

THE CAPITAL ASSET PRICING MODEL (CAPM)

Presented by:
Sachin Goyal
Neeraj Joshi

The Capital Asset Pricing Model

What is it?

- CAPM is a model that provides a framework to determine the required rate of return on an asset and indicates the relationship between return and risk of the asset.

Underlying Assumption

- Market Efficiency
- Risk aversion and mean variance optimization
- Homogeneous expectations
- Single time period
- Risk-free rate

CAPM

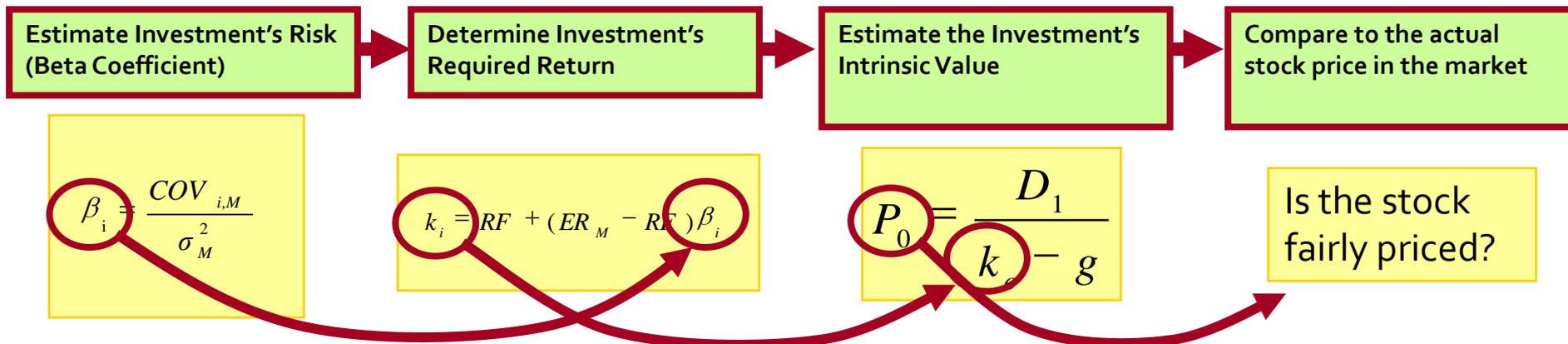
An hypothesis by Professor William F.Sharpe

- Hypothesizes that investors require higher rates of return for greater levels of relevant risk.
 - There are no prices on the model, instead it hypothesizes the relationship between risk and return for individual securities.
 - It is often used, however, the price securities and investments.

The Capital Asset Pricing Model

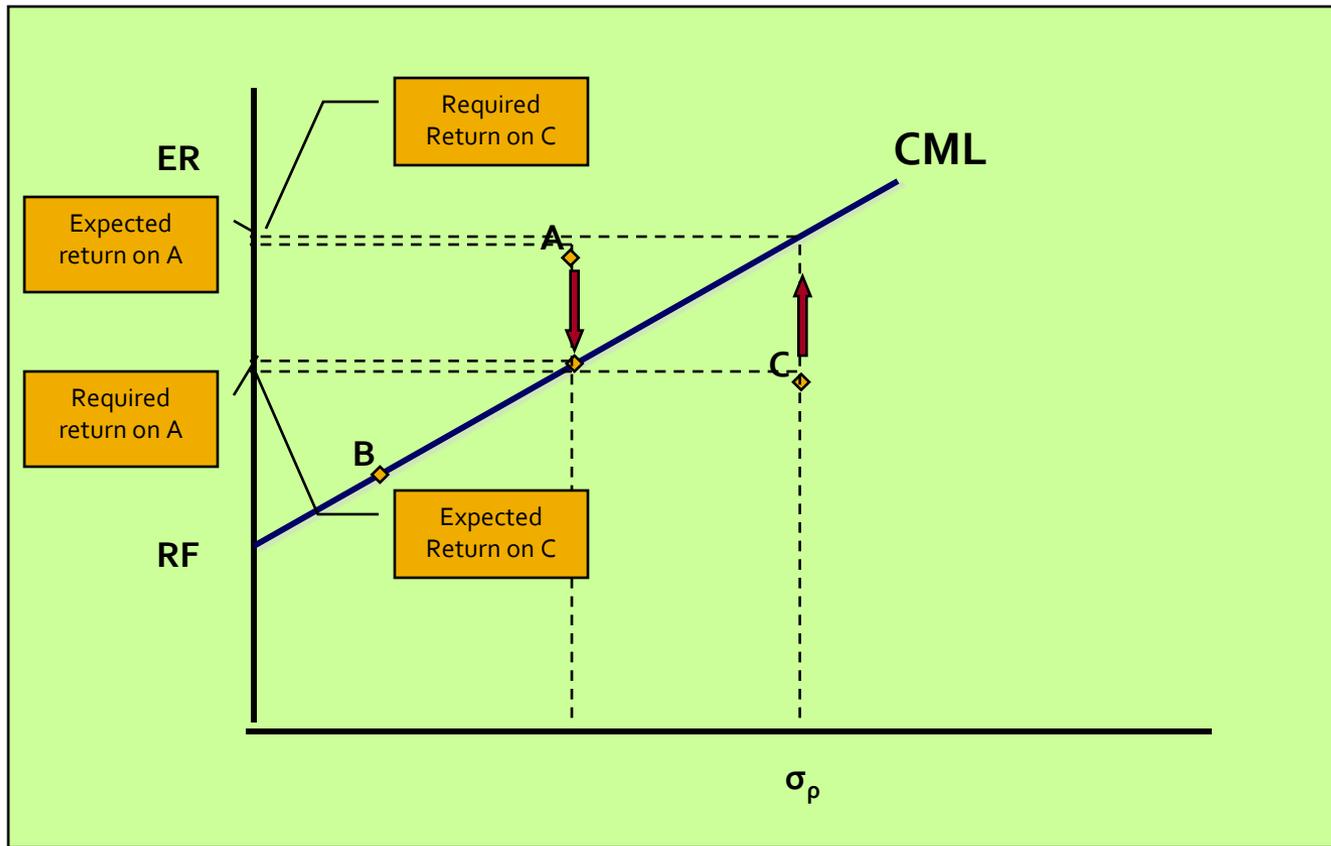
How is it Used?

- Uses include:
 - Determining the cost of equity capital.
 - The relevant risk in the dividend discount model to estimate a stock's intrinsic (inherent economic worth) value. (As illustrated below)



The Capital Asset Pricing Model

Expected and Required Rates of Return



C is an overvalued portfolio. Expected return is less than the required return.

Selling pressure will cause the price to fall and the yield to rise until expected equals the required return.

equals required
(market equilibrium condition is achieved.)

CAPM and Market Risk

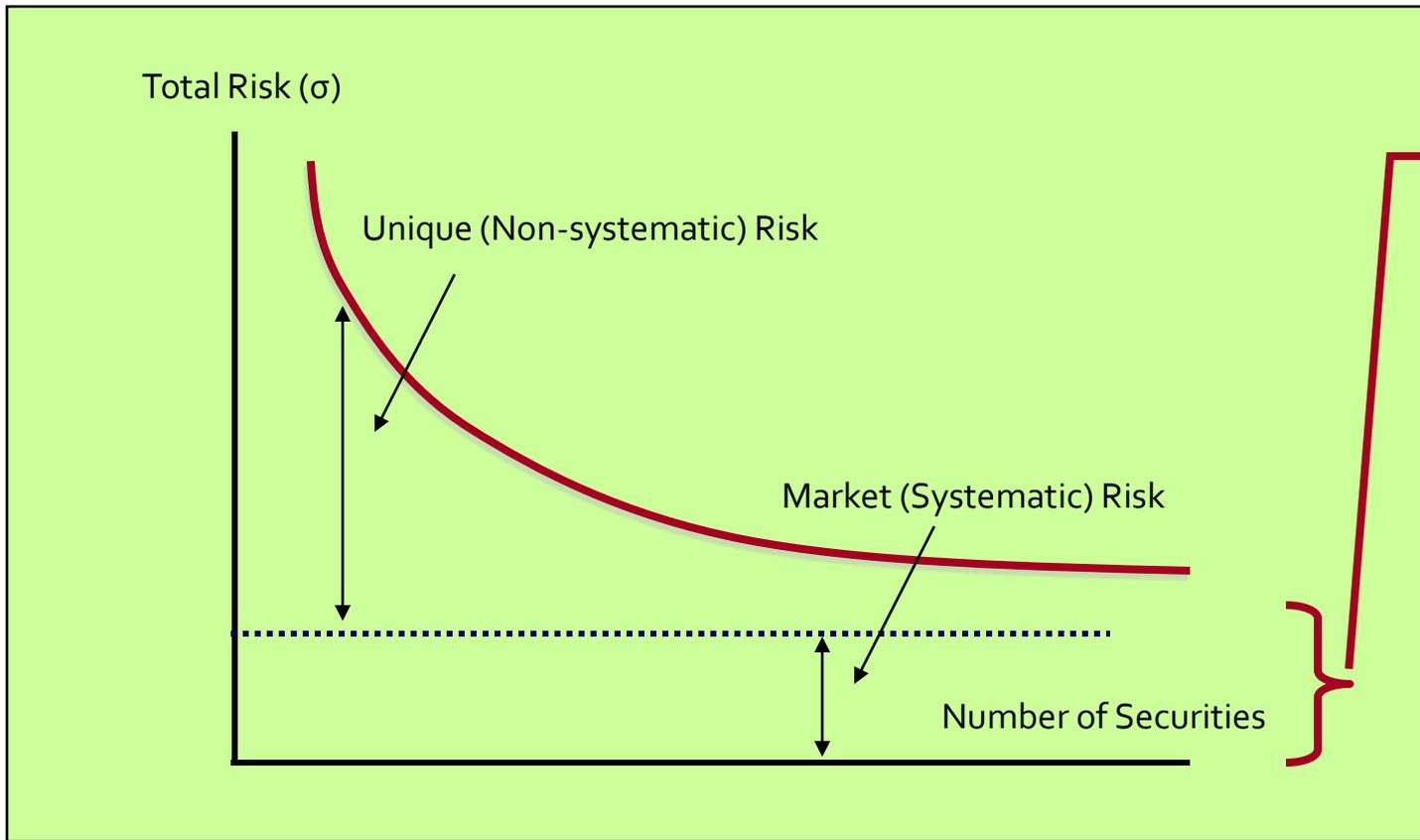
- The Capital Asset Pricing Model

Diversifiable and Non-Diversifiable Risk

- CML applies to efficient portfolios
- Volatility (risk) of *individual security returns* are caused by two different factors:
 - Non-diversifiable risk (system wide changes in the economy and markets that affect all securities in varying degrees)
 - Diversifiable risk (company-specific factors that affect the returns of only one security)

The CAPM and Market Risk

Portfolio Risk and Diversification



Market or systematic risk is risk that cannot be eliminated from the portfolio by investing the portfolio into more and different securities.

Relevant Risk

Drawing a Conclusion from Figure

- Figure demonstrates that an individual securities' volatility of return comes from two factors:
 - Systematic factors
 - Company-specific factors
- When combined into portfolios, company-specific risk is diversified away.
- Since all investors are 'diversified' then in an efficient market, no-one would be willing to pay a 'premium' for company-specific risk.
- Relevant risk to diversified investors then is systematic risk.
- Systematic risk is measured using the Beta Coefficient.

Measuring Systematic Risk

The Beta Coefficient

- The Capital Asset Pricing Model (CAPM)

The Beta Coefficient

What is the Beta Coefficient?

- A measure of systematic (non-diversifiable) risk
- As a 'coefficient' the beta is a pure number and has no units of measure.

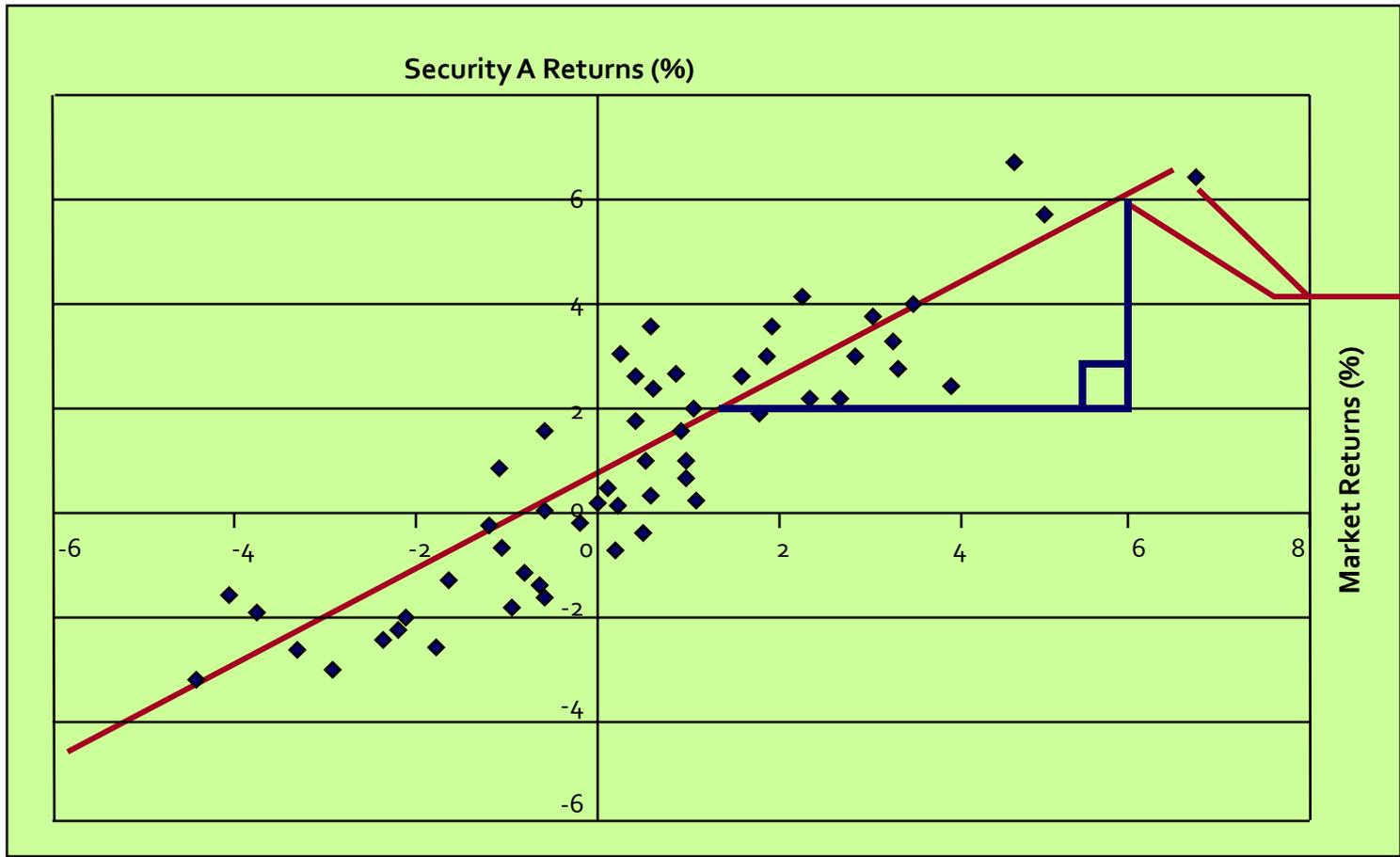
The Beta Coefficient

How Can We Estimate the Value of the Beta Coefficient?

- There are two basic approaches to estimating the beta coefficient:
 1. Using a formula (and subjective forecasts)
 2. Use of regression (using past holding period returns)

The CAPM and Market Risk

The Characteristic Line for Security A



The plotted points are the coincident rates of return earned on the investment and the market portfolio over past periods.

The Formula for the Beta Coefficient

Beta is equal to the covariance of the returns of the stock with the returns of the market, divided by the variance of the returns of the market:

$$\beta_i = \frac{COV_{i,M}}{\sigma_M^2} = \frac{\rho_{i,M} \sigma_i}{\sigma_M}$$

The Beta Coefficient

How is the Beta Coefficient Interpreted?

- The beta of the market portfolio is ALWAYS = 1.0
- The beta of a security compares the volatility of its returns to the volatility of the market returns:
 - $\beta_s = 1.0$ - the security has the same volatility as the market as a whole
 - $\beta_s > 1.0$ - aggressive investment with volatility of returns greater than the market
 - $\beta_s < 1.0$ - defensive investment with volatility of returns less than the market
 - $\beta_s < 0.0$ - an investment with returns that are negatively correlated with the returns of the market

The Security Market Line

- The Capital Asset Pricing Model (CAPM)

The CAPM and Market Risk

The Security Market Line (SML)

- The SML is the hypothesized relationship between return (the dependent variable) and systematic risk (the beta coefficient).
- It is a straight line relationship defined by the following formula:

$$k_i = RF + (ER_M - RF) \beta_i$$

- Where:

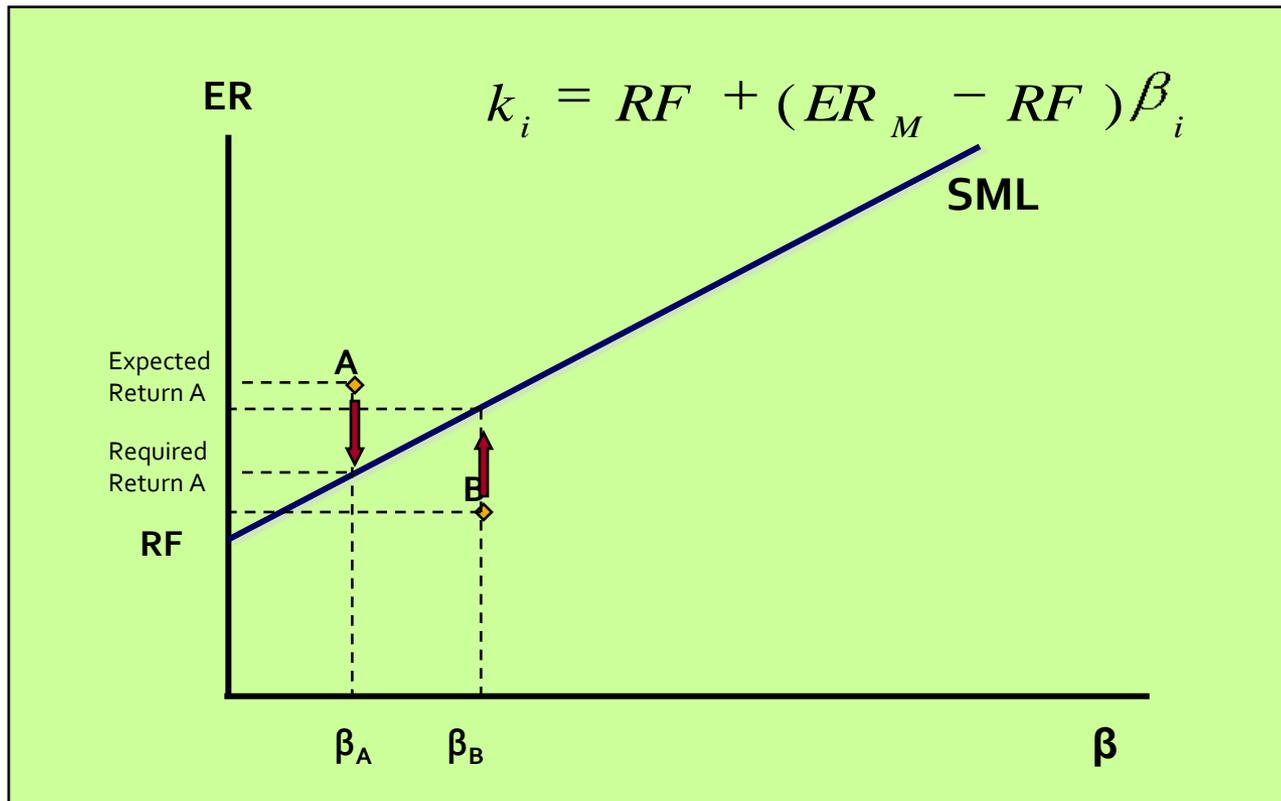
k_i = the required return on security 'i'

$ER_M - RF$ = market premium for risk

B_i = the beta coefficient for security 'i'

The CAPM and Market Risk

The SML and Security Valuation



Similarly, B is an overvalued security.

Investor's will sell to lock in gains, but the selling pressure will cause the market price to fall, causing the expected return to rise until it equals the required return.

The CAPM in Summary

The SML and CML

- The CAPM is well entrenched and widely used by investors, managers and financial institutions.
- It is a single factor model because it based on the hypothesis that required rate of return can be predicted using one factor – systematic risk
- The SML is used to price individual investments and uses the beta coefficient as the measure of risk.
- The CML is used with diversified portfolios and uses the standard deviation as the measure of

Challenges to CAPM

- Empirical tests suggest:
 - CAPM does not hold well in practice:
 - Ex post SML is an upward sloping line
 - Ex ante y (*vertical*) – intercept is higher than RF
 - Slope is less than what is predicted by theory
 - Beta possesses no explanatory power for predicting stock returns (Fama and French, 1992)
- CAPM remains in widespread use despite the foregoing.
 - Advantages include – relative simplicity and intuitive logic.
- Because of the problems with CAPM, other models have been developed including:
 - Fama-French (FF) Model
 - Arbitrage Pricing Theory (APT)
 - Hamada Model

THANKS.....