk-free asset is 3% and the market risk premium is 8%. The capital structure of Toyota consists of equity and debt. There is a risk of default on the debt, and its beta equals 0.5. The equity has a beta of 1.

Toyota is considering an investment project with an expected return of 8%. The risk of the project is about the same as Toyota as a whole.

What debt-equity ratio would make it worthwhile for Toyota to undertake the project?

## Question 2

There are two equally likely states and three assets with the following returns:

	Return in state 1	Return in state 2
Asset X	21	33
Asset Y	-9	82
Market	11	48

Francisco has a lower tolerance to risk, and so he holds 80 percent of his invested money in asset X and 20 percent in asset Y.

Byung is less risk-averse, and so he holds twice as large proportion of his money in asset Y.

- (a) Calculate expected return and standard deviation for Francisco's and Byung's portfolios.
- (b) Calculate the Beta of each investor's portfolio.

## Question 3

	Return in state 1	Return in state 2
Asset A	4	4
Asset B	3	20

Marick has \$1,000, which he decided to invest in a diversified portfolio, since he is a rational risk-averse investor. He decided to invest \$400 in the risk-free asset, and the remaining \$600 in the market portfolio. He expects this portfolio to give him a 9% return, with a standard deviation of 10%.

- What is the standard deviation of returns on asset A, on asset B, and on the market portfolio?
- Marick is also considering investing in asset B, which is perfectly correlated with returns on the market portfolio. What is the Beta on asset B?
- Is asset B priced correctly, according to CAPM? Explain.

## *Short questions:*

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The variance of Stock A is .004, the variance of the market is .007 and the covariance between the two is .0026. What is the correlation coefficient?

A portfolio has 50% of its funds invested in Security One and 50% of its funds invested in Security Two. Security One has a standard deviation of 6. Security Two has a standard deviation of 12. The securities have a coefficient of correlation of .5. What is the portfolio variance?

## *More Questions*

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A portfolio contains four assets. Asset 1 has a beta of .8 and comprises 30% of the portfolio. Asset 2 has a beta of 1.1 and comprises 30% of the portfolio. Asset 3 has a beta of 1.5 and comprises 20% of the portfolio. Asset 4 has a beta of 1.6 and comprises the remaining 20% of the portfolio. If the riskless rate is expected to be 3% and the market risk premium is 6%, what is the beta of the portfolio? What is the expected return?

	Stock A	Stock B	Stock C	T Bills	Market
Exp. R	.19	.15	.09	.07	.18
Variance	.0200	.1196	.0205	.0000	.0064
Cov W/M	.007	.0045	.0013	.0000	.0064

Using the CAPM, calculate the expected return for Stock's A, B, and C. Which stocks would you recommend purchasing?

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Slippery Slope Roof Contracting has an equity beta of 1.2, capital structure with  $\frac{2}{3}$  debt, and a zero tax rate. What is their asset beta?

The NuPress Valet Co. has an improved version of its hotel stand. The investment cost is expected to be \$72 million and will return \$13.5 million for 5 years in net cash flows. The ratio of debt to equity is 1 to 1. The cost of equity is 13%, the cost of debt is 9%, and the tax rate is 34%. What is the NPV of the project?