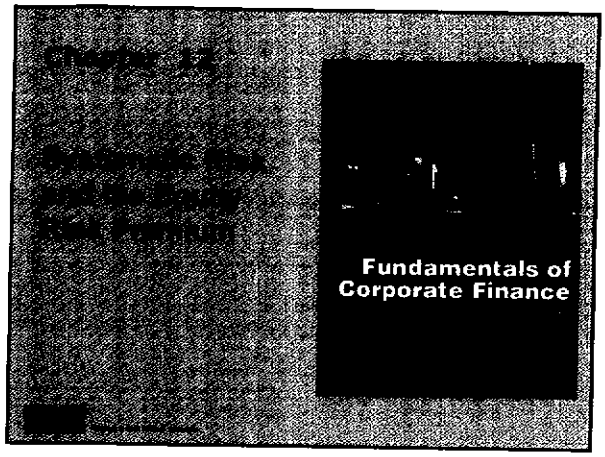
Fin 320

Sections: 4, 5 and 11



Chapter Outline

12.1 The Expected Return of a Portfolio
12.2 The Volatility of a Portfolio
12.3 Measuring Systematic Risk
12.4 Putting it All Together: The Capital Asset Pricing Model

Learning Objectives

- Calculate the expected return and volatility (standard deviation) of a portfolio
- Understand the relation between systematic risk and the market portfolio
- Measure systematic risk
- Use the Capital Asset Pricing Model (CAPM) to compute the cost of equity capital for a stock

Dr. Nadhem Al-Saleh

12.1 The Expected Return of a Portfolio

- In Chapter 11 we found:
  - For large portfolios, investors expect higher returns for higher risk.
  - The same does not hold true for individual stocks.
  - Stocks have both unsystematic and systematic risk
    - only systematic risk is rewarded
    - rational investors should choose to diversify.

12.1 The Expected Return of a Portfolio

- Portfolio weights
  - The fraction of the total portfolio held in each investment in the portfolio:

$$w_i = \frac{\text{Value of investment } i}{\text{Total value of portfolio}} \quad \text{(Eq. 12.1)}$$

  - Portfolio weights add up to 100% (that is, w1 + w2 + ... + wN = 100%)

12.1 The Expected Return of a Portfolio

- Portfolio weights for a portfolio of 200 shares of Apple at $200 per share and 100 shares of Coca-Cola at $60 per share:

$$w_{Apple} = \frac{200 \times \$200}{100,000} = 40\% \qquad w_{Coca\text{-}Cola} = \frac{1000 \times \$60}{100,000} = 60\%$$

12.1 The Expected Return of a Portfolio

- The return on a portfolio, Rp
  - The weighted average of the returns on the investments in the portfolio:

$$R_p = w_1R_1 + w_2R_2 + \ldots + w_nR_n \quad \text{(Eq. 12.2)}$$

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Example 12.1 Calculating Portfolio Returns

Problem:

- Suppose you invest $100,000 and buy 200 shares of Apple at $200 per share ($40,000) and 1000 shares of Coca-Cola at $60 per share ($60,000).
- If Apple's stock goes up to $240 per share and Coca-Cola stock falls to $57 per share and neither paid dividends, what is the new value of the portfolio?
- What return did the portfolio earn?

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Example 12.1 Calculating Portfolio Returns

Problem (cont'd):

- Show that Eq. 12.2 is true by calculating the individual returns of the stocks and multiplying them by their weights in the portfolio.
- If you don't buy or sell any shares after the price change, what are the new portfolio weights?

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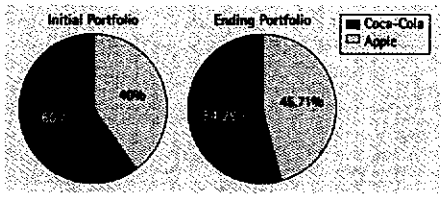
Example 12.1 Calculating Portfolio Returns

Evaluate

The charts below show the initial and ending weights on Apple (shown in yellow) and Coca-Cola (shown in red).



12.1 The Expected Return of a Portfolio

- The expected return of a portfolio
  - The weighted average of the expected returns of the investments within it, using the portfolio weights:

$$E[R_P] = w_1 E[R_1] + w_2 E[R_2] + \ldots + w_n E[R_n]$$

(Eq. 12.3)

Table 12.1 Summary of Portfolio Concepts

Term	Concept	Equation
Portfolio weight	The relative investment in your portfolio	w_j = Value of Investment j / Total Value of Portfolio
Portfolio return	The total return earned on your portfolio, accounting for the returns of all of the securities in the portfolio and their weights	$R_P = w_1 R_1 + w_2 R_2 + \cdots + w_n R_n$
Portfolio expected return	The return you can expect to earn on your portfolio, given the expected returns of the securities in that portfolio and the relative amount you have invested in each	$E[R_P] = w_1 E[R_1] + w_2 E[R_2] + \cdots + w_n E[R_n]$

Example 12.2 Portfolio Expected Return

Problem:

- Suppose you invest $10,000 in Boeing (BA) stock, and $30,000 in Merck (MRK) stock. You expect a return of 10% for Boeing, and 16% for Merck. What is the expected return for your portfolio?

Example 12.2 Portfolio Expected Return

Execute:

- The expected return on your portfolio is:

$$E[R_P] = w_{BA}E[R_{BA}] + w_{MRK}E[R_{MRK}]$$
$$E[R_P] = 0.25 \times 10\% + 0.75 \times 16\% = 14.5\%$$

12.2 The Volatility of a Portfolio

- Investors care about return, but also risk
- When we combine stocks in a portfolio, some risk is eliminated through diversification.
  - Remaining risk depends upon the degree to which the stocks share common risk.
  - The volatility of a portfolio is the total risk, measured as standard deviation, of the portfolio.

12.2 The Volatility of a Portfolio

- Table 12.2 shows returns for three hypothetical stocks, along with their average returns and volatilities.
- Note that while the three stocks have the same volatility and average return, the pattern of returns differs.
- When the airline stocks performed well, the oil stock did poorly, and when the airlines did poorly, the oil stock did well.

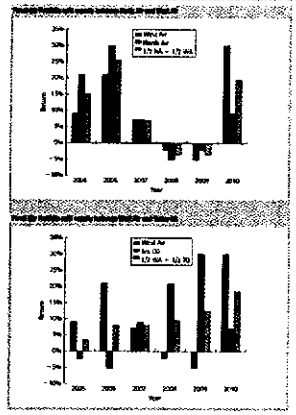
Table 12.2 Returns for Three Stocks, and Portfolios of Pairs of Stocks

	Stock Returns			Portfolio Returns	
Year	North Air	West Air	Tex Oil	(1) Half N.A. and Half W.A.	(2) Half W.A. and Half T.O.
2005	21%	9%	−2%	15.0%	3.5%
2006	30%	21%	−5%	25.5%	8.0%
2007	7%	7%	9%	7.0%	8.0%
2008	−5%	−2%	21%	−3.5%	9.5%
2009	−2%	−5%	30%	−3.5%	12.5%
2010	9%	30%	7%	19.5%	18.5%
Avg. Return	10.0%	10.0%	10.0%	10.0%	10.0%
Volatility	13.4%	13.4%	13.4%	12.1%	5.1%

12.2 The Volatility of a Portfolio

- Table 12.2 shows returns for two portfolios:
  - An equal investment in the two airlines, North Air and West Air.
  - An equal investment in West Air and Tex Oil.
- Average return of both portfolios is equal to the average return of the stocks
- Volatilities (standard deviations) are very different.

Figure 12.1
Volatility of Airline and Oil Portfolios



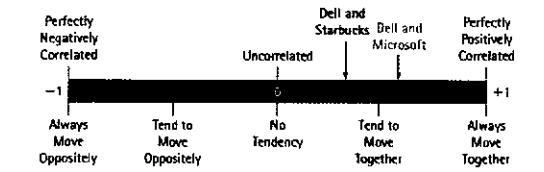
12.2 The Volatility of a Portfolio

- This example demonstrates two important truths.
  - By combining stocks into a portfolio, we reduce risk through diversification.
  - The amount of risk that is eliminated depends upon the degree to which the stocks move together.
- Combining airline stocks reduces volatility only slightly compared to the individual stocks.
- Combining airline and oil stocks reduces volatility below that of either stock.

12.2 The Volatility of a Portfolio

- Measuring Stocks' Co-movement: Correlation
  - To find the risk of a portfolio, we need to know
    - The risk of the component stocks
    - The degree to which they move together
  - Correlation ranges from -1 to +1, and measures the degree to which the returns share common risk.

Figure 12.2 Correlation



Source: Author's calculations based on data from money.central.msn.com.

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12.2 The Volatility of a Portfolio

- Correlation is scaled covariance and is defined as

$$Corr(R_i, R_j) = \frac{Cov(R_i, R_j)}{SD(R_i)\,SD(R_j)}$$

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12.2 The Volatility of a Portfolio

- Stock returns tend to move together if they are affected similarly by economic events.
  - Stocks in the same industry tend to have more highly correlated returns than stocks in different industries.
- Table 12.3 shows several stocks'
  - Volatility of individual stock returns
  - Correlation between them
  - The table can be read across rows or down columns.

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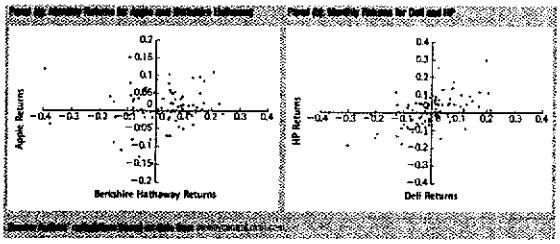
Table 12.3 Estimated Annual Volatilities and Correlations for Selected Stocks. (Based on Monthly Returns, June 2002- May 2010)

Standard Deviation	Apple 48%	Microsoft 30%	Target 31%	Starbucks 39%	Dell 39%	HP 32%	Berkshire Hathaway 29%
Apple		0.40	0.33	0.37	0.47	0.37	
Microsoft	0.40		0.36	0.36		0.52	0.32
Target	0.33	0.36		0.49	0.40	0.44	0.37
Starbucks	0.37	0.36	0.49		0.38	0.37	0.27
Dell	0.47		0.40	0.38		0.50	0.21
HP	0.37	0.52	0.44	0.37	0.50		0.33
Berkshire Hathaway		0.32	0.37	0.27	0.21	0.33	

Source: Authors' calculations based on data from moneycentral.msn.com.

Figure 12.3 Scatterplots of Returns



12.2 The Volatility of a Portfolio

- Computing a Portfolio's Variance and Standard Deviation
  - The formula for the variance of a two-stock portfolio is:

$$Var(R_P) = \overbrace{w_1^2 SD(R_1)^2}^{\text{Accounting for the risk of stock 1}} + \overbrace{w_2^2 SD(R_2)^2}^{\text{Accounting for the risk of stock 2}} + \overbrace{2w_1 w_2 Corr(R_1, R_2) SD(R_1) SD(R_2)}^{\text{Adjustment for how much the two stocks move together}}$$

(Eq. 12.4)

12.2 The Volatility of a Portfolio

- The three parts of Eq. 12.4 each account for an important determinant of the overall variance of the portfolio:
  - the risk of stock 1
  - the risk of stock 2
  - an adjustment for how much the two stocks move together (their correlation, given as Corr(R1,R2)).

12.2 The Volatility of a Portfolio

- Expected return of a portfolio is equal to the weighted average expected return of its stocks.
- Risk of the portfolio is lower than the weighted average of the individual stocks' volatility, unless all the stocks all have perfect positive correlation with each other
  - Diversification

Example 12.4 Reducing Risk Without Sacrificing Return

Problem:

- Based on historical data, your expected annual return for Target is 6% and for Berkshire Hathaway is 5%. What is the expected return and risk (standard deviation) of your portfolio if you only hold Target? If you split your money evenly between Target and Berkshire, what is the expected return and risk of your portfolio?

Example 12.4 Reducing Risk Without Sacrificing Return

Solution:

Plan:

A. From Table 12.3 we can get the standard deviations of Target and Berkshire stock along with their correlation:
$SD(R_{TGT})=0.31$, $SD(R_{BRK})=0.20$, $Corr(R_{TGT},R_{BRK})=0.37$

B. With this information and the information from the problem, we can compute the expected return of the portfolio using Eq. 12.3 and its variance using Eq. 12.4

Example 12.4 Reducing Risk Without Sacrificing Return

Execute:

- For the all-Target portfolio, we have 100% of our money in Target stock, so the expected return and standard deviation of our portfolio is simply the expected return and standard deviation of that stock:

$$E[R_{TGT}] = 0.06,\ SD(R_{TGT}) = 0.31$$

Example 12.4 Reducing Risk Without Sacrificing Return

Execute (cont'd):

- However, when we invest our money 50% in Berkshire and 50% in Target, the expected return is:

$$E[R_p] = w_{BRK}E[R_{BRK}] + w_{TGT}E[R_{TGT}]$$
$$= 0.5(0.05) + 0.5(0.06) = 0.055$$

Example 12.4 Reducing Risk Without Sacrificing Return

Execute (cont'd):

- And the variance is:

$$Var(R_p) = w_{BAC}^2 SD(R_{BAC})^2 + w_{TGT}^2 SD(R_{TGT})^2 + 2w_{BAC}w_{TGT}Corr(R_{BAC},R_{TGT})SD(R_{BAC})SD(R_{TGT})$$
$$= (0.50)^2(0.20)^2 + (0.50)^2(0.31)^2 + 2(0.50)(0.50)(0.37)(0.20)(0.31)$$
$$= 0.0455$$

- The standard deviation in this case is:

$$SD(R_p) = \sqrt{Var(R_p)} = \sqrt{0.0455} = 0.2133, \text{or } 21.33\%$$

Example 12.4a Reducing Risk Without Sacrificing Return

Problem:

- Based on historical data, your expected annual return for Microsoft is 6% and for Starbucks is 8%. What is the expected return and risk (standard deviation) of your portfolio if you only hold Microsoft? If you split your money evenly between Microsoft and Starbucks, what is the expected return and risk of your portfolio?

Example 12.4a Reducing Risk Without Sacrificing Return

Solution:

Plan:

A. From Table 12.3 we can get the standard deviations of Microsoft and Starbuck's stock along with their correlation: $SD(R_{MSFT})=0.28$, $SD(R_{SBUX})=0.39$, $Corr(R_{MSFT},R_{SBUX})=0.36$

B. With this information and the information from the problem, we can compute the expected return of the portfolio using Eq. 12.3 and its variance using Eq. 12.4

Example 12.4a Reducing Risk Without Sacrificing Return

Execute:

- For the all-Microsoft portfolio, we have 100% of our money in Microsoft stock, so the expected return and standard deviation of our portfolio is simply the expected return and standard deviation of that stock:

$$E[R_{MSFT}] = 0.06,\ SD(R_{MSFT}) = 0.28$$

Example 12.4a Reducing Risk Without Sacrificing Return

Execute (cont'd):

- However, when we invest our money 50% in Microsoft and 50% in Starbucks, the expected return is:

$$E[R_p] = w_{MSFT}E[R_{MSFT}] + w_{SBUX}E[R_{MSFT}]$$
$$= 0.5(0.06) + 0.5(0.08) = 0.07$$

Example 12.4a Reducing Risk Without Sacrificing Return

Execute (cont'd):

- And the variance is:

$$Var(R_p) = w_{MSFT}^2 SD(R_{MSFT})^2 + w_{SBUX}^2 SD(R_{SBUX})^2$$
$$+ 2w_{MSFT}w_{SBUX}Corr(R_{MSFT}, R_{SBUX})SD(R_{MSFT})SD(R_{SBUX})$$
$$= (0.50)^2(0.28)^2 + (0.50)^2(0.39)^2 + 2(0.50)(0.50)(0.36)(0.28)(0.39)$$
$$= 0.07728$$

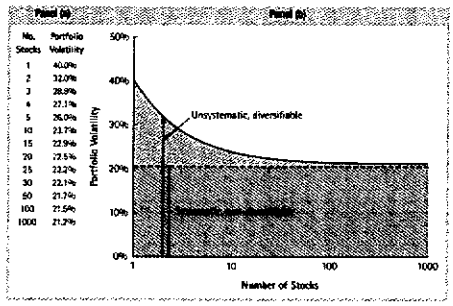
- The standard deviation in this case is:

$$SD(R_p) = \sqrt{Var(R_p)} = \sqrt{0.07728} = 0.278, \text{or } 27.8\%$$

12.2 The Volatility of a Portfolio

- The Volatility of a Large Portfolio
  - Volatility declines as the number of stocks in the equally weighted portfolio grows.
    - Most dramatic initially -going from 1 to 2 stocks reduces risk much more than going from 100 to 101 stocks.
  - Even for a very large portfolio systematic risk remains.

Figure 12.4 Volatility of an Equally Weighted Portfolio versus the Number of Stocks



12.3 Measuring Systematic Risk

- Our goal is to understand the impact of risk on the firm's investors so we can:
  - quantify the relation between risk and required return
  - produce a discount rate for present value calculations.
- To recap:
  - The amount of a stock's risk that is diversified away depends on the portfolio that you put it in.
  - With a large enough portfolio, you can diversify away all unsystematic risk, but you will be left with systematic risk.

12.3 Measuring Systematic Risk

- Role of the Market Portfolio
  - The sum of all investors' portfolios must equal the portfolio of all risky securities in the market.
  - The market portfolio is the portfolio of all risky investments, held in proportion to their value.
    - Thus, the market portfolio contains more of the largest companies and less of the smallest companies.

12.3 Measuring Systematic Risk

- Imagine that there are only two companies in the stock market, each with 1000 shares outstanding:

	Number of Shares Outstanding	Price Per Share	Market Capitalization
Company A	1,000	$40	$40,000
Company B	1,000	$10	$10,000

12.3 Measuring Systematic Risk

- Aggregate market portfolio is 1000 shares of each, with:
  - 80% ($40,000/$50,000) in A
  - 20% ($10,000/$50,000) in B.
- Everyone wants to hold the market portfolio and the sum of everyone's portfolios must be the market portfolio.

12.3 Measuring Systematic Risk

- The only way for this to be true is for everyone to put 80% of their money in A and 20% of their money in B.
- Since stocks are held in proportion to their market capitalization (value), we say that the portfolio is value-weighted.

12.3 Measuring Systematic Risk

- The investment in each security is proportional to its market capitalization, which is the total market value of its outstanding shares:

$$\text{Market Value of a Firm} = (\text{Number of Shares Outstanding}) \times (\text{Price per share}) \quad \text{(Eq. 12.5)}$$

12.3 Measuring Systematic Risk

- Stock Market Indexes as the Market Portfolio
  - In practice we use a market proxy—a portfolio whose return should track the underlying, unobservable market portfolio.
    - The most common proxy portfolios are market indexes.
    - A market index reports the value of a particular portfolio.
      - Dow Jones Industrial Average
      - S&P 500

12.3 Measuring Systematic Risk

- Market Risk and Beta
  - We compare a stock's historical returns to the market's historical returns to determine a stock's beta (β)
    - The sensitivity of an investment to fluctuations in the market portfolio.
    - Use excess returns – security return less the risk-free rate
    - The percentage change in the stock's return that we expect for each 1% change in the market's return

12.3 Measuring Systematic Risk

- Market Risk and Beta
  - There are many data sources that provide estimates of beta
    - Most use 2 to 5 years of weekly or monthly returns
    - Most use the S&P 500 as the market portfolio.

Table 12.4 Average Betas for Stocks by Industry and the Betas of a Selected Company in Each Industry

Industry	Industry Beta	Ticker	Company	Beta
Electric Utilities	0.2	EIX	Edison International	0.4
Personal & Household Prods.	0.5	PG	The Procter & Gamble Company	0.9
Food Processing	0.5	HNZ	H. J. Heinz Company	0.8
Restaurants	0.5	BWLD	Buffalo Wild Wings, Inc.	1.3
Packaged Foods	0.6	KO	The Coca-Cola Company	0.8
Retail Grocery	0.6	SWY	Safeway Inc.	0.7
Major Drugs	0.7	PFE	Pfizer Inc.	0.7
Beverages (Alcoholic)	0.7	BUD	Anheuser-Busch InBev SA/NV	0.8
Apparel Manufacturing	0.7	ANF	Abercrombie & Fitch Co.	1.6
Retail Home Improvement	0.8	HD	Home Depot Inc.	0.7
Software & Programming	0.9	MSFT	Microsoft Corporation	1.0
Recreational Products	1.0	HOG	Harley-Davidson Inc.	2.2
Auto & Truck Manufacturers	1.0	F	Ford Motor Company	2.5
Communications Equipment	1.0	MOT	Motorola	1.7
Forestry & Wood Products	1.0	WY	Weyerhaeuser Company	1.8
Computer Services	1.1	GOOG	Google	1.1
Computer Hardware	1.2	AAPL	Apple	1.3
Conglomerates	1.4	GE	General Electric Company	1.6
Semiconductors	1.5	INTC	Intel Corporation	1.1

Source: Reuters, June 2010.

12.3 Measuring Systematic Risk

- The beta of the overall market portfolio is 1.
- Many industries and companies have betas higher/lower than 1.
  - Differences in betas by industry are related to the sensitivity of each industry's profits to the general health of the economy.

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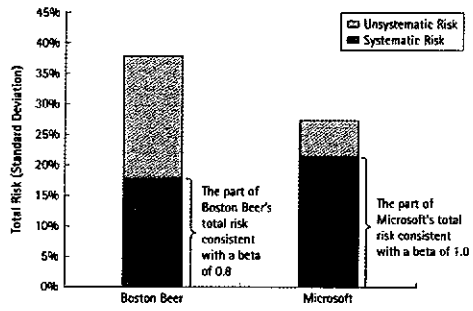
Figure 12.6 Systematic versus Firm-Specific Risk in Microsoft and Starbucks



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Example 12.5 Total Risk Versus Systematic Risk

Problem:

- Suppose that in the coming year, you expect SysCo's stock to have a standard deviation of 30% and a beta of 1.2, and UniCo's stock to have a standard deviation of 41% and a beta of 0.6.
- Which stock carries more total risk?
- Which has more systematic risk?

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Example 12.5 Total Risk Versus Systematic Risk

Solution:

Plan:

	Standard Deviation (Total Risk)	Beta (β) (Systematic Risk)
SysCo	30%	1.2
UniCo	41%	0.6

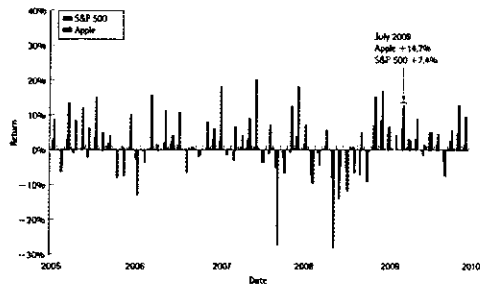
12.3 Measuring Systematic Risk

- Estimating Beta from Historical Returns
  - Beta is the expected percentage change in the excess return of the security for a 1% change in the excess return of the market portfolio.
    - The amount by which risks that affect the overall market are amplified or dampened in a given stock or investment.

12.3 Measuring Systematic Risk

- Estimating Beta from Historical Returns
  - Apple's stock for example (Figure 12.7):
    - The overall tendency is for Apple to have a high return when the market is up and a low return when the market is down.
    - Apple tends to move in the same direction as the market, but its movements are larger.
    - The pattern suggests that Apple's beta is greater than one.

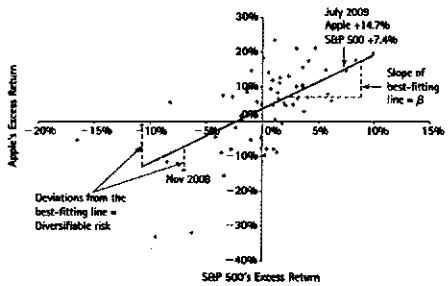
Figure 12.7 Monthly Excess Returns for Apple Stock and for the S&P 500, May 2005-May 2010



12.3 Measuring Systematic Risk

- In practice, we use linear regression to estimate the relation.
  - The output is the best-fitting line that represents the historical relation between the stock and the market.
  - The slope of this line is our estimate of beta.
  - Tells us how much the stock's excess return changed for a 1% change in the market's excess return.

Figure 12.8 Scatterplot of Monthly Returns for Apple versus the S&P 500, May 2005 - May 2010



12.4 Putting It All Together: The Capital Asset Pricing Model

- One of our goals in this chapter is to compute the cost of equity capital
  - The best available expected return offered in the market on a similar investment.
- To compute the cost of equity capital, we need to know the relation between the stock's risk and its expected return.

12.4 Putting It All Together: The Capital Asset Pricing Model

- The CAPM Equation Relating Risk to Expected Return
  - Only systematic risk determines expected returns
    - Firm-specific risk is diversifiable and does not warrant extra return.

12.4 Putting It All Together: The Capital Asset Pricing Model

- The CAPM Equation Relating Risk to Expected Return
  - The expected return on any investment comes from:
    - A risk-free rate of return to compensate for inflation and the time value of money, even with no risk of losing money.
    - A risk premium that varies with the systematic risk
  - Expected Return = Risk-free rate + Risk Premium for Systematic Risk

12.4 Putting It All Together: The Capital Asset Pricing Model

- The Capital Asset Pricing Model (CAPM)
  - The equation for the expected return of an investment:

$$E[R_i] = r_f + \underbrace{\beta_i \left(E[R_{Mkt}] - r_f\right)}_{\text{Risk Premium for Security } i} \quad \text{(Eq. 12.6)}$$

12.4 Putting It All Together: The Capital Asset Pricing Model

- The CAPM says that the expected return on any investment is equal to the risk-free rate of return plus a risk premium proportional to the amount of systematic risk in the investment.
  - The risk premium is equal to the market risk premium times the amount of systematic risk present in the investment, measured by its beta (βi).
  - We also call this return the investment's required return.

Example 12.6 Computing the Expected Return for a Stock

Problem:

- Suppose the risk-free return is 3% and you measure the market risk premium to be 6%. Apple has a beta of 1.6. According to the CAPM, what is its expected return?

Example 12.6 Computing the Expected Return for a Stock

Execute:

- Using Eq. 12.6:

$$E[R_{AAPL}] = r_f + \beta_{AAPL}\left(E[R_{Mkt}] - r_f\right) = 3\% + 1.6(6\%)$$
$$= 12.6\%$$

12.4 Putting It All Together: The Capital Asset Pricing Model

- The Security Market Line
  - The CAPM implies a linear relation between a stock's beta and its expected return.
  - This line is graphed in Figure 12.9(b) as the line through the risk-free investment (with a beta of zero) and the market (with a beta of one); it is called the security market line (SML).

12.4 Putting It All Together: The Capital Asset Pricing Model

- The Security Market Line
  - Recall that there is no clear relation between a stock's standard deviation (volatility) and its expected return
    - The relation between risk and return for individual securities is only evident when we measure market risk rather than total risk.

Figure 12.9 Expected Returns, Volatility, and Beta

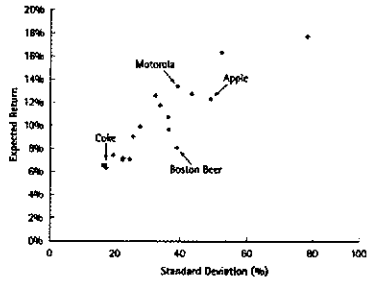


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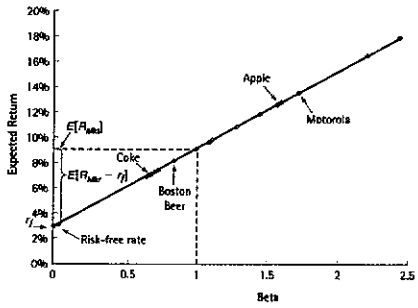
Figure 12.9 Expected Returns, Volatility, and Beta



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Example 12.7 A Negative Beta Stock

Problem:

- Suppose the stock of Bankruptcy Auction Services, Inc. (BAS) has a negative beta of -0.30. How does its expected return compare to the risk-free rate, according to the CAPM? Does your result make sense?

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Example 12.7 A Negative Beta Stock

Execute:

- Because the expected return of the market is higher than the risk-free rate, Eq. 12.6 implies that the expected return of Bankruptcy Auction Services (BAS) will be below the risk-free rate. As long as the market risk premium is positive (as long as people demand a higher return for investing in the market than for a risk-free investment), then the second term in Eq. 12.6 will have to be negative if the beta is negative.

Example 12.7 A Negative Beta Stock

Execute (cont'd):

- For example, if the risk-free rate is 4% and the market risk premium is 6%,
  - E[RBAS] = 4% - 0.30(6%) = 2.2%.
  - (See Figure 12.9: the SML drops below rf for $\beta < 0$.)

12.4 Putting It All Together: The Capital Asset Pricing Model

- The CAPM and Portfolios
  - We can apply the SML to portfolios as well as individual securities.
    - The market portfolio is on the SML, and according to the CAPM, other portfolios (such as mutual funds) are also on the SML.
    - Therefore, the expected return of a portfolio should correspond to the portfolio's beta.
    - The beta of a portfolio made up of securities each with weight w_i is:

$$\beta_P = w_1\beta_1 + w_2\beta_2 + \ldots + w_n\beta_n \quad \text{(Eq. 12.7)}$$

Example 12.8a The Expected Return of a Portfolio

Problem:

- Suppose Ford (F) has a beta of 2.67, whereas the beta of Safeway (SWY) is 0.72. If the risk free interest rate is 3% and the market risk premium is 6%, what is the expected return of an equally weighted portfolio of Ford and Safeway, according to the CAPM?

Example 12.8a The Expected Return of a Portfolio

Execute:

- Using the first approach, we compute the expected return for F and SWY:

$$E[R_F] = r_f + \beta_F(E[R_{Mkt}] - r_f) \qquad E[R_{SWY}] = r_f + \beta_{SWY}(E[R_{Mkt}] - r_f)$$

$$E[R_F] = 3\% + 2.67(6\%) = 19.02\%$$

$$E[R_{SWY}] = 3\% + 0.72(6\%) = 7.32\%$$

- Then the expected return of the equally weighted portfolio P is:

$$E[R_P] = 0.5(19.02\%) + 0.5(7.32\%) = 13.17\%$$

Example 12.8a The Expected Return of a Portfolio

Execute (cont'd):

- Alternatively, we can compute the beta of the portfolio using Eq. 12.7:

$$\beta_P = w_F\beta_F + w_{SWY}\beta_{SWY}$$

$$\beta_P = (0.5)(2.67) + (0.5)(0.72) = 1.695$$

- We can then find the portfolio's expected return from the CAPM:

$$E[R_P] = r_f + \beta_P(E[R_{Mkt}] - r_f)$$

$$E[R_P] = 3\% + 1.695(6\%) = 13.17\%$$

12.4 Putting It All Together: The Capital Asset Pricing Model

- Summary of the Capital Asset Pricing Model
  - Investors require a risk premium proportional to the amount of *systematic* risk they are bearing.
  - We can measure systematic risk using beta (β)
  - The most common way to estimate beta is to use linear regression – the slope of the line is the stock's beta.

12.4 Putting It All Together: The Capital Asset Pricing Model

- Summary of the Capital Asset Pricing Model
  - The CAPM says we can compute the expected (required) return of any investment using the following equation:

$$E[R_i] = r_f + \beta_i(E[R_{Mkt}] - r_f)$$

which, when graphed is called the security market line.

Chapter Quiz

1. How is the expected return of a portfolio related to the expected returns of the stocks in the portfolio?
2. What determines how much risk will be eliminated by combining stocks in a portfolio?
3. What is the market portfolio?
4. What does beta tell us?
5. What does the CAPM say about the required return of a security?
6. What is the Security Market Line?