



27 **The Basic Tools of Finance**

PRINCIPLES OF
ECONOMICS
FOURTH EDITION

N. GREGORY MANKIW

**PowerPoint® Slides
by Ron Cronovich**

© 2007 Thomson South-Western, all rights reserved

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 Money⁰

- 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



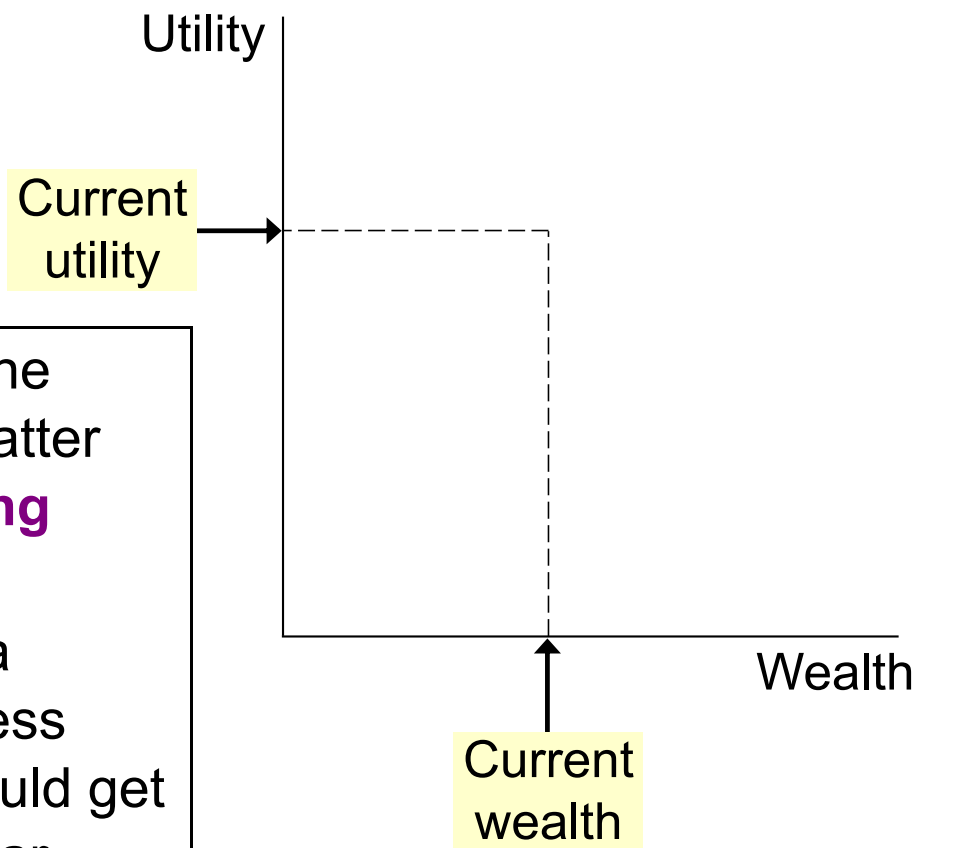
- Most people are **risk averse** – they dislike uncertainty.
- Example: You are offered the following gamble.
Toss a fair coin.
 - If heads, you win \$1000.
 - If tails, you lose \$1000.Should you take this gamble?
- If you are risk averse, the pain of losing \$1000 would exceed the pleasure of winning \$1000, so you should not take this gamble.

The Utility Function

0

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.



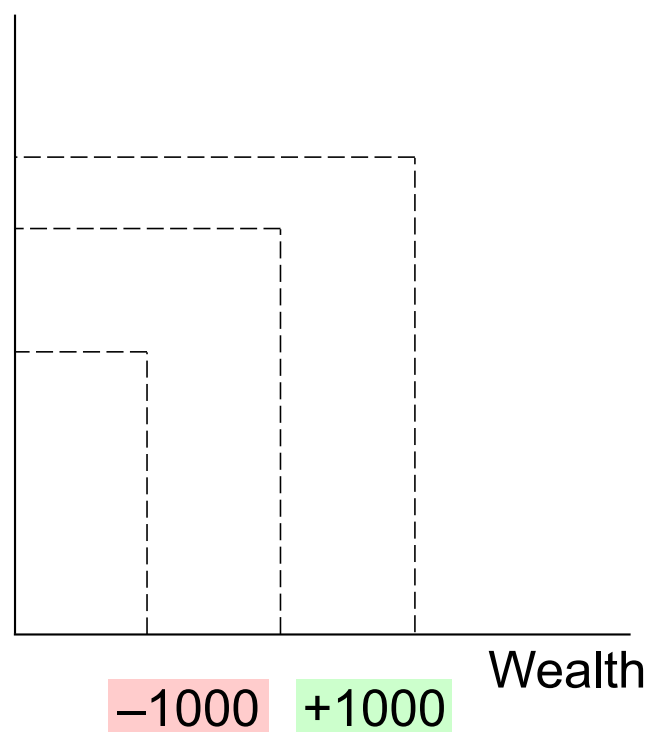
The Utility Function and Risk Aversion

0

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.



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.

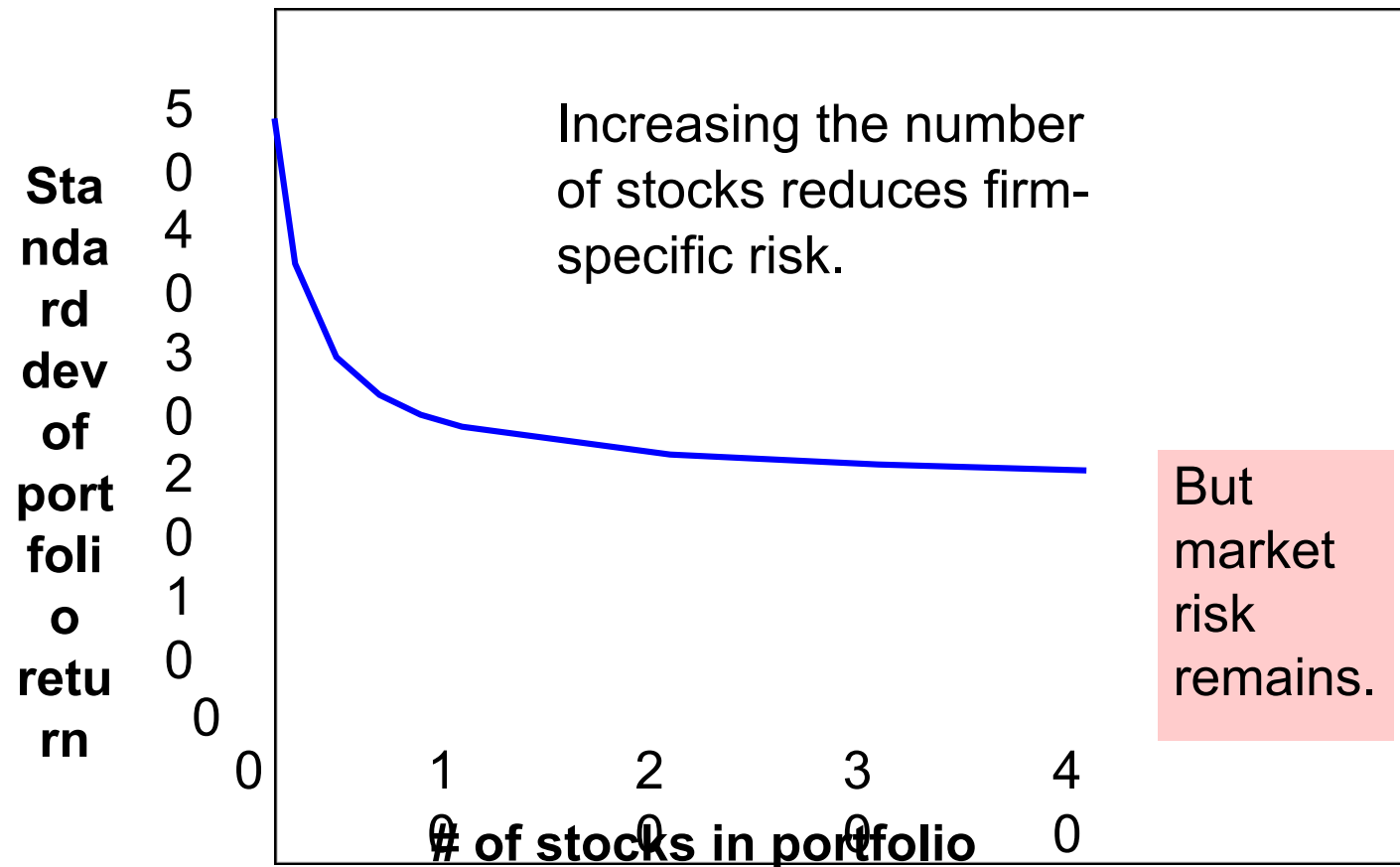
Reducing Risk Through Diversification



- 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

0



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%.



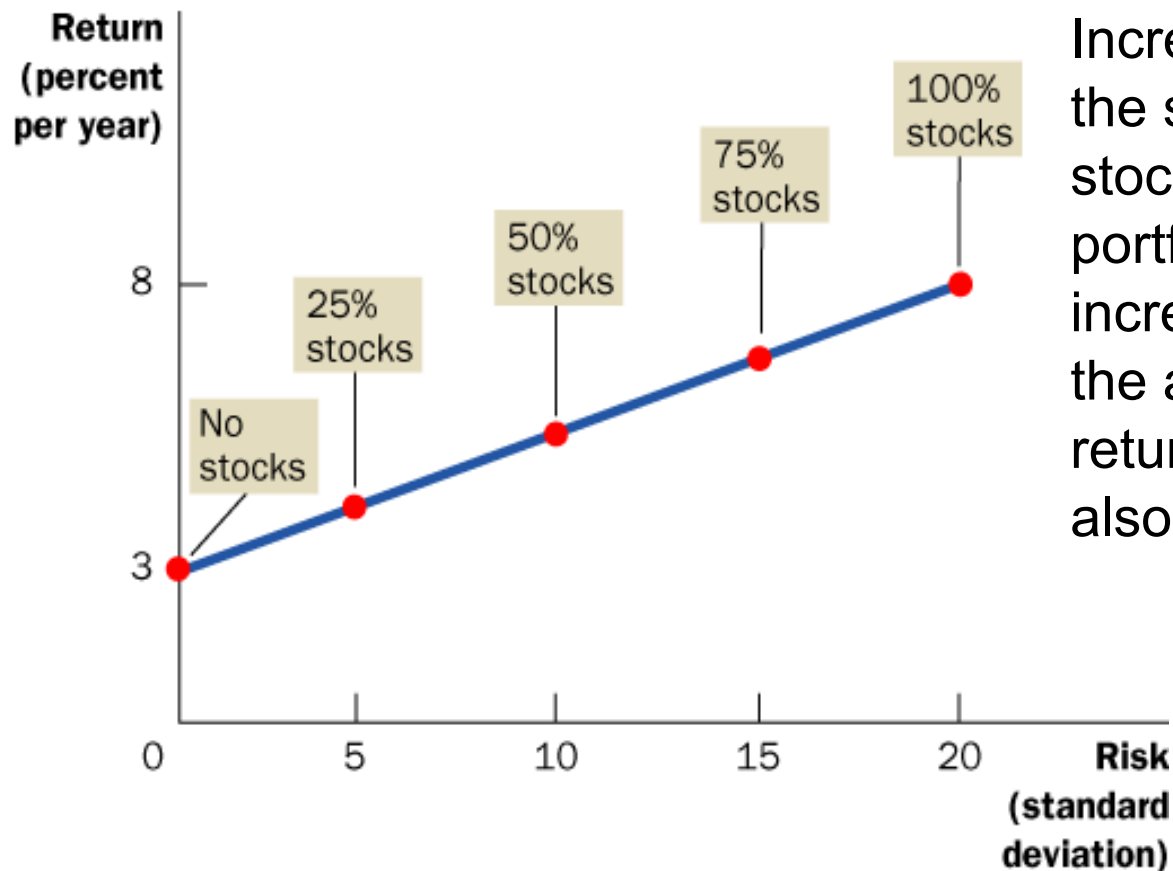
The Tradeoff Between Risk and Return



- 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

0



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.