# 27

# The Basic Tools of Finance

**PRINCIPLES OF**

# ECONOMICS

**FOURTH EDITION**

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**PowerPoint® Slides
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# In this chapter, look for the answers to these questions:

- What is "present value"?  How can we use it to compare sums of money from different times?

- Why are people risk averse?
  How can risk-averse people use insurance and diversification to manage risk?

- What determines the value of an asset?
  What is the "efficient markets hypothesis"?
  Why is beating the market nearly impossible?

# Introduction

- The financial system coordinates saving and investment.

- Participants in the financial system make decisions regarding the allocation of resources over time and the handling of risk.

- **Finance** is the field that studies such decision making.

# Present Value: The Time Value of Money

- To compare a sums from different times, we use the concept of present value.

- The **present value** of a future sum: the amount that would be needed today to yield that future sum at prevailing interest rates.

- Related concept:
  The **future value** of a sum: the amount the sum will be worth at a given future date, when allowed to earn interest at the prevailing rate.

# EXAMPLE 1: A Simple Deposit

- Deposit $100 in the bank at 5% interest. What is the future value (FV) of this amount?

- In $N$ years, FV = $100(1 + 0.05)^N$

- In three years, FV = $100(1 + 0.05)^3$ = $115.76

- In two years, FV = $100(1 + 0.05)^2$ = $110.25

- In one year, FV = $100(1 + 0.05)$ = $105.00

# EXAMPLE 1: A Simple Deposit

- Deposit $100 in the bank at 5% interest. What is the future value (FV) of this amount?

- In $N$ years, FV = $100(1 + 0.05)^N$

- In this example, $100 is the present value (PV).

- In general, $FV = PV(1 + r)^N$

  where $r$ denotes the interest rate (in decimal form).

- Solve for PV to get: $PV = FV/(1 + r)^N$

# EXAMPLE 2: Investment Decision

Present value formula: $PV = FV/(1 + r)^N$

■ Suppose $r = 0.06$.
Should General Motors spend $100 million to build a factory that will yield $200 million in ten years?

Solution:
Find present value of $200 million in 10 years:

$PV = (\$200 \text{ million})/(1.06)^{10} = $ $112 million

Since PV > cost of factory, GM should build it.

# EXAMPLE 2: Investment Decision

- Instead, suppose $r = 0.09$.
  Should General Motors spend $100 million to build a factory that will yield $200 million in ten years?

Solution:

Find present value of $200 million in 10 years:

PV = ($200 million)/$(1.09)^{10}$ = $84 million

Since PV < cost of factory, GM should not build it.

> *present value helps explain why
> investment falls when the interest rate rises*

# Present value

You are thinking of buying a six-acre lot for $70,000. The lot will be worth $100,000 in 5 years.

**A.** Should you buy the lot if $r$ = 0.05?

**B.** Should you buy it if $r$ = 0.10?

# Answers

You are thinking of buying a six-acre lot for $70,000. The lot will be worth $100,000 in 5 years.

**A.** Should you buy the lot if $r$ = 0.05?

PV = $100,000/(1.05)$^5$ = $78,350.

PV of lot > price of lot.

Yes, buy it.

**B.** Should you buy it if $r$ = 0.10?

PV = $100,000/(1.1)$^5$ = $62,090.

PV of lot < price of lot.

No, do not buy it.

# Compounding

- **Compounding**:  the accumulation of a sum of money where the interest earned on the sum earns additional interest

- Because of compounding, small differences in interest rates lead to big differences over time.

- Example:  Buy $1000 worth of Microsoft stock, hold for 30 years.

  If rate of return = 0.08,  FV = $10,063

  If rate of return = 0.10,  FV = $17,450

# The Rule of 70

- The Rule of 70:
  If a variable grows at a rate of **x** percent per year, that variable will double in about 70/**x** years.

- Example:

  - If interest rate is 5%, a deposit will double in about 14 years.

  - If interest rate is 7%, a deposit will double in about 10 years.

# Risk Aversion

- Most people are **risk averse** – they dislike uncertainty.

- Example: You are offered the following gamble. Toss a fair coin.
  - If heads, you win $1000.
  - If tails, you lose $1000.

  Should you take this gamble?

- If you are risk averse, the pain of losing $1000 would exceed the pleasure of winning $1000, so you should not take this gamble.
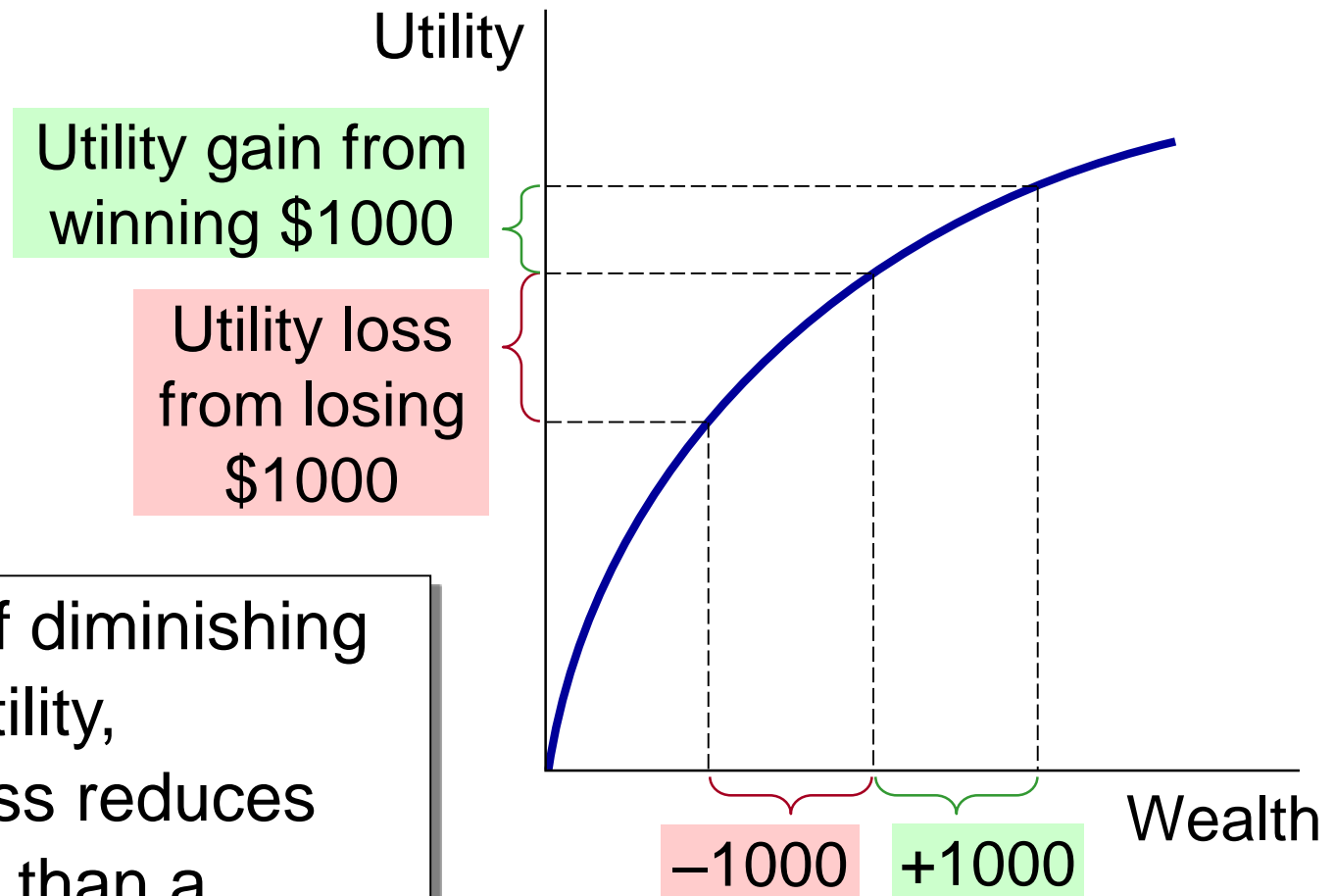
# The Utility Function

**Utility** is a subjective measure of well-being that depends

As wealth rises, the curve becomes flatter due to **diminishing marginal utility**:

the more wealth a person has, the less extra utility he would get from an extra dollar.

Utility

Current utility

Current wealth

Wealth
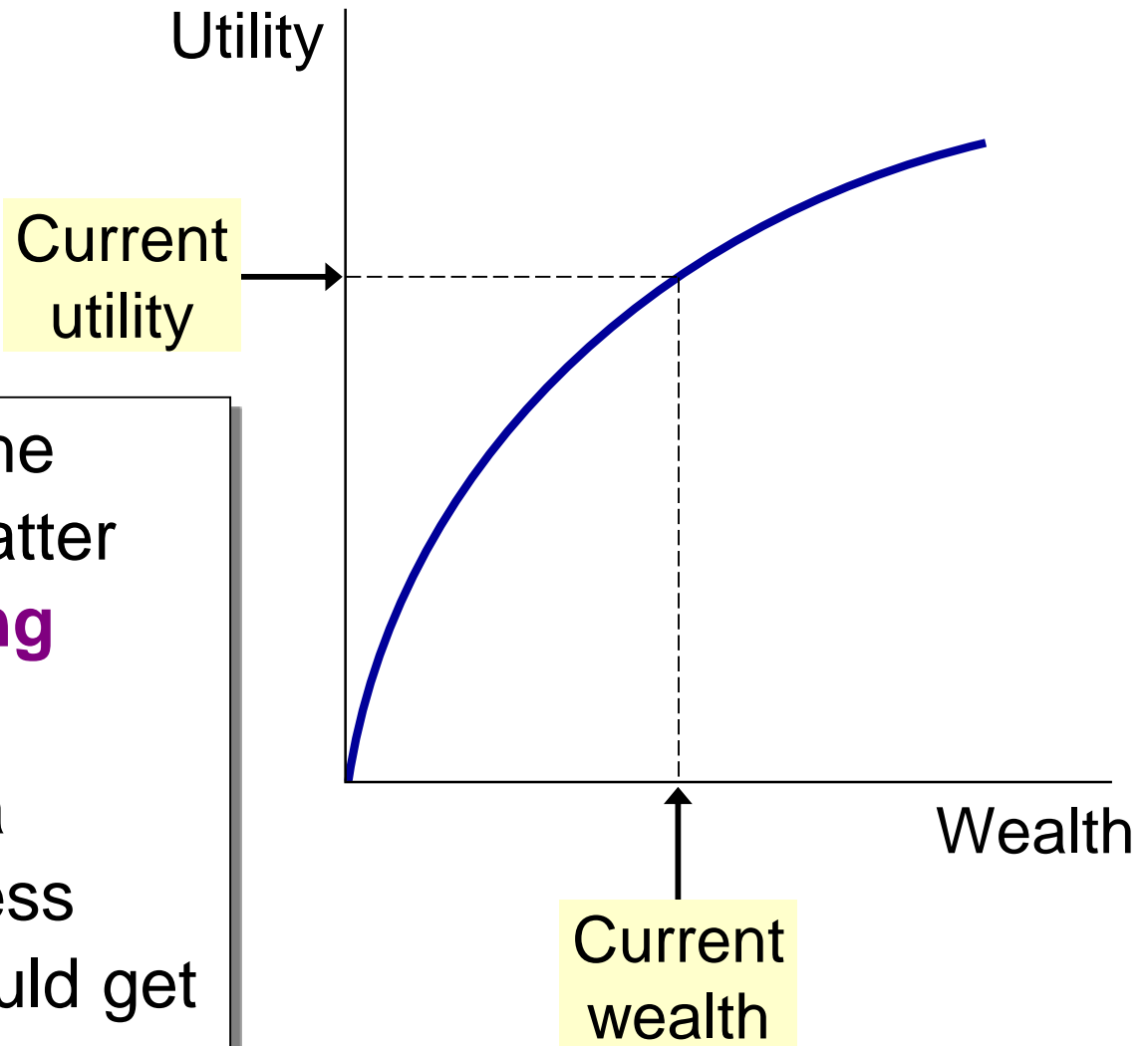
# The Utility Function and Risk Aversion

Utility gain from winning $1000

Utility loss from losing $1000

Because of diminishing marginal utility, a $1000 loss reduces utility more than a $1000 gain increases it.

Utility

Wealth

−1000  +1000

# Managing Risk With Insurance

- How insurance works:
  A person facing a risk pays a fee to the insurance company, which in return accepts part or all of the risk.

- Insurance allows risks to be pooled, and can make risk averse people better off:

  *E.g.,* it is easier for 10,000 people to each bear 1/10,000 of the risk of a house burning down than for one person to bear the entire risk alone.

# Two Problems in Insurance Markets

1.  **Adverse selection**:  A high-risk person benefits more from insurance, so is more likely to purchase it.

2.  **Moral hazard**:  People with insurance have less incentive to avoid risky behavior.

Insurance companies cannot fully guard against these problems, so they must charge higher prices.

As a result, low-risk people sometimes forego insurance and lose the benefits of risk-pooling.

# Adverse selection or moral hazard?

Identify whether each of the following is an example of adverse selection or moral hazard.

**A.** Joe begins smoking in bed after buying fire insurance.

**B.** Both of Susan's parents lost their teeth to gum disease, so Susan buys dental insurance.

**C.** When Gertrude parks her Corvette convertible, she doesn't bother putting the top up, because her insurance covers theft of any items left in the car.

# Answers

Identify whether each of the following is an example of adverse selection or moral hazard.

**A.** Joe begins smoking in bed after buying fire insurance.

*moral hazard*

**B.** Both of Susan's parents lost their teeth to gum disease, so Susan buys dental insurance.

*adverse selection*

**C.** When Gertrude parks her Corvette convertible, she doesn't bother putting the top up, because her insurance covers theft of any items left in the car.

*moral hazard*

# Measuring Risk

- We can measure risk of an asset with the **standard deviation**, a statistic that measures a variable's volatility – how likely it is to fluctuate.

- The higher the standard deviation of the asset's return, the greater the risk.

# Reducing Risk Through Diversification

- **Diversification** reduces risk by replacing a single risk with a large number of smaller, unrelated risks.

- A diversified portfolio contains assets whose returns are not strongly related:
  - Some assets will realize high returns, others low returns.
  - The high and low returns average out, so the portfolio is likely to earn an intermediate return more consistently than any of the assets it contains.

# Reducing Risk Through Diversification

- Diversification can reduce **firm-specific risk**, which only a single company.

- Diversification *cannot* reduce **market risk**, which affects all companies in the stock market.

# Reducing Risk Through Diversification
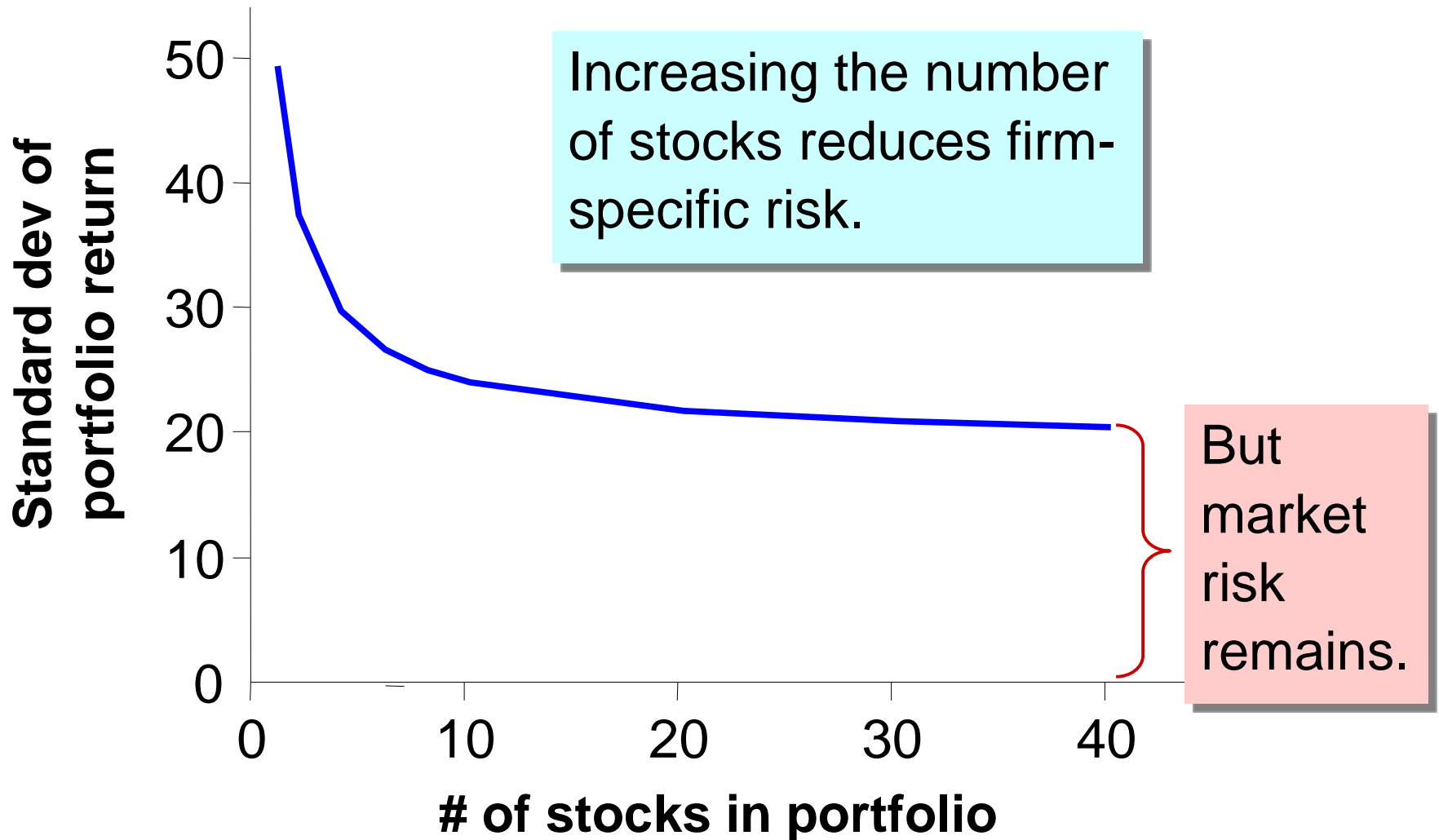
# The Tradeoff Between Risk and Return

- One of the Ten Principles from Chapter 1:
    *People face tradeoffs*.

- A tradeoff between risk and return:
  Riskier assets pay a higher return, on average, to compensate for the extra risk of holding them.

- *E.g.,* over past 200 years, average real return on stocks, 8%. On short-term govt bonds, 3%.

# The Tradeoff Between Risk and Return

- Example:
  Suppose you are dividing your portfolio between two asset classes.

  - A diversified group of risky stocks:
    average return = 8%, standard dev. = 20%

  - A safe asset:  return = 3%, standard dev. = 0%

- The risk and return on the portfolio depends on the percentage of each asset class in the portfolio…

# The Tradeoff Between Risk and Return
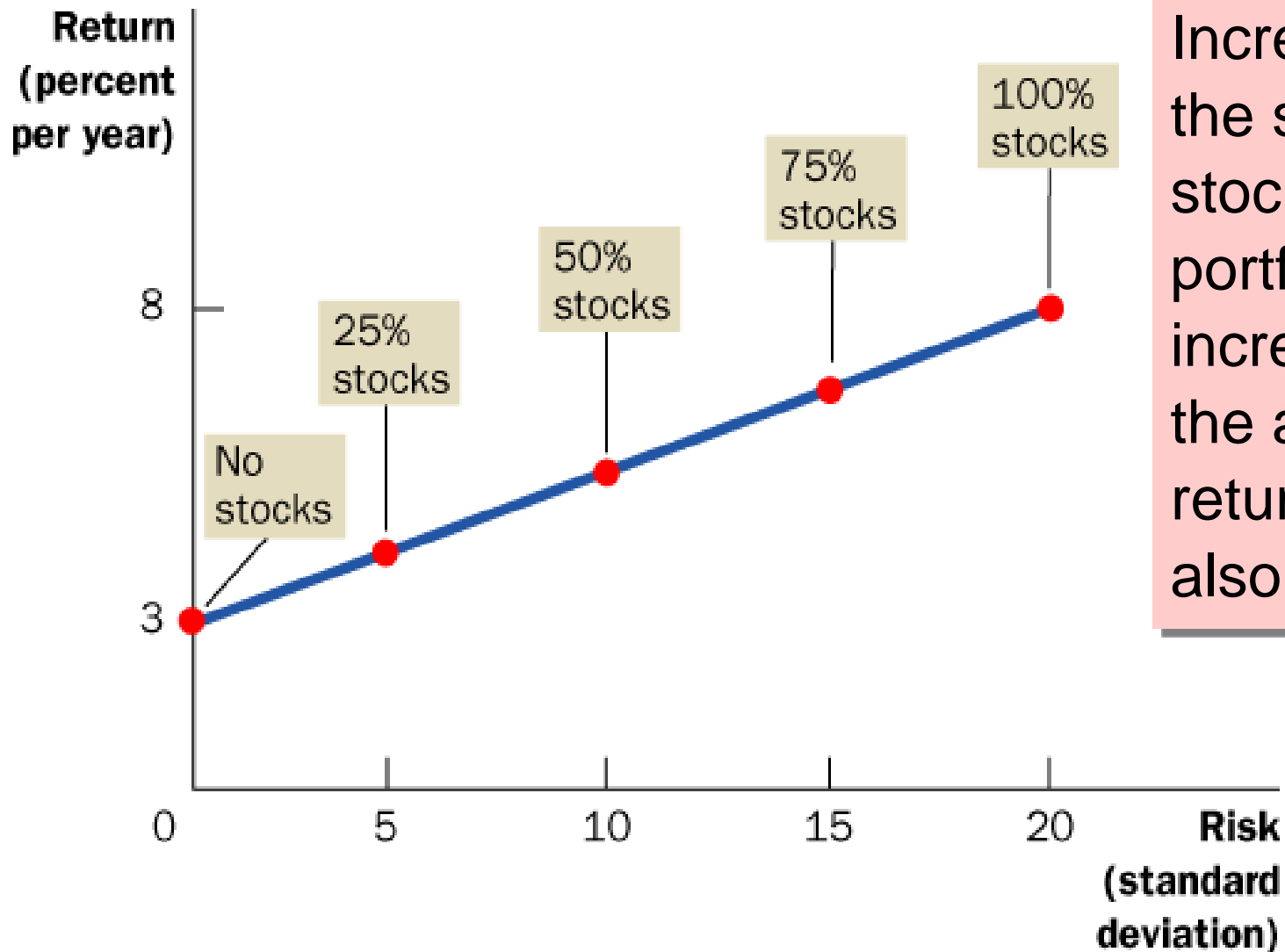


Increasing the share of stocks in the portfolio increases the average return but also the risk.

# Asset Valuation

- When deciding whether to buy a company's stock, you compare the price of the shares to the value of the company.

  - If share price > value, the stock is **overvalued**.
  - If price < value, the stock is **undervalued**.
  - If price = value, the stock is **fairly valued**.

- It's easy to look up the price.
  But how does one determine the stock's value?

# Valuing a share of stock

If you buy a share of AT&T stock today,

- you will be able to sell it in 3 years for $30
- you will receive a $1 dividend at the end of each of those 3 years

If the prevailing interest rate is 10%,
what is the value of a share of AT&T stock today?

# Answers

| amount you will receive | when you will receive it | present value of the amount |
|---|---|---|
| $1 | in 1 year | $1/(1.1) = \$ .91 |
| $1 | in 2 years | $1/(1.1)^2 = \$ .83 |
| $1 | in 3 years | $1/(1.1)^3 = \$ .75 |
| $30 | in 3 years | $30/(1.1)^3 = \$22.54 |

The value of a share of AT&T stock equals the sum of the numbers in the last column:  **$25.03**

# Asset Valuation

- Value of a share
  = PV of any dividends the stock will pay
  + PV of the price you get when you sell the share

- Problem:  When you buy the share, you don't know what future dividends or prices will be.

- One way to value a stock:  **fundamental analysis**, the study of a company's accounting statements and future prospects to determine its value

# The Efficient Markets Hypothesis

- **Efficient Markets Hypothesis**:  the theory that each asset price reflects all publicly available information about the value of the asset

- Mutual fund managers
  - use fundamental analysis to assess value of all publicly traded companies
  - buy shares when price < value,
    sell shares when price > value
  - continuously monitor and act on any news that affects the valuation of any stock

# The Efficient Markets Hypothesis

- Stock prices determined by supply & demand. In equilibrium,
    - the number of people who believe a stock is overvalued exactly balances the number who believe it to be undervalued
    - the typical person perceives all stocks fairly valued

# Informational Efficiency

- According to the Efficient Markets Hypothesis, the stock market is **informationally efficient**: each stock price reflects all available information about the value of the company.

  - When good news about a company's prospects becomes public, the value of the company rises, so money managers buy lots of shares until the price rises to the new, higher value.

  - When bad news becomes public, the value of the company falls, so money managers sell the shares until their price falls by the same amount.

# Informational Efficiency

- At any moment, a stock price is the market's best guess of the company's value based on all available information.

# Random Walk

- **Random walk**:  the path of a variable whose changes are impossible to predict

- The efficient markets hypothesis implies that stock prices should follow a random walk.

- According to this theory, the only thing that can move stock prices is news that changes the market's perception of the company's value.

- Such news is impossible to predict. (Otherwise it wouldn't really be news, and would already be reflected in the stock price.)

# Index Funds vs. Managed Funds

- An index fund is a mutual fund that buys all the stocks in a given stock index.

- An actively managed mutual fund aims to buy only the best stocks.

- The efficient markets hypothesis implies that it is impossible to consistently "beat the market."

- If true, the returns on actively managed funds should not consistently exceed the returns on index funds.

- In fact, most actively managed funds perform worse than index funds (and have higher fees).

# Market Irrationality

- Economists have argued that stock price movements are partly psychological:

  - 1930s: John Maynard Keynes said stock prices are driven by investors' "animal spirits" – irrational waves of pessimism and optimism

  - 1990s: Fed Chair Alan Greenspan said the stock boom reflected "irrational exuberance"

- Speculative "bubbles" may occur:
  Someone may be willing to pay more than she thinks a stock is worth if she believes she will be able to sell it for even more in the future

# Market Irrationality

- Economists and market watchers debate the importance of departures from rationality.

  - It's true that stock prices often move in ways that are hard to explain rationally.

  - Yet, it's impossible to know what price movements are "rational."

  - And if many investors behaved irrationally, there would be profit opportunities for rational investors.  Yet, beating the market is nearly impossible.

# CONCLUSION

- This chapter has introduced some of the basic tools people use when they make financial decisions.

- The efficient markets hypothesis teaches that a stock price should reflect the company's expected future profitability.

- Fluctuations in the stock market have important macroeconomic implications, which we will study later in this course.

# CHAPTER SUMMARY

- The present value of any future sum is the amount that would be needed today, given prevailing interest rates, to produce that future sum.

- Because of diminishing marginal utility of wealth, most people are risk-averse. Risk-averse people can manage risk with insurance, through diversification, and by choosing a portfolio with a lower risk and lower return.

# CHAPTER SUMMARY

- The value of an asset equals the present value of all payments its owner will receive.  For a share of stock, these payments include dividends plus the final sale price.

- According to the efficient markets hypothesis, financial markets are informationally efficient, a stock price always equals the market's best guess of the firm's value, and stock prices follow a random walk as new information becomes available.

# CHAPTER SUMMARY

- Some economists question the efficient markets hypothesis, and believe that irrational psychological factors also influence asset prices.