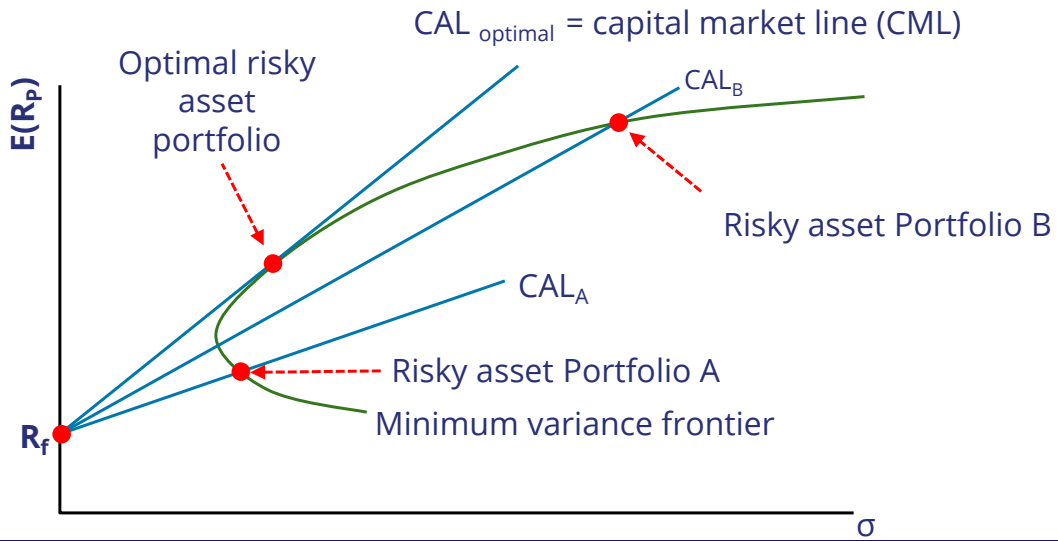
Portfolio Management

Portfolio Risk and Return: Part 2

Exam Focus

- Optimal portfolio
- Systematic and unsystematic risk
- Return-generating models
- CAPM, SML, and CML
- Portfolio performance evaluation

Adding a Risk-Free Security to the Model



Systematic and Unsystematic Risk

Systematic risk + unsystematic risk = total risk

Systematic risk (market risk)

- Caused by **macro factors**: interest rates, GDP growth, supply shocks
- Measured by covariance of returns with returns on the market portfolio

Unsystematic risk (firm-specific risk, diversifiable risk)

- Can be reduced/eliminated by holding a **well-diversified portfolio**

Capital asset model result

- Only **systematic** risk must be rewarded with higher expected returns

Types of Risk: Example

The issuer-specific component of the variability in a stock's total return that is unrelated to overall market variability is known as:

A. systematic risk.

B. non-diversifiable risk.

C. unsystematic risk.

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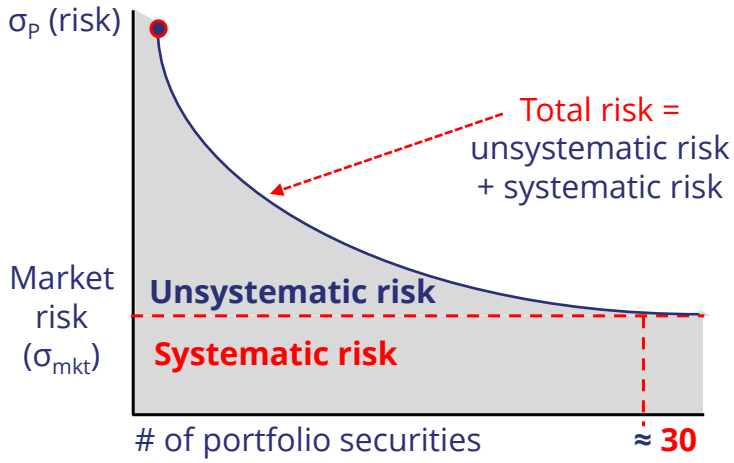
A Well-Diversified Portfolio



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Portfolio Diversification: Example

Which of the following statements concerning portfolio diversification is *most likely* correct?

A. By increasing the number of securities in a portfolio, total risk would be expected to fall at a decreasing rate.

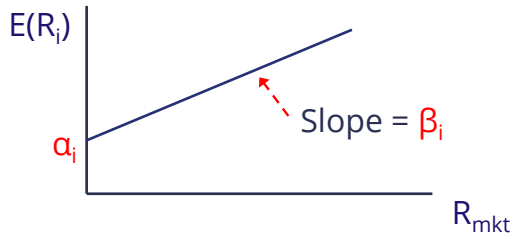
B. Diversification reduces the portfolio's expected return because diversification reduces a portfolio's total risk.

C. The benefits of diversification are not realized until at least 25 individual securities are included in the portfolio.

Return-Generating Models

Market model: $R_i = \alpha_i + \beta_i R_{mkt} + e_i$

- *Linear* relation, slope = β_i, intercept = α_i
- One risk factor, market return over the period
- β_i is the sensitivities of asset returns to market return



Return-Generating Models

Fama-French three-factor model

Risk factors

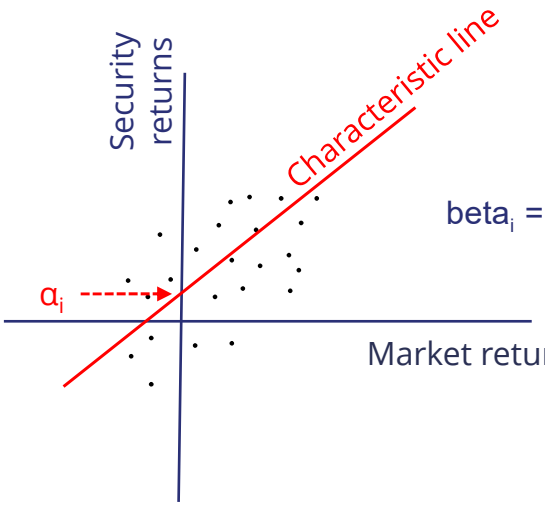
1. Firm size
2. Book-to-market ratio

} Added these two factors to market model

3. Excess return on the market portfolio ($R_M - R_f$)

Carhart added a fourth factor: momentum

Estimating Beta With Market Model



$$R_i = alpha_i + (beta_i \times R_{mkt}) + e_i$$

$$beta_i = \frac{cov_{i,mkt}}{\sigma^2_{mkt}} = slope$$

Portfolio beta is value-weighted average of the portfolio assets' betas

CAPM Assumptions

$$R_i = R_f + \beta_i (R_{mkt} - R_f)$$

- Investors are **risk-averse**, **utility-maximizing**, rational individuals
- Homogeneous **expectations**
- Investors have same **one-period time horizon**
- **Infinitely divisible** assets
- **Frictionless** markets
- No inflation and **unchanging interest rates**
- Capital markets are in equilibrium; **investors are price takers**

CAPM: Example

Market return = 8%

Risk-free rate = 1.5%

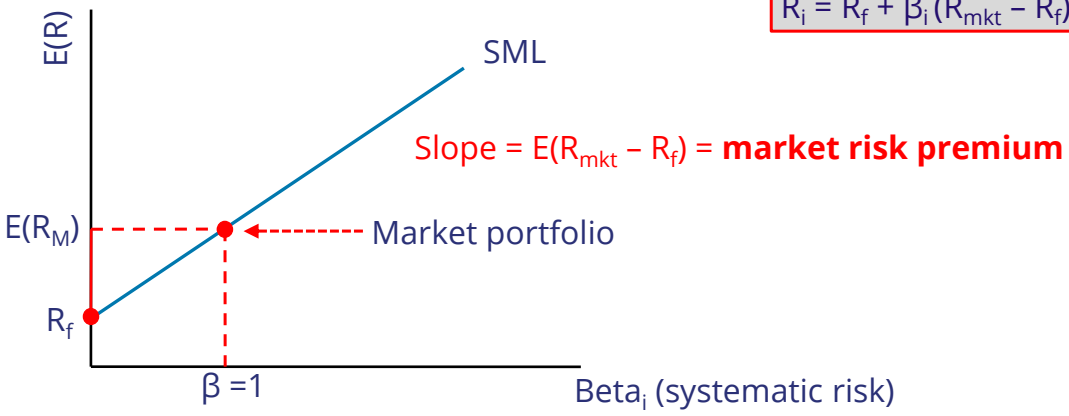
Beta for ABC stock = 1.06

r_i =

r_i =

Security Market Line

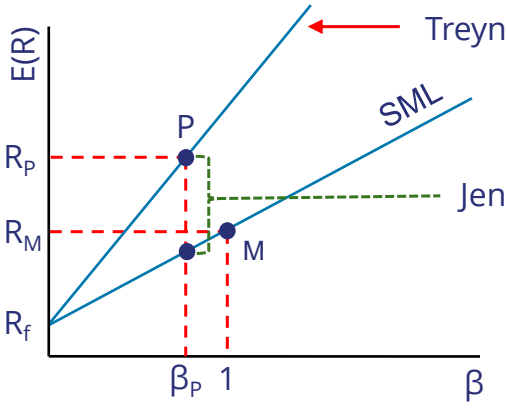
$R_i = R_f + \beta_i (R_{mkt} - R_f)$



Portfolio Performance Evaluation

- Sharpe ratio
- Treynor ratio
- M^2 alpha
- Jensen's alpha

Evaluation With Risk = Beta

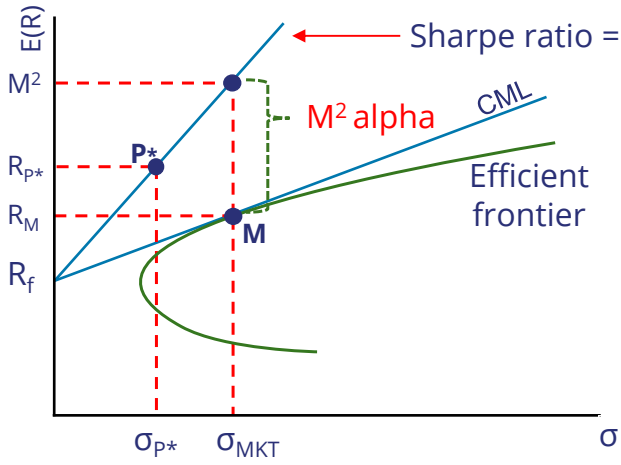


Treynor ratio = slope = $(R_P - R_f) / \beta_P$

Jensen's alpha = $R_P - [R_f + \beta_P (R_M - R_f)]$

Risk (beta) adjusted performance relative to the market portfolio: best for *well-diversified* portfolios

Evaluation With Risk = Standard Deviation



Sharpe ratio = slope = $(R_{P*} - R_f)/\sigma_{P*}$

$$M^2 = R_f + (R_{P*} - R_f)\left(\frac{\sigma_m}{\sigma_{P*}}\right)$$

Risk (std. dev.) adjusted performance relative to the market portfolio: best for *concentrated* portfolios

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Portfolio Performance Evaluation: Example

	Average Return %	σ %	β
Manager	10	20	1.1
Market	9	19	
Risk-free rate	3		

Calculate expected return, Sharpe ratio, Treynor ratio, M^2 alpha, and Jensen's alpha.

E(R) =

Treynor = vs. market

Jensen's alpha =

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Source: CFA Institute. Used with permission.

Portfolio Performance Evaluation: Solution

	Average Return %	σ %	β
Manager	10	20	1.1
Market	9	19	
Risk-free rate	3		

Sharpe manager =

Sharpe market =

M^2 =

M^2 alpha =

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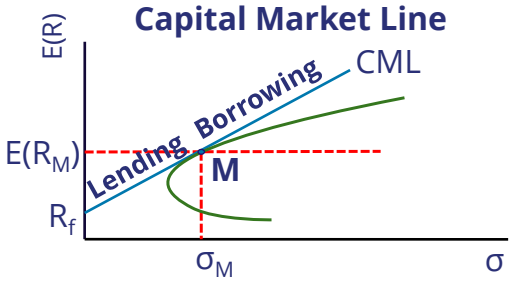
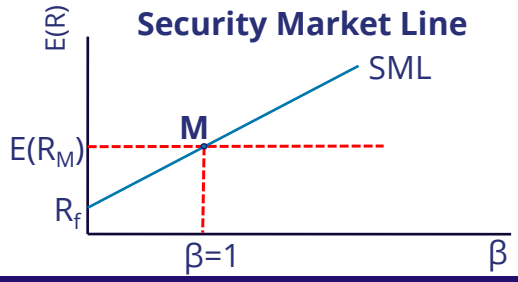
CML vs. SML





CML has only **efficient portfolios**

CML based on **total risk** (σ)

Any asset or portfolio plots on the SML in equilibrium

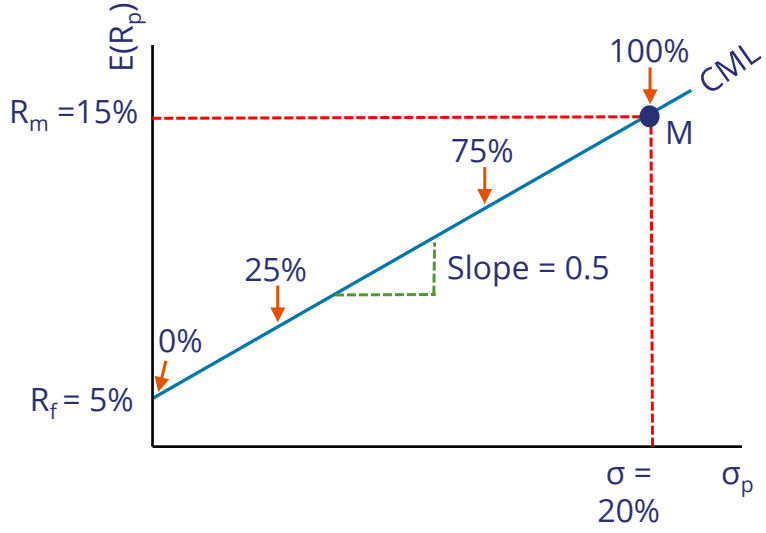
SML based on **systematic risk** (β)

Capital Market Line: Example

- **Investor portfolio**
  - U.S. T-bills: 5% return
  - S&P 500 Index fund: expected return = 15%, σ = 20%
- **Construct CML**
  - Mark points where investment in the market is 0%, 25%, 75%, and 100%
- **Determine exact risk and return at each point**

Source: CFA Institute. Used with permission.

Capital Market Line: Solution



E(R) 25% mkt =

σ =

E(R) 75% mkt =

σ =

$$\text{slope} = \frac{(0.15 - 0.05)}{0.2} = 0.5$$

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Source: CFA Institute. Used with permission.

Solutions

Types of Risk: Example

The issuer-specific component of the variability in a stock's total return that is unrelated to overall market variability is known as:

A. systematic risk.

B. non-diversifiable risk.

C. unsystematic risk.

Unsystematic risk is unique to a single security, business, industry, or country and may be reduced by diversification.

-1

Portfolio Diversification: Example

Which of the following statements concerning portfolio diversification is *most likely* correct?

A. By increasing the number of securities in a portfolio, total risk would be expected to fall at a decreasing rate.

B. Diversification reduces the portfolio's expected return because diversification reduces a portfolio's total risk.

C. The benefits of diversification are not realized until at least 25 individual securities are included in the portfolio.

As more securities are added to a portfolio, diversification benefits begin to diminish. The main attraction of diversification is the reduction of risk without an accompanying loss of return.

CAPM: Example

Market return = 8%

Risk-free rate = 1.5%

Beta for ABC stock = 1.06

$r_i = 1.5\% + 1.06(8\% - 1.5\%)$

$r_i = 8.39\%$

Portfolio Performance Evaluation: Example

	Average Return %	σ %	β
Manager	10	20	1.1
Market	9	19	
Risk-free rate	3		

Calculate expected return, Sharpe ratio, Treynor ratio, M^2 alpha, and Jensen's alpha.

E(R) = 0.03 + 1.10 (0.09 – 0.03) = 9.6%

Treynor = (0.10 – 0.03) / 1.1 = 0.064 vs. market

Jensen's alpha = 0.10 – [0.03 + 1.1(0.09 – 0.03)] = 0.40%

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Source: CFA Institute. Used with permission.

Portfolio Performance Evaluation: Solution

	Average Return %	σ %	β
Manager	10	20	1.1
Market	9	19	
Risk-free rate	3		

Sharpe manager = (0.10 – 0.03) / 0.20 = 0.35

Sharpe market = (0.09 – 0.03) / 0.19 = 0.32

M^2 = 0.35 × 0.19 + 0.03 = 9.65%

M^2 alpha = 9.65% – 9% = 0.65%

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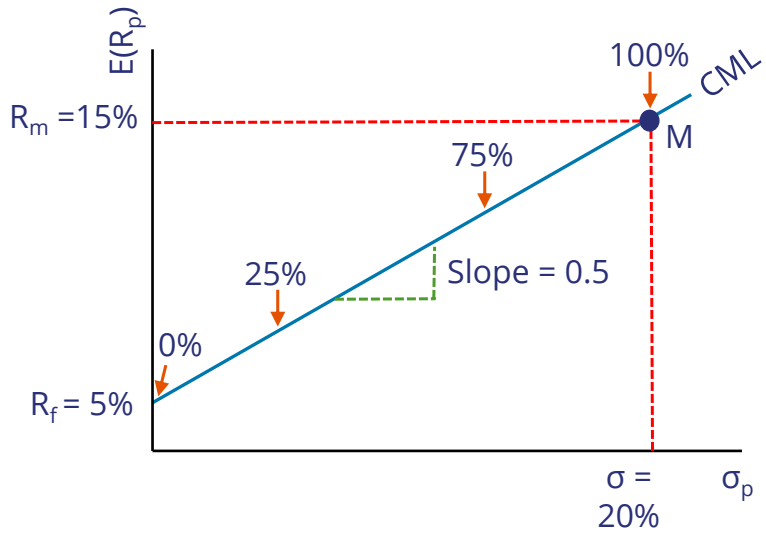
Capital Market Line: Solution



E(R) 25% mkt = (0.75 × 5%) + (0.25 × 15%) = 7.5%,
σ = 0.25 × 20% = 5%

E(R) 75% mkt = (0.25 × 5%) + (0.75 × 15%) = 12.5%,
σ = 0.75 × 20% = 15%

$$\text{slope} = \frac{(0.15 - 0.05)}{0.2} = 0.5$$

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