

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:

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

Since $PV > \text{cost of factory}$, 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:

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

Since $PV < \text{cost of factory}$, GM should not build it.

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

ACTIVE LEARNING 1:

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 $r = 0.10$?

ACTIVE LEARNING 1:

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.

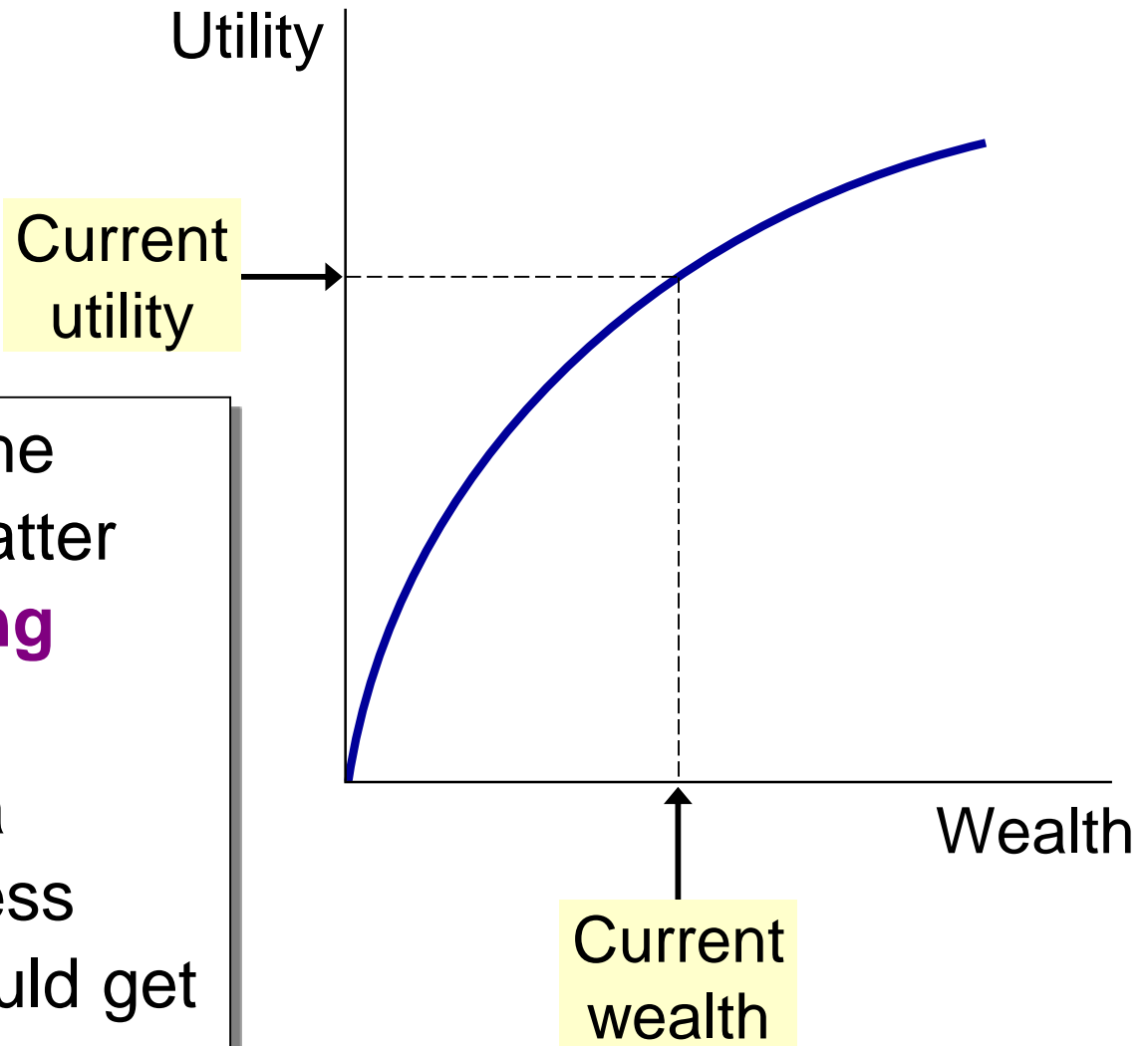
Risk Aversion

- 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.

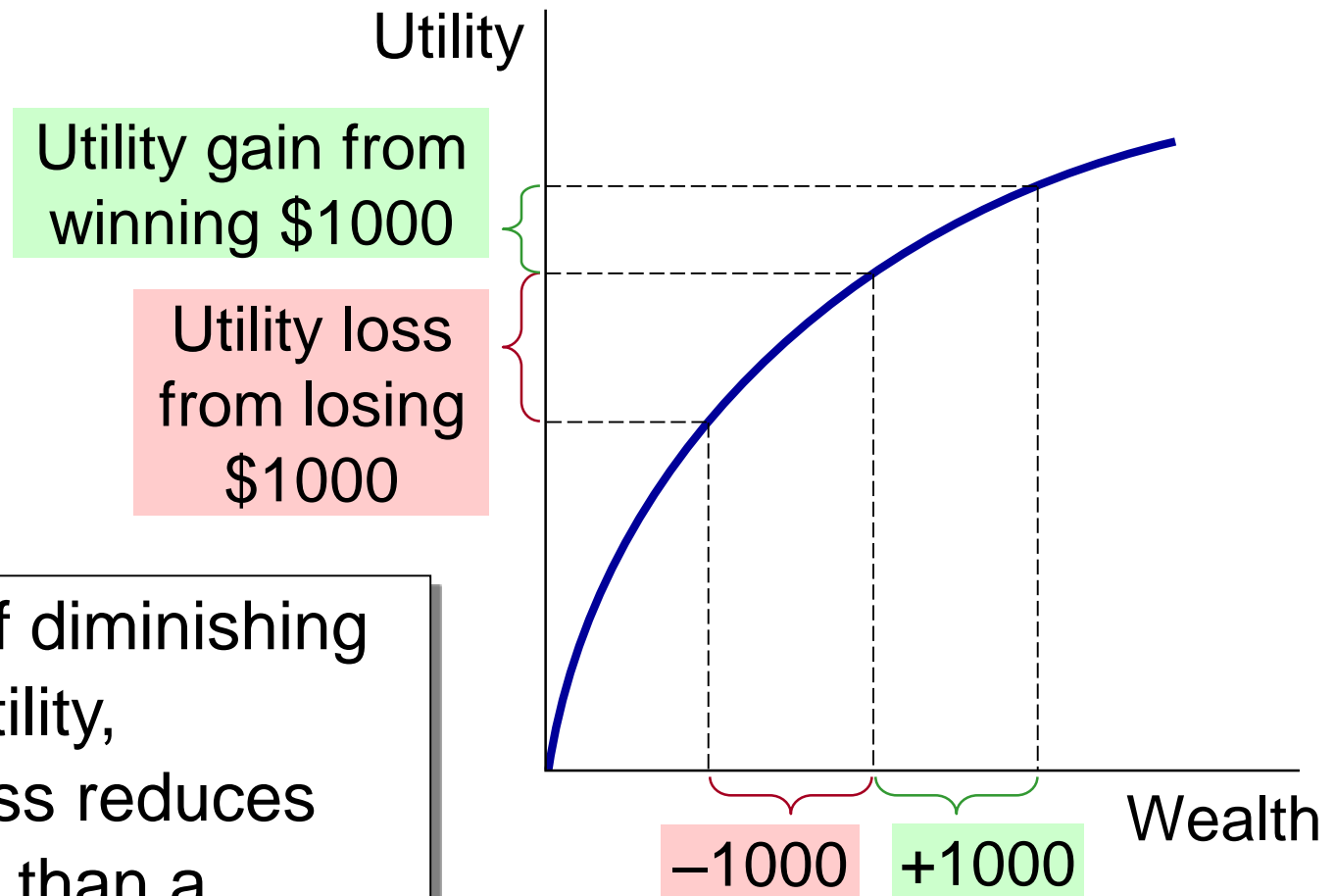
The Utility Function

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.



The Utility Function and Risk Aversion



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

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.

ACTIVE LEARNING 2:

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.

ACTIVE LEARNING 2:

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.

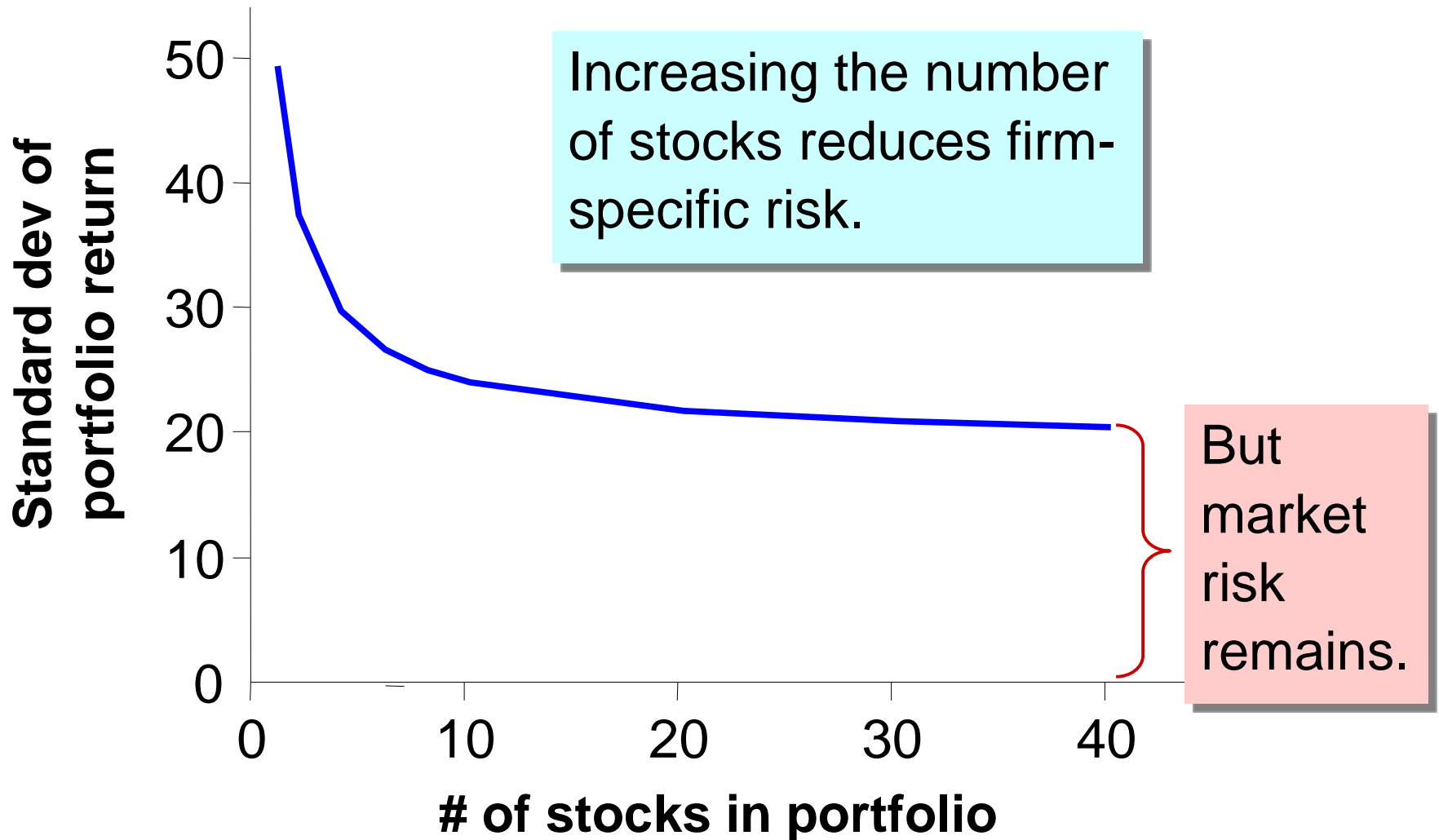
Reducing Risk Through Diversification

- **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

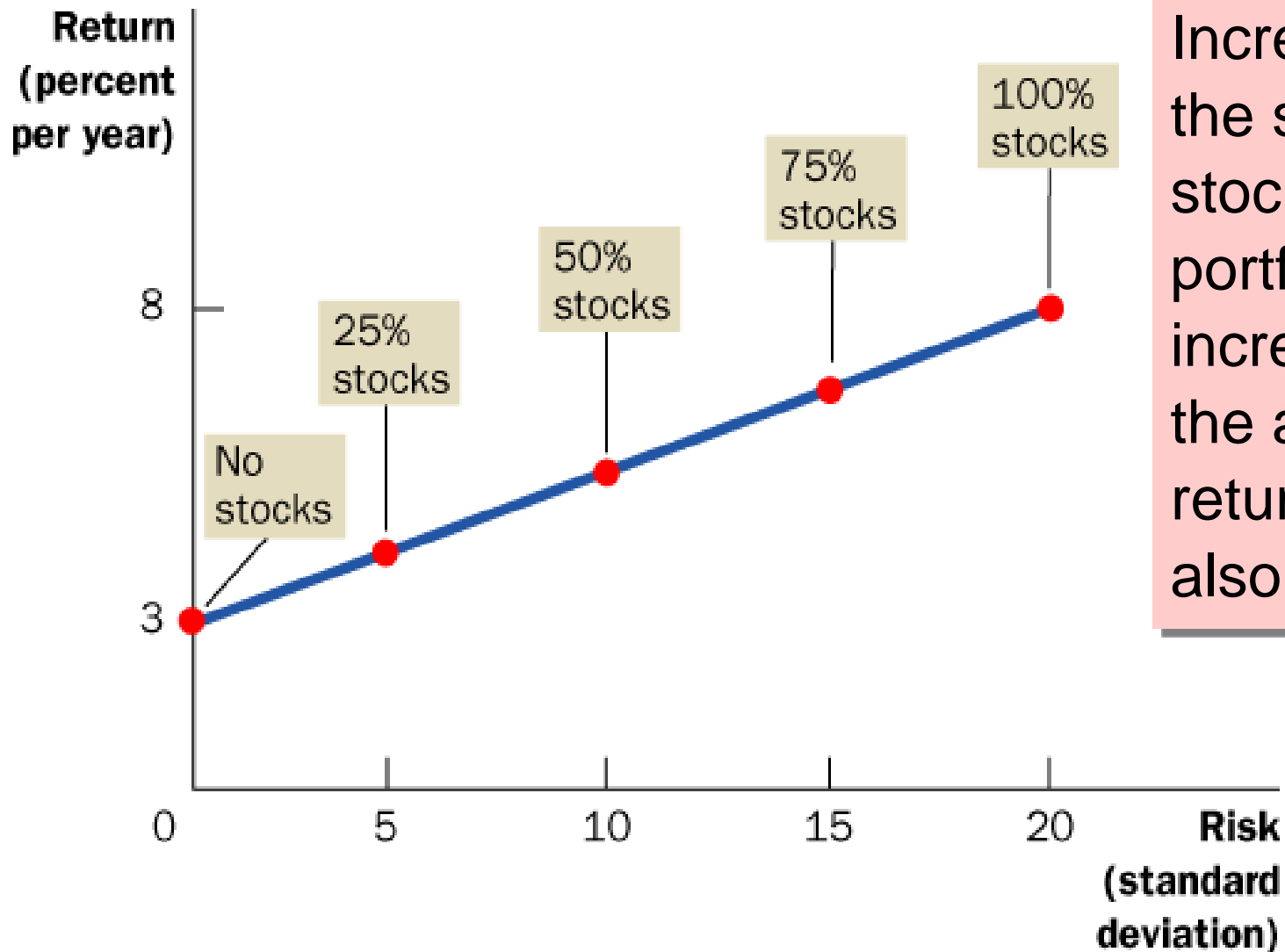
- One of the Ten Principles from Chapter 1:
People face tradeoffs.
- A tradeoff between risk and return:
Riskier assets pay a higher return, on average, to compensate for the extra risk of holding them.
- *E.g.*, over past 200 years, average real return on stocks, 8%. On short-term govt bonds, 3%.



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?

ACTIVE LEARNING 3:

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?

ACTIVE LEARNING 3:

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 $\text{price} < \text{value}$,
sell shares when $\text{price} > \text{value}$
 - 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.