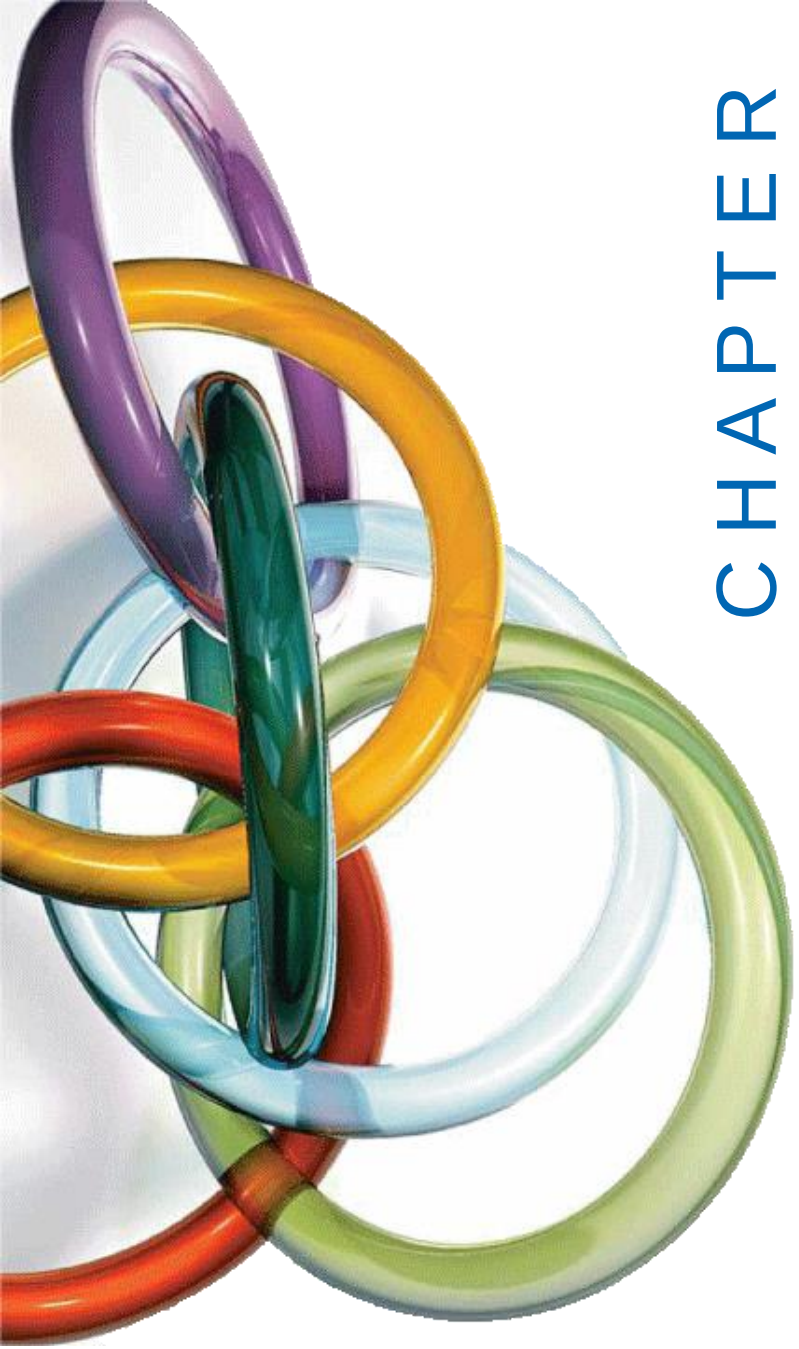

CHAPTER 5

Uncertainty and Consumer Behavior

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CHAPTER 5 OUTLINE

Uncertainty and Consumer Behavior

To examine the ways that people can compare and choose among risky alternatives, we take the following steps:

1. In order to compare the riskiness of alternative choices, we need to quantify risk.

2. We will examine people's preferences toward risk.

3. We will see how people can sometimes reduce or eliminate risk.

4. In some situations, people must choose the amount of risk they wish to bear.

In the final section of this chapter, we offer an overview of the flourishing field of behavioral economics.

5.1 DESCRIBING RISK

Probability

- **probability** Likelihood that a given outcome will occur.

Subjective probability is the perception that an outcome will occur.

Expected Value

- **expected value** Probability-weighted average of the payoffs associated with all possible outcomes.
- **payoff** Value associated with a possible outcome.

The expected value measures the *central tendency*—the payoff or value that we would expect on average.

$$\text{Expected value} = \Pr(\text{success})(\$40/\text{share}) + \Pr(\text{failure})(\$20/\text{share})$$
$$= (1/4)(\$40/\text{share}) + (3/4)(\$20/\text{share}) = \$25/\text{share}$$

$$E(X) = \Pr_1 X_1 + \Pr_2 X_2$$

$$E(X) = \Pr_1 X_1 + \Pr_2 X_2 + \ldots + \Pr_n X_n$$

5.1 DESCRIBING RISK

Variability

- **variability** Extent to which possible outcomes of an uncertain event differ.

TABLE 5.1 Income from Sales Jobs

	OUTCOME 1		OUTCOME 2		Expected Income ($)
	Probability	Income ($)	Probability	Income ($)	
Job 1: Commission	.5	2000	.5	1000	1500
Job 2: Fixed Salary	.99	1510	.01	510	1500

- **deviation** Difference between expected payoff and actual payoff.

TABLE 5.2 Deviations from Expected Income ($)

	Outcome 1	Deviation	Outcome 2	Deviation
Job 1	2000	500	1000	-500
Job 2	1510	10	510	-990

5.1 DESCRIBING RISK

Variability

- **standard deviation** Square root of the weighted average of the squares of the deviations of the payoffs associated with each outcome from their expected values.

Table 5.3 Calculating Variance ($)

	Outcome 1	Deviation Squared	Outcome 2	Deviation Squared	Weighted Average Deviation Squared	Standard Deviation
Job 1	2000	250,000	1000	250,000	250,000	500
Job 2	1510	100	510	980,100	9900	99.5

5.1 DESCRIBING RISK

Variability

Figure 5.1

Outcome Probabilities for Two Jobs

The distribution of payoffs associated with Job 1 has a greater spread and a greater standard deviation than the distribution of payoffs associated with Job 2.

Both distributions are flat because all outcomes are equally likely.

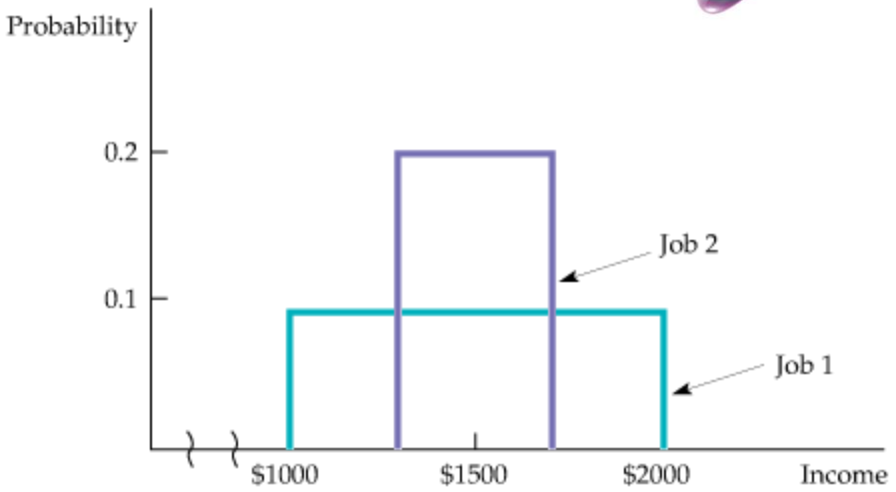
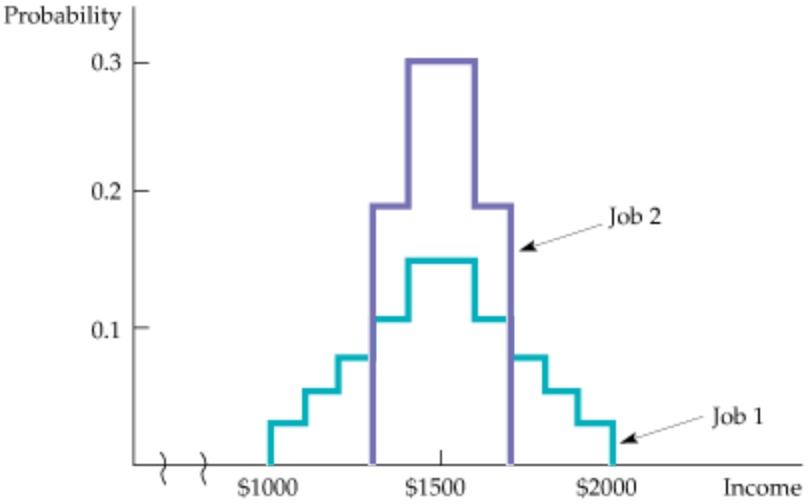


Figure 5.2

Unequal Probability Outcomes

The distribution of payoffs associated with Job 1 has a greater spread and a greater standard deviation than the distribution of payoffs associated with Job 2.

Both distributions are peaked because the extreme payoffs are less likely than those near the middle of the distribution.



5.1 DESCRIBING RISK

Decision Making

Table 5.4 Incomes from Sales Jobs—Modified ($)

	Outcome 1	Deviation Squared	Outcome 2	Deviation Squared	Expected Income	Standard Deviation
Job 1	2000	250,000	1000	250,000	1600	500
Job 2	1510	100	510	980,100	1500	99.5

EXAMPLE 5.1 Deterring Crime

Fines may be better than incarceration in deterring certain types of crimes. Other things being equal, the greater the fine, the more a potential criminal will be discouraged from committing the crime. In practice, however, it is very costly to catch lawbreakers.

Therefore, we save on administrative costs by imposing relatively high fines. A policy that combines a high fine and a low probability of apprehension is likely to reduce enforcement costs.

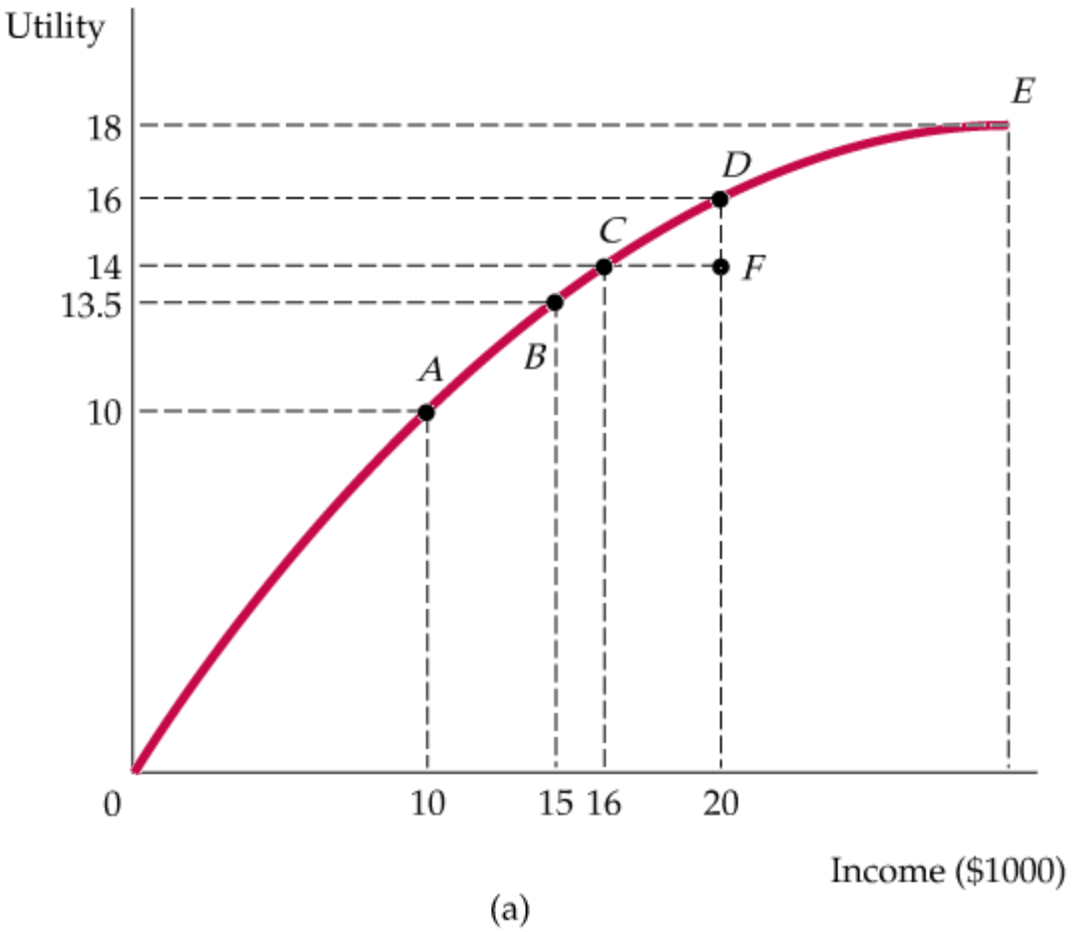
Figure 5.3

Risk Aversion, Risk Loving, and Risk Neutrality

In (a), a consumer's marginal utility diminishes as income increases.

The consumer is risk averse because she would prefer a certain income of $20,000 (with a utility of 16) to a gamble with a .5 probability of $10,000 and a .5 probability of $30,000 (and expected utility of 14).

The expected utility of the uncertain income is 14—an average of the utility at point *A* (10) and the utility at *E* (18)—and is shown by *F*.



5.2 PREFERENCES TOWARD RISK

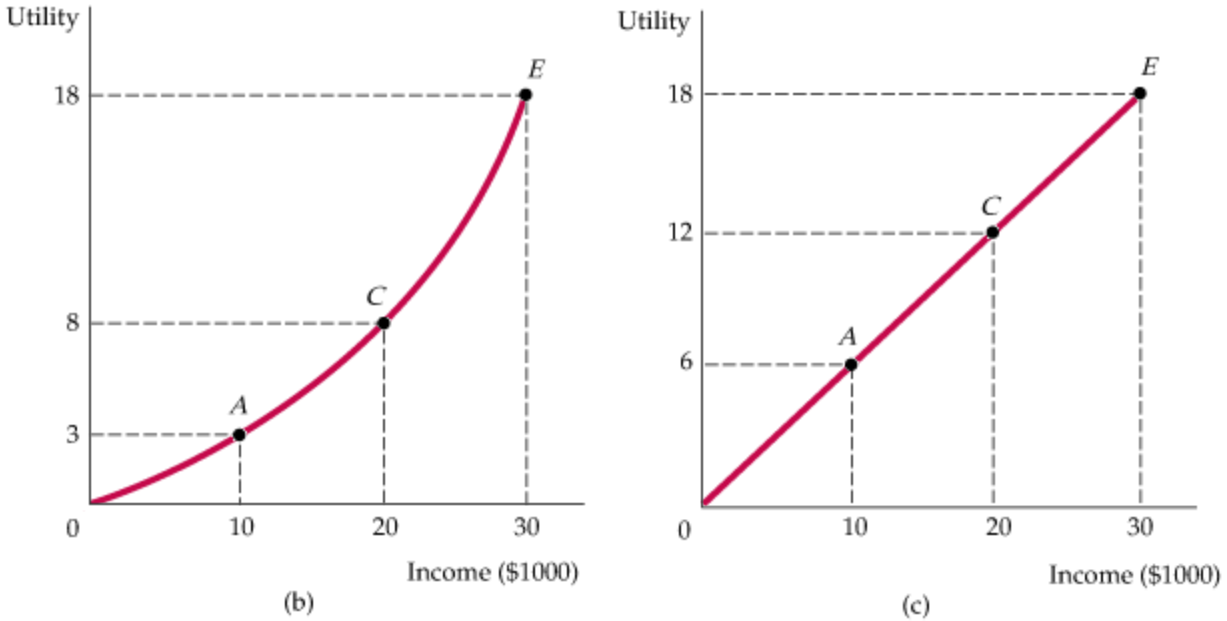
Figure 5.3

Risk Aversion, Risk Loving, and Risk Neutrality

In (b), the consumer is risk loving:

She would prefer the same gamble (with expected utility of 10.5) to the certain income (with a utility of 8).

In (c), the consumer is risk neutral, and indifferent between certain and uncertain events with the same expected income.



- **expected utility** Sum of the utilities associated with all possible outcomes, weighted by the probability that each outcome will occur.

5.2 PREFERENCES TOWARD RISK

Different Preferences Toward Risk

- **risk averse** Condition of preferring a certain income to a risky income with the same expected value.
- **risk neutral** Condition of being indifferent between a certain income and an uncertain income with the same expected value.
- **risk loving** Condition of preferring a risky income to a certain income with the same expected value.

Different Preferences Toward Risk

Risk Premium

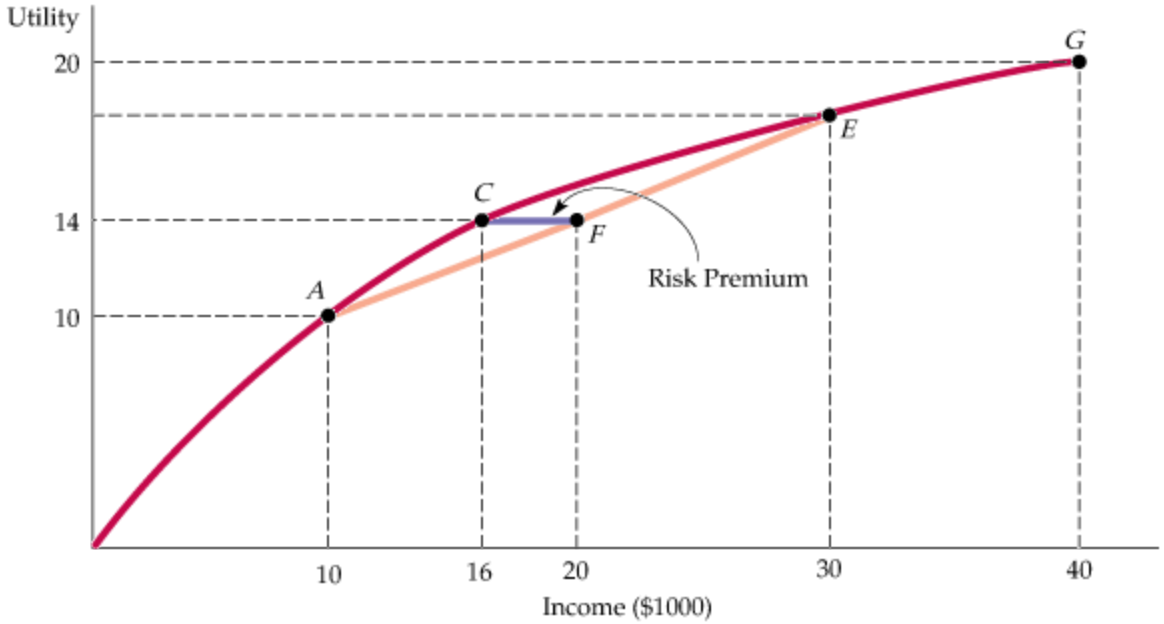
- **risk premium** Maximum amount of money that a risk-averse person will pay to avoid taking a risk.

Figure 5.4

Risk Premium

The risk premium, *CF*, measures the amount of income that an individual would give up to leave her indifferent between a risky choice and a certain one.

Here, the risk premium is $4000 because a certain income of $16,000 (at point *C*) gives her the same expected utility (14) as the uncertain income (a .5 probability of being at point *A* and a .5 probability of being at point *E*) that has an expected value of $20,000.



Different Preferences Toward Risk

Risk Aversion and Income

The extent of an individual's risk aversion depends on the nature of the risk and on the person's income.

Other things being equal, risk-averse people prefer a smaller variability of outcomes.

The greater the variability of income, the more the person would be willing to pay to avoid the risky situation.

Different Preferences Toward Risk

Risk Aversion and Indifference Curves

Figure 5.5

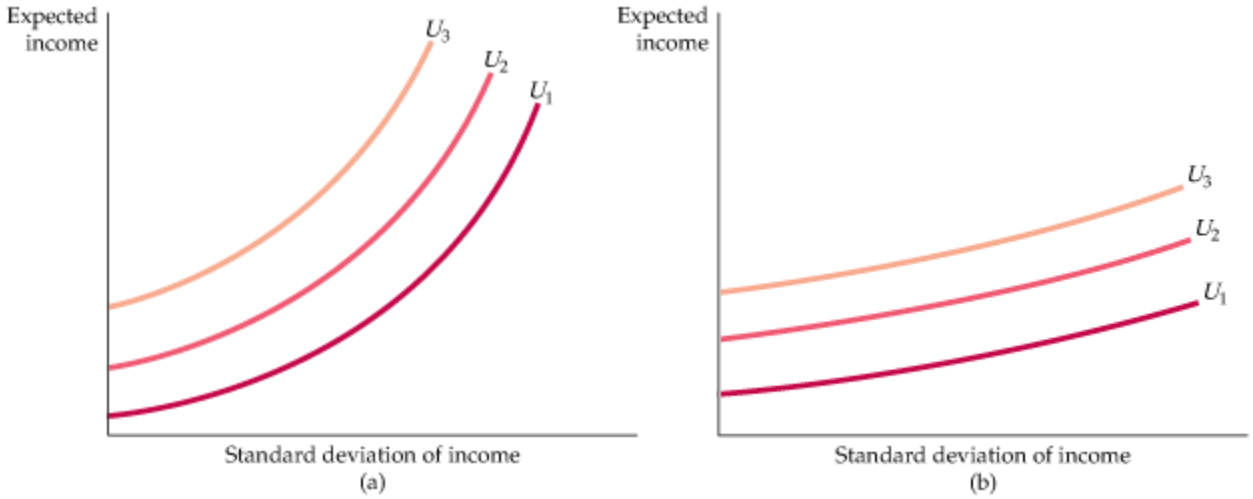
Risk Aversion and Indifference Curves

Part (a) applies to a person who is highly risk averse:

An increase in this individual's standard deviation of income requires a large increase in expected income if he or she is to remain equally well off.

Part (b) applies to a person who is only slightly risk averse:

An increase in the standard deviation of income requires only a small increase in expected income if he or she is to remain equally well off.



5.2 PREFERENCES TOWARD RISK

EXAMPLE 5.2 Business Executives and the Choice of Risk

Are business executives more risk loving than most people?

In one study, 464 executives were asked to respond to a questionnaire describing risky situations that an individual might face as vice president of a hypothetical company.

The payoffs and probabilities were chosen so that each event had the same expected value.

In increasing order of the risk involved, the four events were:

1. A lawsuit involving a patent violation
2. A customer threatening to buy from a competitor
3. A union dispute
4. A joint venture with a competitor

The study found that executives vary substantially in their preferences toward risk. More importantly, executives typically made efforts to reduce or eliminate risk, usually by delaying decisions and collecting more information.

5.3 REDUCING RISK

Diversification

- **diversification** Practice of reducing risk by allocating resources to a variety of activities whose outcomes are not closely related.

TABLE 5.5 Income from Sales of Appliances ($)

	Hot Weather	Cold Weather
Air conditioner sales	30,000	12,000
Heater sales	12,000	30,000

- **negatively correlated variables** Variables having a tendency to move in opposite directions.

The Stock Market

- **mutual fund** Organization that pools funds of individual investors to buy a large number of different stocks or other financial assets.

- **positively correlated variables** Variables having a tendency to move in the same direction.

5.3 REDUCING RISK

Insurance

TABLE 5.6 The Decision to Insure ($)

Insurance	Burglary (Pr = .1)	No Burglary (Pr = .9)	Expected Wealth	Standard Deviation
No	40,000	50,000	49,000	3000
Yes	49,000	49,000	49,000	0

The Law of Large Numbers

The ability to avoid risk by operating on a large scale is based on the *law of large numbers*, which tells us that although single events may be random and largely unpredictable, the average outcome of many similar events can be predicted.

Actuarial Fairness

- **actuarially fair** Characterizing a situation in which an insurance premium is equal to the expected payout.

EXAMPLE 5.3 The Value of Title Insurance When Buying a House

Suppose you are buying your first house. To close the sale, you will need a deed that gives you clear "title." Without such a clear title, there is always a chance that the seller of the house is not its true owner.

In situations such as this, it is clearly in the interest of the buyer to be sure that there is no risk of a lack of full ownership.

The buyer does this by purchasing "title insurance."

Because the title insurance company is a specialist in such insurance and can collect the relevant information relatively easily, the cost of title insurance is often less than the expected value of the loss involved.

In addition, because mortgage lenders are all concerned about such risks, they usually require new buyers to have title insurance before issuing a mortgage.

5.3 REDUCING RISK

The Value of Information

- **value of complete information** Difference between the expected value of a choice when there is complete information and the expected value when information is incomplete.

TABLE 5.7 Profits from Sales of Suits ($)

	Sales of 50	Sales of 100	Expected Profit
Buying 50 suits	5000	5000	5000
Buying 100 suits	1500	12,000	6750

EXAMPLE 5.4 The Value of Information in the Dairy Industry

Per-capita consumption of milk has declined over the years—a situation that has stirred producers to look for new strategies to encourage milk consumption.

One strategy would be to increase advertising expenditures and to continue advertising at a uniform rate throughout the year.

A second strategy would be to invest in market research in order to obtain more information about the seasonal demand for milk.

Research into milk demand shows that sales follow a seasonal pattern, with demand being greatest during the spring and lowest during the summer and early fall.

In this case, the cost of obtaining seasonal information about milk demand is relatively low and the value of the information substantial.

Applying these calculations to the New York metropolitan area, we discover that the value of information—the value of the additional annual milk sales—is about $4 million.

EXAMPLE 5.5 Doctors, Patients, and the Value of Information

Suppose you were seriously ill and required major surgery. Assuming you wanted to get the best care possible, how would you go about choosing a surgeon and a hospital to provide that care?

A truly informed decision would probably require more detailed information.

This kind of information is likely to be difficult or impossible for most patients to obtain.

More information is often, but not always, better. Whether more information is better depends on which effect dominates—the ability of patients to make more informed choices versus the incentive for doctors to avoid very sick patients.

More information often improves welfare because it allows people to reduce risk and to take actions that might reduce the effect of bad outcomes. However, information can cause people to change their behavior in undesirable ways.

5.4 THE DEMAND FOR RISKY ASSETS

Assets

- **asset** Something that provides a flow of money or services to its owner.

An increase in the value of an asset is a *capital gain*; a decrease is a *capital loss.*

Risky and Riskless Assets

- **risky asset** Asset that provides an uncertain flow of money or services to its owner.

- **riskless (or risk-free) asset** Asset that provides a flow of money or services that is known with certainty.

5.4 THE DEMAND FOR RISKY ASSETS

Asset Returns

- **return** Total monetary flow of an asset as a fraction of its price.
- **real return** Simple (or nominal) return on an asset, less the rate of inflation.

Expected versus Actual Returns

- **expected return** Return that an asset should earn on average.
- **actual return** Return that an asset earns.

TABLE 5.8 Investments—Risk and Return (1926–2006*)

	Average Rate of Return (%)	Average Real Rate of Return (%)	Rate Risk (Standard Deviation, %)
Common stocks (S&P 500)	5000	5000	5000
Long-term corporate bonds	6.2	3.1	8.5
U.S. Treasury bills	3.8	0.7	3.1

**Source: Stocks, Bonds, Bills, and Inflation: 2007 Yearbook,* Morningstar, Inc.*

5.4 THE DEMAND FOR RISKY ASSETS

The Trade-Off Between Risk and Return

The Investment Portfolio

$$R_p = bR_m = (1-b)R_f \quad (5.1)$$

$$\sigma_p = b\sigma_m \quad (5.2)$$

The Investor's Choice Problem

$$R_p = R_f + b(R_m - R_f)$$

$$R_p = R_f + \frac{(R_m - R_f)}{\sigma_m}\sigma_p \quad (5.3)$$

- **Price of risk** Extra risk that an investor must incur to enjoy a higher expected return.

The Investor's Choice Problem

Risk and Indifference Curves

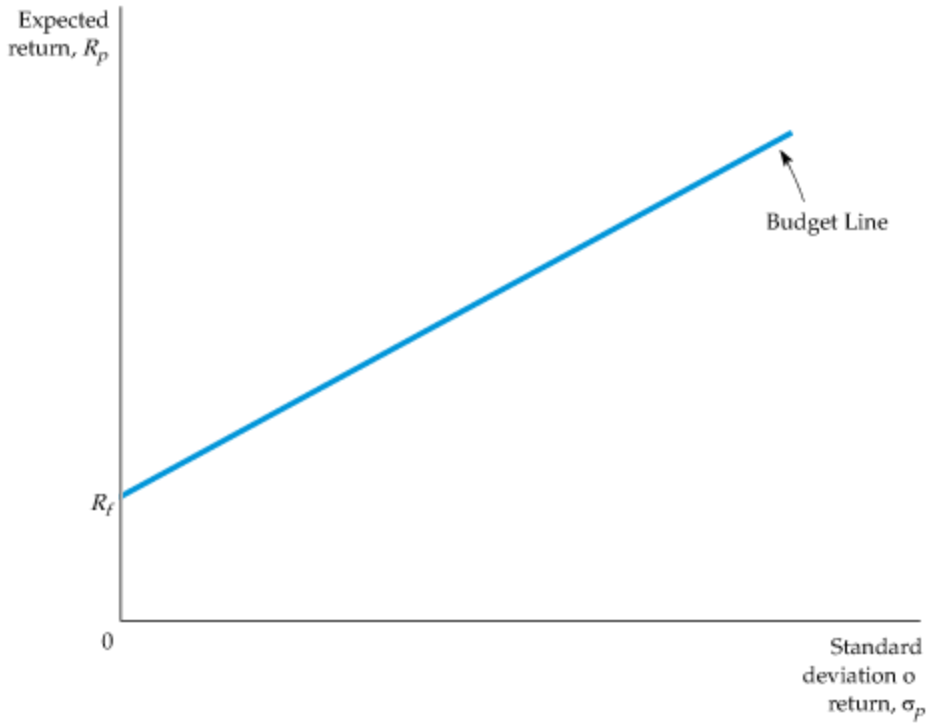
Figure 5.6

Choosing Between Risk and Return

An investor is dividing her funds between two assets—Treasury bills, which are risk free, and stocks.
To receive a higher expected return, she must incur some risk.

The budget line describes the trade-off between the expected return and its riskiness, as measured by the standard deviation of the return.

The slope of the budget line is $(R_m - R_f)/\sigma_m$, which is the price of risk.



The Investor's Choice Problem

Risk and Indifference Curves

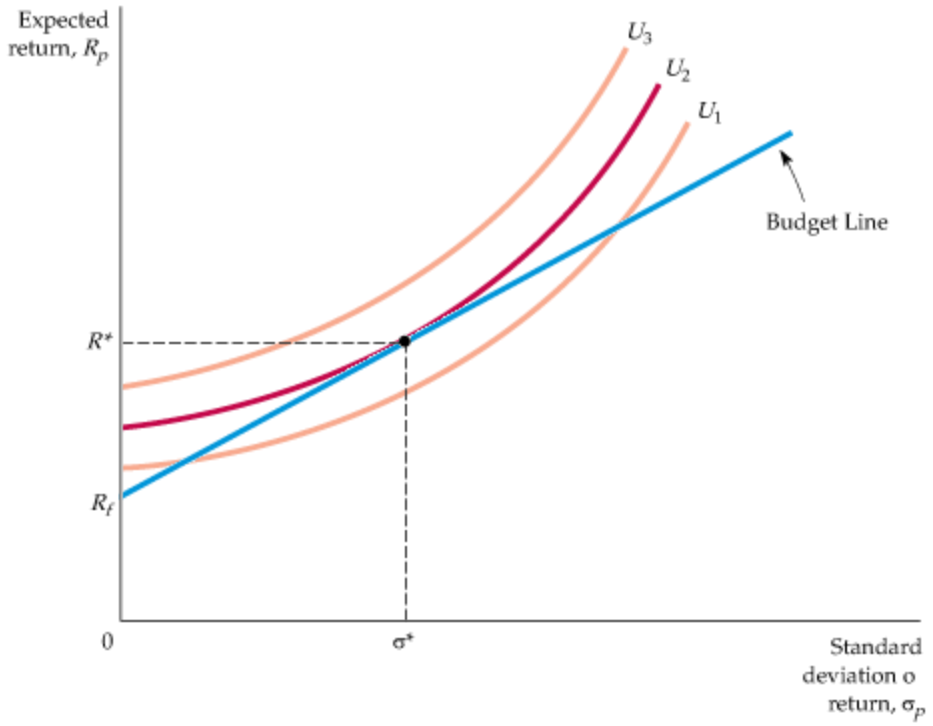
Figure 5.6

Choosing Between Risk and Return

Three indifference curves are drawn, each showing combinations of risk and return that leave an investor equally satisfied.

The curves are upward-sloping because a risk- averse investor will require a higher expected return if she is to bear a greater amount of risk.

The utility-maximizing investment portfolio is at the point where indifference curve U_2 is tangent to the budget line.



The Investor's Choice Problem

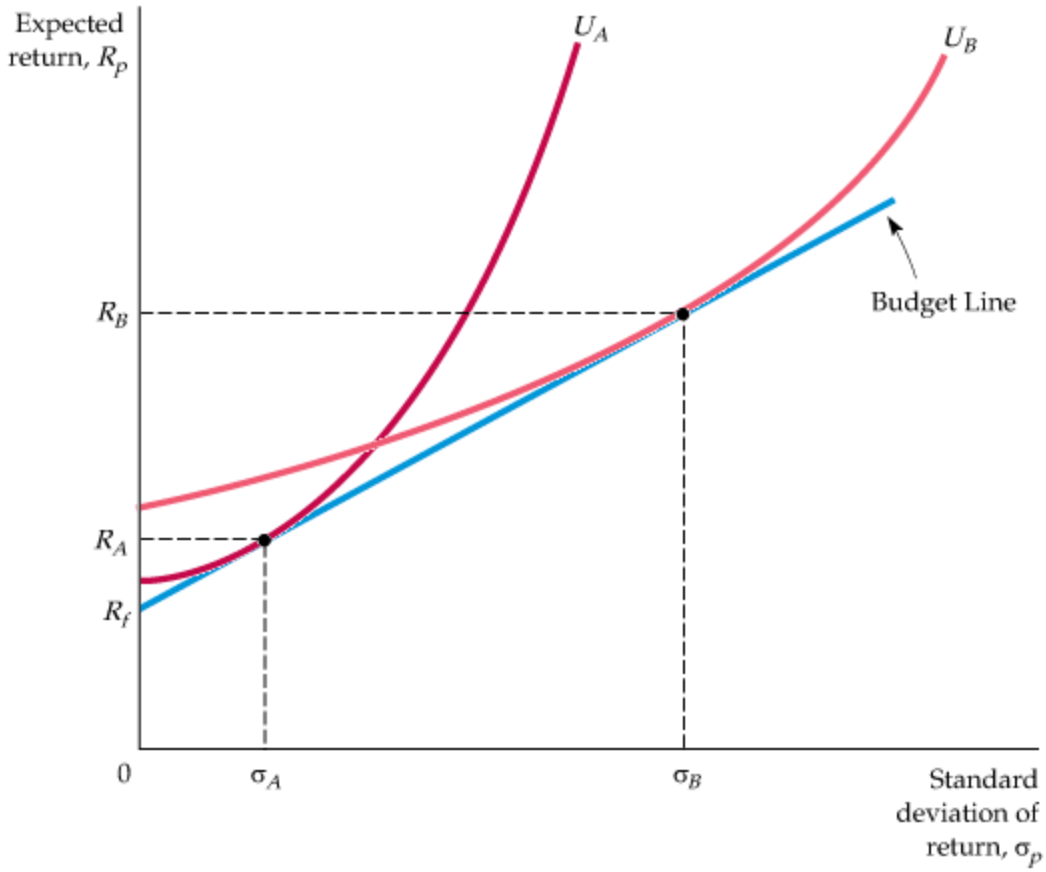
Risk and Indifference Curves

Figure 5.7

The Choices of Two Different Investors

Investor A is highly risk averse. Because his portfolio will consist mostly of the risk-free asset, his expected return R_A will be only slightly greater than the risk-free return. His risk σ_A, however, will be small.

Investor B is less risk averse. She will invest a large fraction of her funds in stocks. Although the expected return on her portfolio R_B will be larger, it will also be riskier.



The Investor's Choice Problem

Risk and Indifference Curves

Figure 5.8

Buying Stocks on Margin

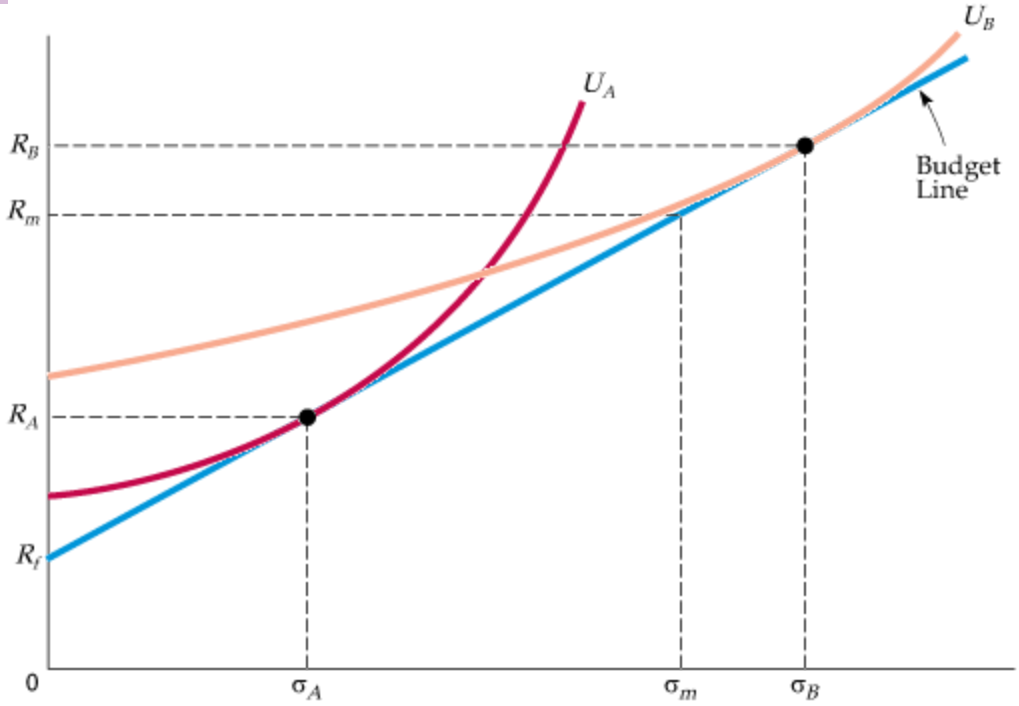
Because Investor *A* is risk averse, his portfolio contains a mixture of stocks and risk-free Treasury bills.

Investor *B*, however, has a very low degree of risk aversion.

Her indifference curve, U_B, is tangent to the budget line at a point where the expected return and standard deviation for her portfolio exceed those for the stock market overall (R_m, σ_m) .

This implies that she would like to invest *more* than 100 percent of her wealth in the stock market.

She does so by buying stocks *on margin*—i.e., by borrowing from a brokerage firm to help finance her investment.



EXAMPLE 5.6 Investing in the Stock Market

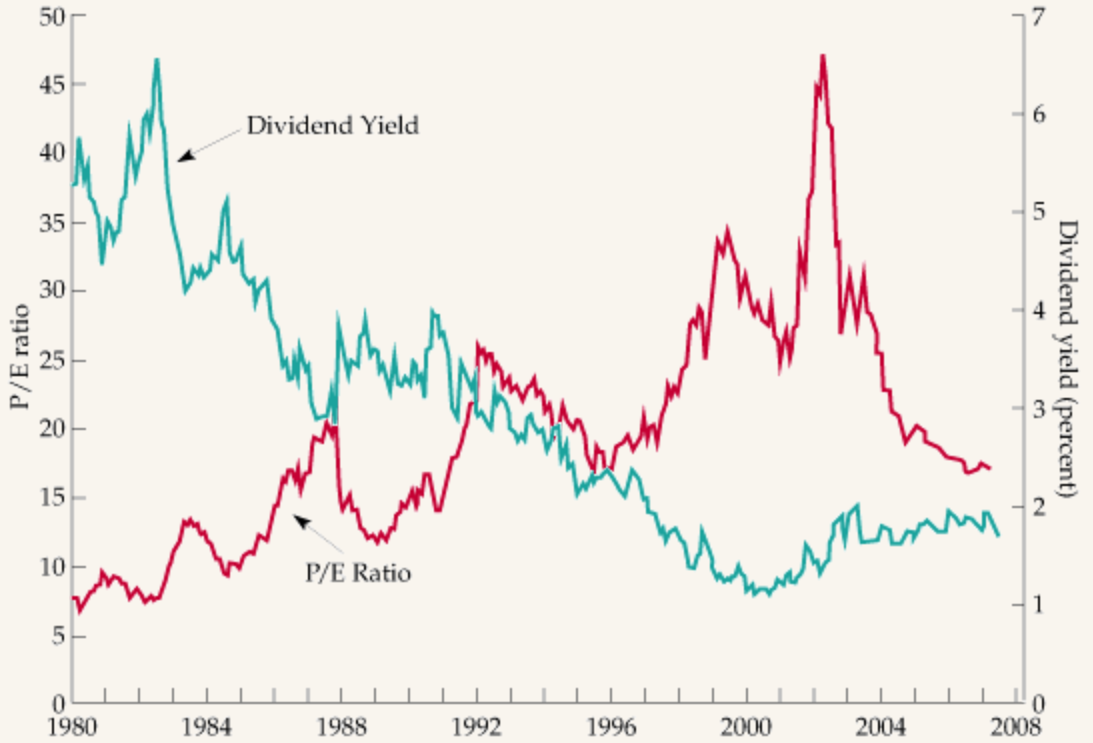
Why have more people started investing in the stock market? One reason is the advent of online trading, which has made investing much easier.

Figure 5.9

Dividend Yield and P/E Ratio for S&P 500

The price/earnings ratio (the stock price divided by the annual earnings-per-share) rose from 1980 to 2002 and then dropped.

During the same period, the dividend yield for the S&P 500 (the annual dividend divided by the stock price) has fallen dramatically.



5.5 BEHAVIORAL ECONOMICS

Recall that the basic theory of consumer demand is based on three assumptions:

(1) consumers have clear preferences for some goods over others;

(2) consumers face budget constraints; and

(3) given their preferences, limited incomes, and the prices of different goods, consumers choose to buy combinations of goods that maximize their satisfaction.

These assumptions, however, are not always realistic.

Perhaps our understanding of consumer demand (as well as the decisions of firms) would be improved if we incorporated more realistic and detailed assumptions regarding human behavior.

This has been the objective of the newly flourishing field of *behavioral economics*.

5.5 BEHAVIORAL ECONOMICS

Here are some examples of consumer behavior that cannot be easily explained with the basic utility-maximizing assumptions:

- There has just been a big snowstorm, so you stop at the hardware store to buy a snow shovel. You had expected to pay $20 for the shovel—the price that the store normally charges. However, you find that the store has suddenly raised the price to $40. Although you would expect a price increase because of the storm, you feel that a doubling of the price is unfair and that the store is trying to take advantage of you. Out of spite, you do not buy the shovel.
- Tired of being snowed in at home you decide to take a vacation in the country. On the way, you stop at a highway restaurant for lunch. Even though you are unlikely to return to that restaurant, you believe that it is fair and appropriate to leave a 15-percent tip in appreciation of the good service that you received.
- You buy this textbook from an Internet bookseller because the price is lower than the price at your local bookstore. However, you ignore the shipping cost when comparing prices.

5.5 BEHAVIORAL ECONOMICS

More Complex Preferences

- **reference point** The point from which an individual makes a consumption decision.

- **endowment effect** Tendency of individuals to value an item more when they own it than when they do not.

- **loss aversion** Tendency for individuals to prefer avoiding losses over acquiring gains.

Rules of Thumb and Biases in Decision Making

- **anchoring** Tendency to rely heavily on one or two pieces of information when making a decision.

5.5 BEHAVIORAL ECONOMICS

Probabilities and Uncertainty

An important part of decision making under uncertainty is the calculation of expected utility, which requires two pieces of information: a utility value for each outcome (from the utility function) and the probability of each outcome.

People are sometimes prone to a bias called the *law of small numbers*: They tend to overstate the probability that certain events will occur when faced with relatively little information from recent memory.

Forming subjective probabilities is not always an easy task and people are generally prone to several biases in the process.

Summing Up

The basic theory that we learned up to helps us to understand and evaluate the characteristics of consumer demand and to predict the impact on demand of changes in prices or incomes.

The developing field of behavioral economics tries to explain and to elaborate on those situations that are not well explained by the basic consumer model.

EXAMPLE 5.7 New York City Taxicab Drivers

Most cab drivers rent their taxicabs for a fixed daily fee from a company. As with many services, business is highly variable from day to day. How do cabdrivers respond to these variations, many of which are largely unpredictable?

A recent study analyzed actual taxicab trip records obtained from the New York Taxi and Limousine Commission for the spring of 1994.31 The daily fee to rent a taxi was then $76, and gasoline cost about $15 per day.

Surprisingly, the researchers found that most drivers drive more hours on slow days and *fewer* hours on busy days.

In other words, there is a *negative relationship* between the effective hourly wage and the number of hours worked each day.

EXAMPLE 5.7 New York City Taxicab Drivers (continued)

A different study, also of New York City cabdrivers who rented their taxis, concluded that the traditional economic model does indeed offer important insights into drivers' behavior.

The study concluded that daily income had only a small effect on a driver's decision as to when to quit for the day.

Rather, the decision to stop appears to be based on the cumulative number of hours already worked that day and not on hitting a specific income target.

What can account for these two seemingly contradictory results? The two studies used different techniques in analyzing and interpreting the taxicab trip records.