

# The Capital Asset Pricing Model

The Hypothesized Relationship  
between Risk and Return

# The Capital Asset Pricing Model

What is it?

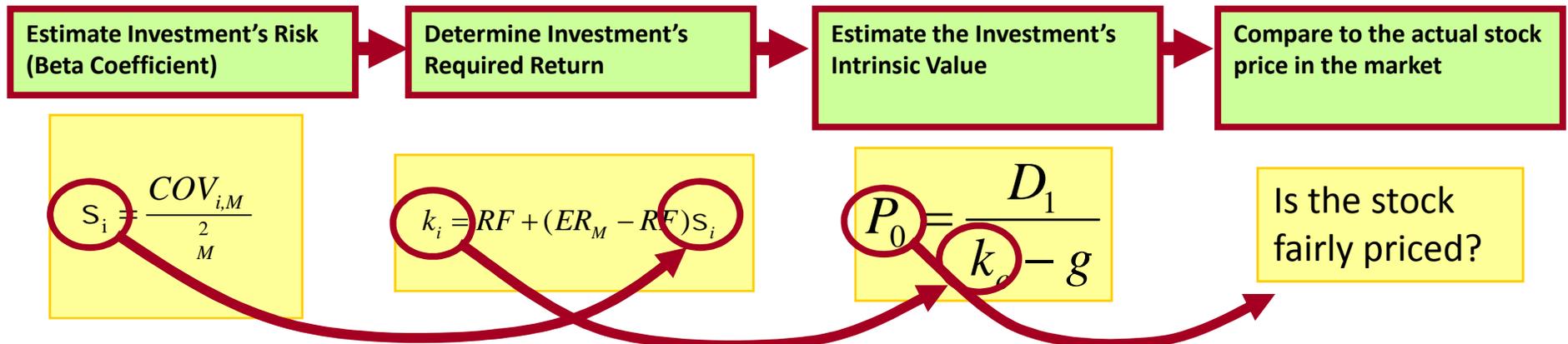
- An hypothesis by Professor William Sharpe
  - Hypothesizes that investors require higher rates of return for greater levels of relevant risk.
  - There are no prices on the model, instead it hypothesizes the relationship between risk and return for individual securities.
  - It is often used, however,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

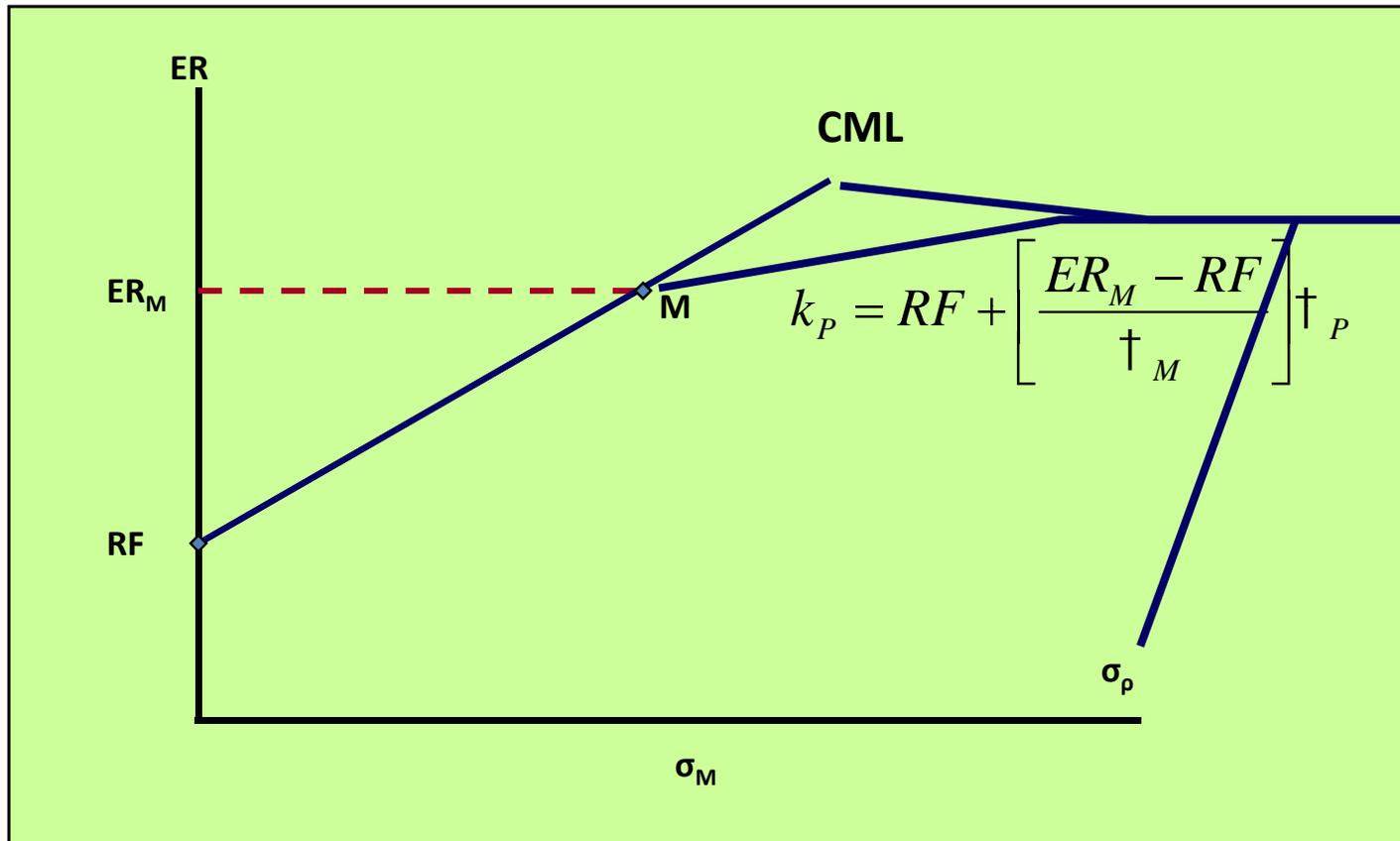
## Assumptions

- CAPM is based on the following assumptions:
  1. All investors have identical expectations about expected returns, standard deviations, and correlation coefficients for all securities.
  2. All investors have the same one-period investment time horizon.
  3. All investors can borrow or lend money at the risk-free rate of return (RF).
  4. There are no transaction costs.
  5. There are no personal income taxes so that investors are indifferent between capital gains and dividends.
  6. There are many investors, and no single investor can affect the price of a stock through his or her buying and selling decisions. Therefore, investors are price-takers.
  7. Capital markets are in equilibrium.

# Market Portfolio and Capital Market Line

- The assumptions have the following implications:
  1. The “optimal” risky portfolio is the one that is tangent to the efficient frontier on a line that is drawn from RF. This portfolio will be the same for all investors.
  2. This optimal risky portfolio will be the *market portfolio* (M) which contains all risky securities.

# The Capital Market Line



The CML has standard deviation of portfolio returns as the independent variable.

# The Capital Asset Pricing Model

## The Market Portfolio and the Capital Market Line (CML)

- The slope of the CML is the incremental expected return divided by the incremental risk.

$$\text{Slope of the CML} = \frac{ER_M - RF}{\sigma_M}$$

- This is called **the market price for risk**. Or
- The equilibrium price of risk in the capital market.

# The Capital Asset Pricing Model

## The Market Portfolio and the Capital Market Line (CML)

- Solving for the expected return on a portfolio in the presence of a RF asset and given the market price for risk :

$$E(R_P) = RF + \left[ \frac{ER_M - RF}{\sigma_M} \right] \sigma_P$$

- Where:
  - $ER_M$  = expected return on the market portfolio M
  - $\sigma_M$  = the standard deviation of returns on the market portfolio
  - $\sigma_P$  = the standard deviation of returns on the efficient portfolio being considered

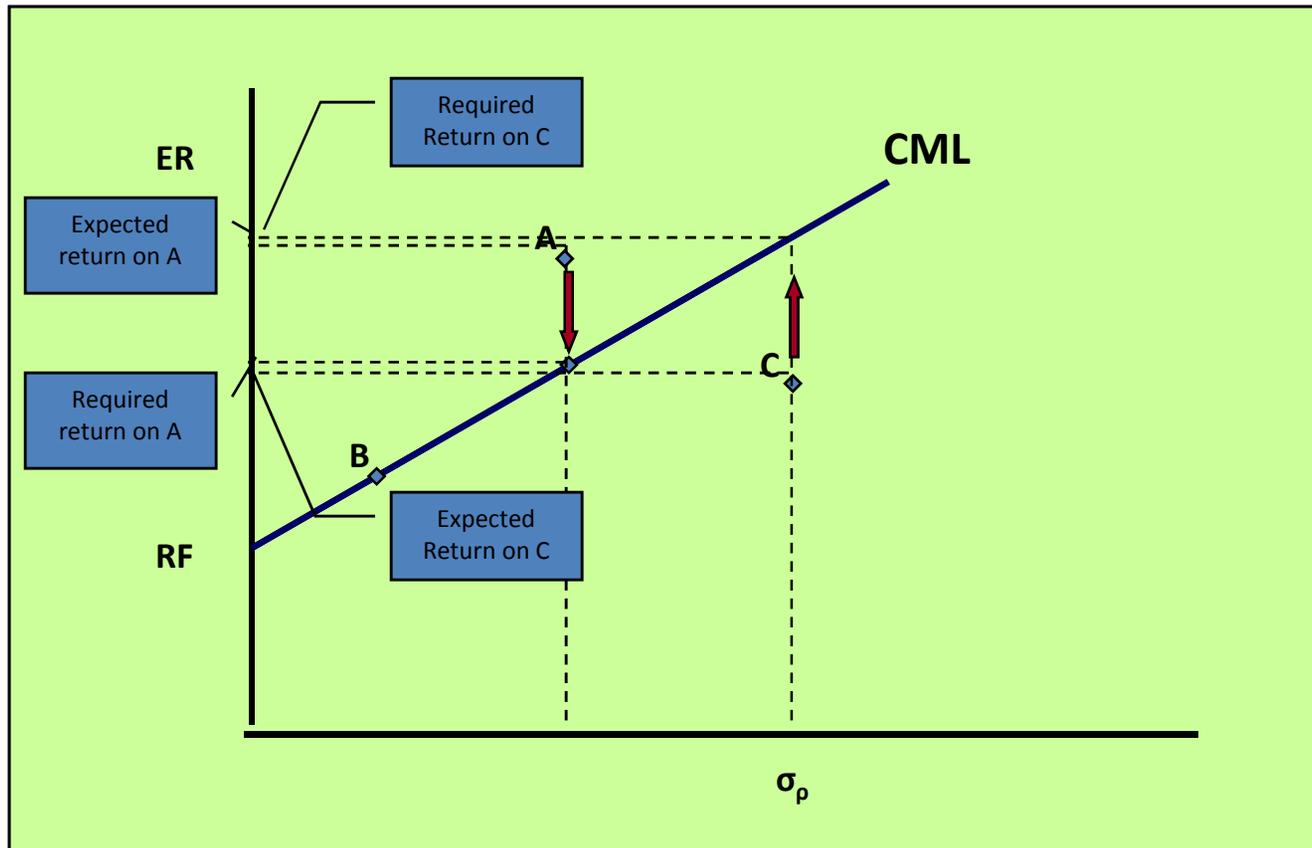
# The Capital Market Line

## Using the CML – Expected versus Required Returns

- In an efficient capital market investors will require a return on a portfolio that compensates them for the risk-free return as well as the market price for risk.
- This means that portfolios should offer returns along the CML.

# 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.)

# The Capital Asset Pricing Model

## Risk-Adjusted Performance and the Sharpe Ratios

- William Sharpe identified a ratio that can be used to assess the risk-adjusted performance of managed funds (such as mutual funds and pension plans).
- It is called the Sharpe ratio:

$$\text{Sharpe ratio} = \frac{ER_P - RF}{\sigma_P}$$

- Sharpe ratio is a measure of portfolio performance that describes how well an asset's returns compensate investors for the risk taken.
- It's value is the premium earned over the RF divided by portfolio risk...so it is measuring value added per unit of risk.
- Sharpe ratios are calculated ex post (after-the-fact) and are used to rank portfolios or assess the effectiveness of the portfolio manager in adding value to the portfolio over and above a benchmark.

# The Capital Asset Pricing Model

## Sharpe Ratios and Income Trusts

- Following slide illustrates return, standard deviation, Sharpe and beta coefficient for four very different portfolios from 2012 to 2014.
- Income Trusts did exceedingly well during this time, however, the recent announcement of Finance Minister and the subsequent drop in Income Trust values has done much to eliminate this historical performance.

# Income Trust Estimated Values

## Income Trusts Estimated Values

	Return	$\rho$	Sharpe	
Median income trusts	25.83%	18.66%	1.37	0.22
Equally weighted trust portfolio	29.97%	8.02%	3.44	0.28
Composite Index	8.97%	13.31%	0.49	1.00
Government bond index	9.55%	6.57%	1.08	20.02