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Chapter 2

Economic Methods and Economic Questions

Questions

1. What does it mean to say that economists use the scientific method? How do economists distinguish between models that work and those that don't?

Answer: The scientific method is the name for the ongoing process that economists and other scientists use to develop models of the world, test those models with data, and evaluate how well the models predict behavior. While this process may not reveal the 'true' model of the world, it does help identify models that are useful in understanding the world.

In order to decide whether models make accurate predictions or not, economists test them against real-world data. Data are facts, measurements, or statistics that describe the world. This process of testing models against data is called empiricism.

2. What is meant by empiricism?

Answer: Empirical evidence is a set of facts established by observation and measurement, which are used to evaluate a model. Empiricism refers to the practice of using data to test economic models. When conducting empirical analysis, economists refer to a model's predictions as hypotheses. Hypotheses are predictions (typically generated by a model) that can be tested with data.

3. What are two important properties of economic models? Models tend to be simplified descriptions of a real-world phenomenon. Does this mean that they are unrealistic?

Answer: A good economic model has two important properties. First, it is an approximation. The model predicts what would happen on average. Second, it makes predictions that can be falsified by data.

A model is a simplified description, or representation, of reality. Because models are simplified, they are not perfect replicas of reality. However, this does not mean that they are unrealistic. Models are usually simplified in order to be able to isolate the relationship between two variables. Even if a model is based on simplified assumptions, it may still help us make good predictions.

4. Suppose 5,000 people bought popsicles on a hot summer day. If the average number of popsicles that each person bought is 2, how many popsicles were sold that day?

Answer: The mean is calculated as the sum of all the different items divided by the number of items. The average value is the sum of all popsicles sold divided by the number of people who bought them. If each of the 5,000 people bought an average of 2 popsicles, that implies that 10,000 popsicles were sold that day.

5. How does the sample size affect the validity of an empirical argument? When is it acceptable to use only one example to disprove a statement?

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Answer: The size of the sample used to test the argument can affect the results. A small sample may mean no conclusions can be drawn from a study. A key strength of economic analysis is the amount of data used. Using a large number of observations strengthens the force of an empirical argument. For example, if you collect information on consumption from 20,000 people as opposed to 20 people, you are likely to get a more representative result. However, a single example can be used to contradict a statement.

6. Explain why correlation does not always imply causation. Does causation always imply *positive* correlation? Explain your answer.

Answer: Correlation means that there is a relationship between two variables; as one variable changes, another variable changes. Causation occurs when one variable directly affects another through a cause-and-effect relationship. Correlation suggests that there is some kind of connection, but not necessarily a cause and an effect. For example, number of storks in a region might be correlated with the number of babies born in the region. But this doesn't mean that storks bring babies.

Positive correlation implies that two variables tend to move in the same direction. However, causation need not only imply positive correlation. For example, sleeping an extra hour per night may improve your energy level at work. However, this positive relationship is swamped by the fact that people who sleep a ton tend to be low energy; thus hours of sleep and energy will be negatively correlated even though there is a positive causal link.

7. Give an example of a pair of variables that have a positive correlation, a pair of variables that have a negative correlation, and a pair of variables that have zero correlation.

Answer: A person's IQ and his or her telephone number are likely to show zero correlation. The number of winter coats sold and the average temperature in a region are likely to show a negative correlation. The quantity of fertilizers used and crop yield (e.g., the number of bushels of wheat grown per acre) are likely to have a positive correlation.

8. What is meant by randomization? How does randomization affect the results of an experiment?

Answer: Randomization is the assignment of subjects by chance, rather than by choice, to the effect of a treatment. Assigning participants randomly will ensure that the result of the experiment is not biased. When randomization is employed, correlation *does* imply causation: How else can a positive correlation be explained? There is no other way (assuming perfect random assignment) except with a causal link between the treatment and the outcome.

9. This chapter discussed natural and randomized experiments. How does a natural experiment differ from a randomized one?

Answer: A natural experiment is an empirical study in which some process – out of the control of the experimenter – has assigned subjects to control and test groups in a random or nearly random way. The process of randomization involves the assignment of subjects by chance, rather than by choice, to a test group or control group.

10. Suppose you had to find the effect of seat belt rules on road accident fatalities. Would you choose to run a randomized experiment or would it make sense to use natural experiments here? Explain.

Answer: It would be difficult (and, in many people's view, unethical) to conduct a randomized experiment. Instead, the study should use a natural experiment. You can study data on the causes of road accident fatalities in cities where seat belt rules were not enforced, or in cities that have recently adopted new, more stringent seat belt laws. Controlling for other factors like an increase in the number of cars, etc., you can then look at similar data when seat belt rules have been implemented.

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Problems

1. Although the mean and median are closely related, the difference between the mean and the median is sometimes of interest.
   a. Suppose country A has five families. Their incomes are $10,000, $20,000, $30,000, $40,000, and $50,000. What is the median family income in A? What is the mean income?
   b. Country B also has five families. Their incomes are $10,000, $20,000, $30,000, $40,000, and $150,000. What is the median family income in B? What is the mean income?
   c. In which country is income inequality greater, A or B?
   d. Suppose you thought income inequality in the US had increased over time. Based on your answers to this question, would you expect that the ratio of the mean income in the US to the median income has risen or fallen? Explain.

Answer:

   a. We can find the mean by summing the observations and dividing by the number of observations. So the mean income in Country A is ($10,000 + $20,000 + $30,000 + $40,000 + $50,000) / 5 = $30,000. The median income is the income of the family in the middle of the income distribution. The median income in Country A is $30,000. Two families have income below $30,000 and two have income above $30,000.
   b. A similar argument shows that the mean income in Country B is ($10,000 + $20,000 + $30,000 + $40,000 + $150,000) / 5 = $50,000. Median income in B is $30,000; as in Country A, two families have income below $30,000 and two have income above $30,000.
   c. Income inequality is higher in Country B. The highest income family in Country B earns $150,000, 60% of the total income in that country. The highest income family in A earns $50,000, just 33% of total income in A. We found that the median income in the two countries was the same but the mean income was very different. Means will be heavily influenced by extreme values such as the incomes of the very wealthy; median income is less sensitive to extremes. Economists sometimes use the ratio of the mean to median income in a country as a rough measure of income inequality; higher values of this ratio reflect greater inequality.
   d. You should expect to find that the ratio of the mean to median income has risen. As we argued above, the mean is more sensitive than the median to the incomes of the very wealthy.

2. Consider the following situation: your math professor tells your class (of five students) that the mean score on the final exam is 80 but the median is 100. How is that possible? Explain.

Answer: Typically, when the mean is lower than the median there is a skew in the data: The test scores that were below the median were way below the median. For example, with only five tests, the median may be 100 because three out of five people scored 100. If the lower scorers received scores of 40 and 60 then the average (i.e. the mean) will be (40+60+100+100+100)/5 = 80.

3. Suppose you come across a study that has discovered a correlation between reading books and life expectancy: People who read more books live longer. Come up with at least one plausible way that this correlation exists even though there is no direct causal link.

Answer: One possibility is that wealthier individuals can afford to spend more time reading; they also can afford better medical care. Another possibility is that sitting in a quiet place is good for health, and reading just happens to be one way to sit in a quiet place. Also, if you live longer you have more time to

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read more books (reverse causality), though any reasonable study would account for this effect before drawing conclusions.

4. Some studies have found that people who owned guns were more likely to be killed with a gun. Do you think this study is strong evidence in favor of stricter gun control laws? Explain.

Answer: Not necessarily. It is quite possible that people who thought they were at risk (perhaps because they live in dangerous neighborhoods) were more likely to buy a gun for self-protection. This is an example of a case where correlation may not imply causation. There has been a good deal of research on this question. See, for example, a Harvard School of Public Health 2011 interview with David Hemenway (http://www.hsph.harvard.edu/news/features/review-guns-politics-hemenway).

5. As the text explains, it can sometimes be very difficult to sort out the direction of causality.

   a. Why might you think more police officers would lead to lower crime rates? Why might you think that higher crime rates would lead to more police officers?

   b. In 2012, the *New England Journal of Medicine* published research that showed a strong correlation between the consumption of chocolate in a country and the number of Nobel Prize winners in that country. Do you think countries that want to encourage their citizens to win Nobel Prizes should increase their consumption of chocolate?

   c. A recent article in the Journal of Applied Physiology found that elderly runners had healthier muscles than a comparison group of the same age. Although the members of the comparison group were all still living independently, they had lower muscle mass and muscle strength than the athletes. The popular press framed the article as proof that exercise causes people to be healthier. Is that the only way to interpret causality in this example?

Answer:

   a. There is a great deal of evidence that increasing the number of police officers in a neighborhood can drive down crime. The police, for example, will deter criminals who realize the chances they will be caught have gone up and the police may be able to head off conflicts between gangs. Therefore more police could lead to less crime. Cities strategically assign more police to high crime areas (since by definition, those are the areas where crimes are more likely to occur). Therefore, more crime can lead to more police.

   b. Correlation does not necessarily imply causation. A strong positive correlation between chocolate consumption and Nobel Prize winners does not, by itself, suggest causation. It is possible that this is a chance correlation. It may also be case that certain variables that could explain this relationship have been omitted from the study.

   c. Another quite likely story that would generate the same correlation between running and muscle mass: Elderly people with enough muscle to go outside for a run are more likely to go outside for a run! It is likely some people who lose muscle mass and respond by not running as much; in fact, this almost surely happens. This argument is not definitive proof that the causal link from running to muscle mass is false, but the study is also not definitive proof that the causal link is true.

   See the June 11, 2013 New York Times article "Chicago Tactics Put Major Dent in Killing Trend" (http://www.nytimes.com/2013/06/11/us/chicago-homicides-fall-by-34-percent-so-far-this-year.html?hp) on the relationship between police and crime rates. See http://www.reuters.com/article/2012/10/10/us-eat-chocolate-win-the-nobel-prize-idUSBRE8991MS20121010 on the effects of eating chocolate.

6. The chapter shows that as a general rule people with more education earn higher salaries. Economists

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have offered two explanations of this relationship. The human capital argument says that high schools and colleges teach people valuable skills and employers are willing to pay higher salaries to attract people with those skills. The signaling argument says that college graduates earn more because a college degree is a signal to employers that a job applicant is diligent, intelligent, and persevering. How might you use data on people with 2, 3, and 4 years of college education to shed light on this controversy?

Answer: If the human capital explanation is correct, then we might expect to find that people who attend college but do not graduate earn salaries that are close to what college graduates earn. Consider the extreme case of people who drop out of college the week before graduation. It is very unlikely that they would have improved their job skills much in that last week. The human capital school of thought would suggest that they should therefore earn roughly the same salaries as college graduates. On the other hand, the signaling school of thought would argue that these people should earn significantly less than college graduates. Employers would interpret their failure to graduate as a signal they are not as diligent or persevering as people who see their college educations through to the end. There is substantial literature on what is often called the "sheepskin effect" (college diplomas used to be written on sheepskin; Notre Dame continued to use sheepskin until 2012). That literature suggests that human capital and signaling both contribute to the returns to education that we observe in the data.

For recent evidence, see the Michael Greenstone and Adam Looney 2013 Brookings Institution study **"**Is Starting College and Not Finishing Really That Bad?" (http://www.brookings.edu/blogs/jobs/posts/2013/06/07-return-to-some-college-greenstone-looney). They find that people with some college education but who do not graduate from college earn an average of $8,000 more per year than high school graduates who never attend college.

7. You decide to run an experiment. You invite 50 friends to a party. You randomly select 25 friends and tell them that there will be free food; most of them show up to your party. For the other 25 friends you do not mention the free food; none of these friends show up. Based on the correlation in your data, you conclude that free food causes people to come to parties. A buddy points out "be careful, correlation does not imply causation." How should you respond?

Answer: Assuming you really did choose the two groups randomly, then the *correlation does in fact imply causation*. If your friend challenges you, ask him "what else could it be?" Given randomization, the relationship is not due to omitted variables, nor is it due to reverse causality. (It is possible that due to a small sample you just happened to get a spurious correlation, but this is another matter related to statistical inference, not correlation vs causation.)

8. Oregon expanded its Medicaid coverage in 2008. Roughly 90,000 people applied but the state had funds to cover only an additional 30,000 people (who were randomly chosen from the total applicant pool of 90,000). How could you use the Oregon experience to estimate the impact of increased access to health care on health outcomes?

Answer: The Oregon experience is a natural experiment. The state chose people randomly from the pool of applicants, and so on average the new Medicaid recipients were very similar to the people who applied but were turned down. By tracking the health outcomes of people in these two groups we can study the effect of better access to health care.

See "Medicaid Access Increases Use of Care, Study Finds," New York Times, May 1, 2013 (http://www.nytimes.com/2013/05/02/business/study-finds-health-care-use-rises-with-expanded-medicaid.html?_r=0).

9. A simple economic model predicts that a fall in the price of bus tickets means that more people will take the bus. However, you observe that some people still do not take the bus even after the price of a ticket fell.

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a. Is the model incorrect?

b. How would you test this model?

Answer:

a. The model is not necessarily incorrect. Models are only approximations of real-life behavior. Even very good models make predictions that are often correct. So, on average, more people will take the bus. The model is also likely to have made some assumptions, such as no change in costs of other types of transport, or that people have no specific preferences and cost is the only determinant of the mode of transport used. In reality, some of these assumptions may be violated which could explain why a fall in the price of bus tickets does not induce everyone to take the bus. That does not imply that the model's conclusion is incorrect. In situations where the assumptions it makes are satisfied, its prediction will often be correct.

b. The hypothesis here states that as bus prices fall, the number of passengers who take the bus will increase. A natural experiment can be used to test this model. You can use data on price changes and changes in revenues earned from tickets to see whether the model is accurate.

A1. How would you represent the following graphically?

a. Income inequality in the U.S. has increased over the past 10 years.

b. All the workers in the manufacturing sector in a particular country fit into one (and only one) of the following categories: 31.5 percent are high school dropouts, 63.5 percent have a high school diploma, and the rest have vocational training certificates.

c. The median income of a household in Alabama was $43,464 in 2012, and the median income of a household in Connecticut was $64,247 in 2012.

Answer:

a. Since the graph needs to show how income inequality increases over a period of time, a time-series graph needs to be used here.

b. A pie chart is a circular chart split into segments to show the percentages of parts to the whole. Since the given data is in percentages, a pie-chart can be used to represent each category of workers.

c. A bar chart would be a good way to compare income in Alabama and Connecticut. The height of each bar would represent the income in each one of the states.

A2. Consider the following data that shows the quantity of coffee produced in Brazil from 2004-2012.

Year	Production (in tons)
2004	2,465,710
2005	2,140,169
2006	2,573,368
2007	2,249,011
2008	2,796,927
2009	2,440,056
2010	2,907,265
2011	2,700,440

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2012	3,037,534

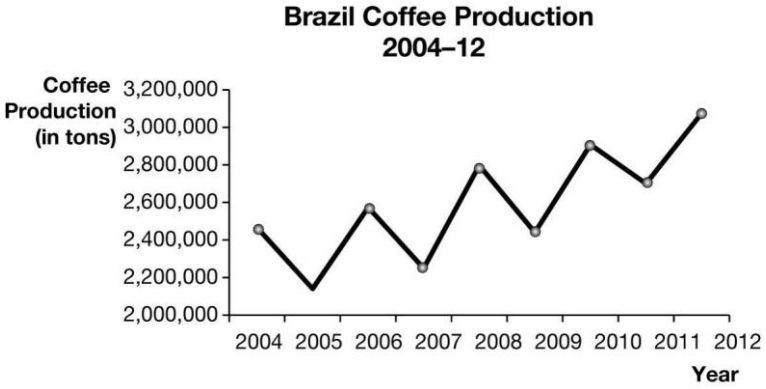
a. Plot the data in a time series graph.

b. What is the mean quantity of coffee that Brazil produced from 2009 to 2011?

c. In percentage terms, how much has the 2012 crop increased over the 2009-2011 mean?

Answer:

a. A time-series graph can be used to represent the quantity of coffee produced from 2004 to 2012.



b. The average quantity of coffee that Brazil produced during the 2009-11 period is 2,682,589 587 tons. This is the sum of the total quantity produced divided by the number of years.

c. The coffee crop in 2012 is 14.6% larger than the average coffee crop in 2009-2011. The increase in production is 3,073,534 – 2,682,589 = 390,945. In percentage terms, the change is 390,945 / 2,682,589 587 = 14.6%.

Data taken from: http://faostat.fao.org/site/567/default.aspx#ancor

A3. Suppose the following table shows the relationship between revenue that the Girl Scouts earn and the number of cookie boxes that they sell.

Number of cookie boxes	Revenue ($)
50	200
150	600
250	1,000
350	1,400
450	1,800
550	2,200

a. Present the data in a scatter plot.

b. Do the two variables have a positive relationship or do they have a negative relationship? Explain.

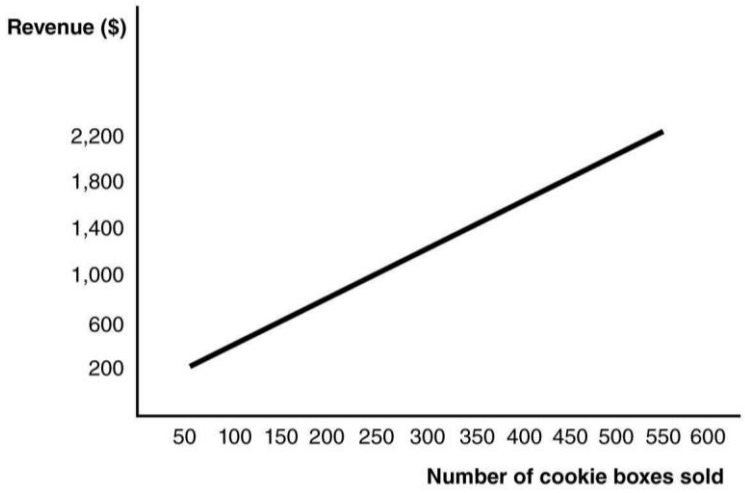
c. What is the slope of the line that you get in the scatter plot? What does the slope imply about the price of a box of Girl Scout cookies?

Answer:

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a. The following line chart shows the relationship between the Girl Scouts' revenue and the number of cookie boxes that they sell:



b. Since the values of both variables increase together in the same direction, they have a positive relationship. This means that as more cookie boxes are sold, the revenue earned increases.

c. The slope is constant in this problem and so we can choose any two points to calculate the slope. Suppose we use the first and last data points. The slope is calculated as $\frac{\text{Change in revenue}}{\text{Change in cookie boxes sold}} = \frac{2200-200}{550-50} = \frac{2000}{500} = 4$. The slope implies that one extra box of cookies sold is associated with $4 more in revenue.

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CHAPTER W1
Financial Decision Making

I. Key Ideas

The process that determines how an investment grows over time is referred to as compound returns.

If returns are risky, as they are for stock investments, it is important to consider the probability of good returns and bad returns.

Diversification—spreading one's investments across many assets—reduces the risks associated with investments.

Investors save in many different types of investment accounts: bank accounts, brokerage accounts, mutual funds, and retirement savings plans.

II. Getting Started

A. The Big Picture

Students who will start working and receiving income after they graduate should be especially interested in this chapter. As they start collecting a salary and making choices related to consumption and saving, they should understand concepts related to the power of compounding, risk associated with investments, the different types of assets, diversification, and other topics related to saving for their retirement. The goal is to educate students who are not majoring in economics and/or finance on money matters, in order to help them make better financial decisions in the future.

Where We've Been

The previous chapters of this textbook covered standard topics in microeconomics and macroeconomics. This chapter introduces a "special topic": how to better make financial decisions.

Where We're Going

The last two chapters will introduce two additional special topics—one on the economics of life, health, and the environment, and one on political economy.

B. Number of Lectures

Instructors are advised to spend one 50-minute lecture on this chapter. Here's a suggested breakdown of the lecture:

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- Provide a general overview of the chapter—the big picture [5 mins.]
- Using numerical examples, explain how asset values grow through compounding [10 mins.]
- Spend the next few minutes on securities and the difference between stocks (or equity) and bonds [5 mins.]
- Explain how to use percentiles to identify the risk associated with investment [5 mins.]
- Explain the benefits from diversification in investment. [5 mins.]
- Describe the different investment accounts [15 mins.]
- Finally, discuss the EBE and link it to the opening question [5 mins.]

C. Opening Question and Evidence-Based Economics

"Do investors chase historical returns?"—Using the example of Enron is a good choice because it captures the potential perils of lack of diversification and the risk associated with return chasing.

III. Chapter Outline

W1.1 Investment Returns

Let's remind our students that when people save, they postpone consumption. They do so to enjoy more consumption in the future, because the money they save today grows at a rate that depends on the interest rate they receive.

How Money Grows—The process by which the value of an investment grows over time is referred to as **compounding. Compound returns** are generated when short-term returns are reinvested, producing returns on both the initial investment and on later investment returns. To see how, we first choose a *principal amount, which is* the value of the initial investment). Then, we identify the rate of return on the investment, r, and we use the following formula:

$$\text{Final value} = \text{principal amount } (1 + r)^T \ ,$$

where T is known as the **holding period**—the time interval, usually measured in years, between the initial investment and the final withdrawal.

- *Alternative Teaching Example:* Let's find the final value of a principal amount of $500 growing at an annual rate of return of 8%. Let's find the final value after each year.

  Final value after 1st year = $500 x (1 + 0.08) = $540
  Final value after 2nd year = $500 x $(1 + 0.08)^2$ = $583.2
  Final value after 3rd year = $500 x $(1 + 0.08)^3$ = $629.86
  Final value after 4th year = $500 x $(1 + 0.08)^4$ = $680.24
  Final value after 5th year = $500 x $(1 + 0.08)^5$ = $734.66
  .
  .
  .

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Final value after 30^{th} year = \$500 x $(1 + 0.08)^{30}$ = \$5,031.33

Notice that in the calculations above, two complications are ignored. First, rising prices, or inflation, may erode the purchasing power of the final value. We held inflation constant in the example. To adjust for inflation, we could subtract the rate of inflation from the rate of return *r* to arrive at the real rate of return. For example, if the inflation rate is 3%, then the real rate of return is approximately 8% - 3% = 5%. In this case, the final value after the 30^{th} year is \$500 x $(1 + 0.5)^{30}$ = \$2,160.97 (as compared to \$5,031.33 without adjusting for inflation). That is, the final value \$5,031.33 has the same purchasing power that \$2160.97 had at the time of the initial investment. The second factor that we ignored was **risk**, which exists when an outcome is not known with certainty in advance. In our example, we assumed that an investor receives a constant rate of return of 8% throughout the life of the investment—that's to say, without any risk that the return in some years might be lower (or higher). In real life, the return on most investments varies considerably—in some years there are high real returns and in other years there are low real returns. There is more discussion of risk later on in this chapter.

Securities—There are different types of financial investments. They are generally called **securities**, and they can take the form of bonds, stocks, or other financial claims. Some of these securities are short-term in nature and others are long-term. Short-term loans that individuals extend to the government (buying Treasury bills, for example) or to a highly secured corporation (like GE or GM) are practically risk-free and have low rates of return (knows as commercial papers). Bonds, on the other hand, are long-term loans made to a borrower (debtor) by a lender (creditor). Borrowers are obligated to pay bondholders a certain value at the end of a predetermined period, and to make periodic interest payments to bondholders. Finally, investing in stock is fundamentally different from investing in bonds. While the latter are loans that investors make to the government or to corporations, investing in a corporation's stock (also known as investing in its equity) gives the investors ownership rights in the corporation.

Stocks are riskier than bonds. To see this, suppose a company sells bonds and shares of stock to investors. If the company's business weakens and its earnings plummet, it is contractually obligated to first pay returns to its bondholders; then -- if there is remaining income-- the stockholders receive a return on their investment. In other words, if a company declares bankruptcy, first it must pay its bondholders in full, and then it pays its stockholders if there is additional income is available for distribution. But with risk come higher average returns. If a company's business is doing well, its shareholders earn higher rates of return than its bondholders.

W1.2 Risky Returns

The simulations in this part of the chapter illustrate the concept of risks associated with investments. The simulations are done on stock market returns, showing how it is often the case that returns on stocks go through runs of good returns and runs of bad returns. Just as with tossing a coin many times (say, 50), there will be times when heads come up several times in a row, times when tails come up several times in a row, and times when heads and tails alternate. Exhibit W1.2 illustrates the results of such a simulation.

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Exhibit W1.4 shows the results of 1,000 simulations of a $1 initial stock investment held for 50 years. Each simulation represents different year-by-year stock returns, under assumptions based on actual historical data from the U.S. stock market. The worst result shows a final balance of $1.10 after 50 years, and the best result shows a final balance of $2,151. The average of the 1,000 final balances is $117. As Exhibit W1.4 shows, however, there is a very wide range of possibilities, in terms of returns over 50 years. Is there an easier way to look at these possible returns?

Percentiles—One way to look at the different possibilities is to calculate the *N*th percentile, which is a cutoff that divides the data so that the *N***%** of the data is below the cutoff and (100-*N*)% of the data is above the cutoff.

Exhibit W1.5 illustrates percentiles of a final balance from a 50-year holding period of a $1 initial investment. For example, according to the simulation, what are the chances of turning a $1 investment into $169 after 50 years? Based on the exhibit, there is a 75% chance that a person will turn a $1 investment into less than $169, and 25% chance to turn the $1 into more than $169 after a 50-year holding period.

- *Alternative Teaching Example:* Since this is a principles class, students should remember what they scored on their SATs. For example, a student who scored 700 in math is in the 93rd percentile, meaning that 93% of students who took the exam earned a lower score than her. Instructors can use more SAT percentile ranks here: http://media.collegeboard.com/digitalServices/pdf/research/SAT-Percentile-Ranks-2012.pdf

Risk Associated with Individual Stocks—Why do financial consultants advise their clients not to "put all of their eggs in one basket"? Diversification is discussed in more detail next, but the short answer to the question is because it's a lot more risky to invest in an individual stock than it is to invest in, say, a composite index like the S&P 500 index, which consists of packages of shares of the stocks of the 500 largest U.S. companies. If one company goes bankrupt, the equity owned by its stockholders will most likely be completely wiped out. How often do companies declare bankruptcy? The answer is: more often than the average person thinks they do. Big companies like Enron, Lehman Brothers, GM, Delta Airlines, and United Airlines have declared bankruptcy in recent years. Some of them were able to reorganize the company and survive (e.g., Delta Airlines, GM, and United Airlines), but others couldn't (e.g., Enron and Lehman Brothers). Exhibit W1.6(a) illustrates how volatile the stock market in general can be. Looking at the S&P 500 index over the last 80 years, we see that annual nominal returns in the U.S. stock market have been highly variable and largely unpredictable. If the index comprised of stocks of the largest 500 companies shows such volatility, can you imagine the volatility of a single stock?!

W1.3 Diversification

- *Alternative Teaching Example:* Brokerage firms, like Merrill Lynch (ML), manage the assets of their clients. When an ML financial advisor selects an appropriate investment strategy for a client, he/she first determines the risk level that the client can tolerate. For example, a younger client may tolerate more risk than an older client who is about to

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retire. Based on age (and other considerations, of course), the financial advisor may suggest a more aggressive investment strategy to the younger client and a more conservative one to the older client. An aggressive investment strategy typically includes investing in a mutual fund that has 80% stocks, 15% bonds, and a 5% cash account. A conservative mutual fund typically includes 55% bonds, 20% stocks, and a 25% cash account. Regardless of how aggressive or conservative an investment strategy is, a financial advisor will never suggest that a client invests in stocks only. Why? Because the financial advisor understands very well the benefit of diversifying, and the risk associated with investing only in stocks.

The textbook uses a wonderful example on how diversification reduces risk by spreading an investment across more than one asset. The idea here is that individual assets are hit by different economic shocks. For example, a significant decrease in the world oil price may have a positive impact on the automobile industry and a negative impact on the oil industry in the United States. Such a shock may therefore have different impacts on the values of stocks of companies in both industries. Moreover, the positive impact on the stocks of automobile companies may vary across the companies (GM's stock may increase by 10%, whereas Ford's stock may only increase by 2%). Likewise, the negative impact on companies in the oil industry may vary as well. In such cases, diversification reduces an investor's exposure to shocks and reduces (but does not eliminate) the risk associated with investment.

Exhibit W1.8 is a great example of why we should diversify. It shows the results of simulating two investment strategies—investing $1 in a single stock (right column), or investing $1 in a stock index consisting of thousands of stocks (left column). Clearly, it's a lot more risky to invest in a single stock. For example, if you invest in a single stock, there is a 25% chance that you will end up with less than your $1 investment after holding the stock for 50 years. If you invest in a stock index, there is almost no chance that you will end up with less than your initial investment after 50 years. In fact, the simulation shows that there is a 99% chance of receiving at least $5.52 if you choose a diversified investment strategy.

W1.4 Investment Accounts

There are several different types of investment accounts in which households can hold their securities (stocks and bonds). The following is a list of these accounts and a brief description of each.

Bank Accounts—These are very safe accounts; they include checking accounts, savings accounts, money market deposit accounts, and certificates of deposit (CDs). The advantage of these accounts is that they are fully insured by the FDIC—that is, in case your bank fails, you can recover 100% of the money that you deposited, up to $250,000 (or $500,000 for a married couple). The disadvantage is that they pay a very low interest rate because they are almost risk-free.

Brokerage Accounts—These accounts are offered by investment management firms, not banks. Examples of these firms include Fidelity and Vanguard. The disadvantage of brokerage accounts is that they are not insured by the FDIC (except for those that are affiliated with or owned by a

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bank, like Merrill Lynch). In principle, an investors can lose all of his or her investments in a brokerage account.

Mutual Funds—A mutual fund starts with a pool of money that is collected from many investors, which is then invested in hundreds of stocks, bonds, and/or short-term money market instruments. Mutual funds are managed by investment professionals who charge fees for managing them. Some mutual funds are passively managed, meaning the fund manager tracks the returns of a specific index, like the S&P 500 stock index. Other mutual funds are actively managed, meaning the fund manager buys and sells assets frequently in an attempt to outperform the competition. Investors pay fees to the managers of mutual funds, with managers who actively manage investors' portfolios charging more than those who passively manage. As **Choice and Consequence: Overlooking Fees** demonstrates, the lowest fees in the industry (also known as expense ratios) are 0.05%. Fees above 1% are considered to be too high. Although the difference between 1% and 2% fees may not seem large, the impact on the returns of a mutual fund is substantial, particularly if the holding period is relatively long.

Retirement Savings Plans—These plans can be organized in four categories.

- *Social Security*: Each worker pays a payroll tax of 6.2% of his/her income (up to a cap of $117,000/year), and the employer matches that with another 6.2%. A total of 12.4% of each worker's salary, up to the cap, goes into the Social Security Trust Fund every year. This fund is controlled by the U.S. government, andthe money paid into it is used to pay benefits to people who are currently retired. A household consisting of two earners with a combined income of $20,000 receives 87% of that income when they retire. On the other hand, a two-earner household with a combined income of $150,000 receives only 35% of their income when they both retire. These percentages are called replacement ratios. Exhibit W1.10 gives a more detailed list of replacement ratios. A household continues to receive retirement income until both members die. When the first member of a household dies, the surviving member receives reduced social security benefits.
- *Defined Benefit Pensions:* These are contractual obligations under which employers promise to pay retirement benefits for employees in the form of a fixed annuity. The amount of the annuity depends on the number of years of service and the final salary that a worker earned. For example, a typical fixed annuity is calculated by the following formula: 2% x (number of years of service) x (final salary). These types of benefits are relatively safe. Even if a company goes bankrupt, the pension plans are insured by the government. State and local government employees are even more secure because it's very rare for a government (whether state or local) to go bankrupt.
- *Defined Contribution Pensions:* These are individual investment accounts that are owned and controlled by employees. An example of these pension accounts is 401(k) accounts. Under defined contribution pensions, an employee contributes a certain percentage of her income (5% to 10%), and the employer matches these contributions. Typically, an employer contributes $0.5 for every dollar an employee contributes, up to 6% of the employee's income. Unlike social security, these contributions are done on a voluntary basis. Also, employees contributing to these accounts own and control their accounts—they decide how much to invest, and they are free to choose from a list of approved mutual funds approved by their employers. The amount of the benefits in these accounts depends on the performance of the selected mutual funds.

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- *Individual Retirement Accounts (IRAs)*: These are straightforward savings accounts that are used predominantly for retirement. They are voluntarily established by individuals, who have full control over them. These accounts are particularly attractive to workers who don't contribute to defined contribution pensions, or those who work in firms that don't offer savings plans to their employees.

How Easy Is It to Beat the Market? —There are around 10,000 mutual funds in the United States alone. These funds are managed by managers who claim they can outperform the market every year. The truth of the matter is that only very few active managers are able to *reliably* outperform the stock market. Sure, some managers may beat the market in a given year, or maybe for two or three years in a row, but it is often the case that their odds of beating the market are the same as your odds of getting a "head" when you toss a coin—a 50% chance. But over a long period of time, say 10 years, several thousand mutual funds will beat the stock market more than half the time, even though they don't beat it every year. Thus, when we look at a 10-year performance, we see impressive winnings of many mutual funds that didn't necessarily win in every single year. The key question here is whether the 10-year historical performance of a certain mutual fund is a strong predictor of its performance over the next 10 years. Economists find that successful historical asset managers tend to perform no better in the next 10-year period than pure chance would predict.

Evidence-Based Economics: Do investors chase historical returns?—The answer to the opening question is yes, investors do tend to chase historical returns. Why did Enron employees invest 62% of their retirement savings in Enron stock rather than diversifying? It's because Enron's stock rose 1,000% during the 10-year period prior to the company's total collapse, as Exhibit W1.11 shows. The fact that investors chase historical returns was demonstrated in a study that was done by economist Shlomo Benartzi. Studying employees' retirement fund contribution decisions in 154 of the largest companies in the United States, Benartzi found that there was a positive correlation between a company's historical returns and the percentage of retirement savings that its employees chose to contribute to employer stocks. From the sample of companies selected, the study also found that return chasing didn't benefit employees.

IV. Active Learning Exercises

1. *Excel-based Activity*—This activity asks students to use the Excel function "FV" to discover the time value of money and how compounding works. The input values that are necessary are 1) the initial investment, 2) the yearly payments, 3) the rate of return or interest rate, and 4) the number of periods. Due to the way Excel accepts inputs, the initial investment and the monthly additions must be entered as negative numbers.

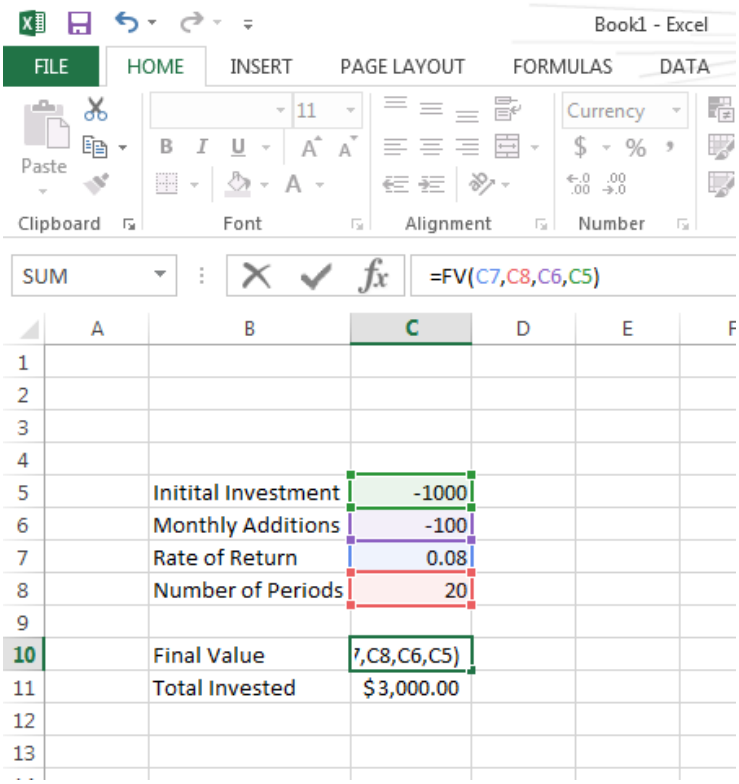
Activity: Using the FV function in Excel, determine the final value of
A. an initial investment of $1,000 and 20 monthly payments of $100 when you expect to earn a rate of return of 8%. Also, show how much total money is being invested.
B. an initial investment of $1,000 and 10 monthly payments of $200 when you expect to earn a rate of return of 8%. Also, show how much total money is being invested.

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C. Compare the total investment returns and the total invested for parts (a) and (b). What causes this difference?

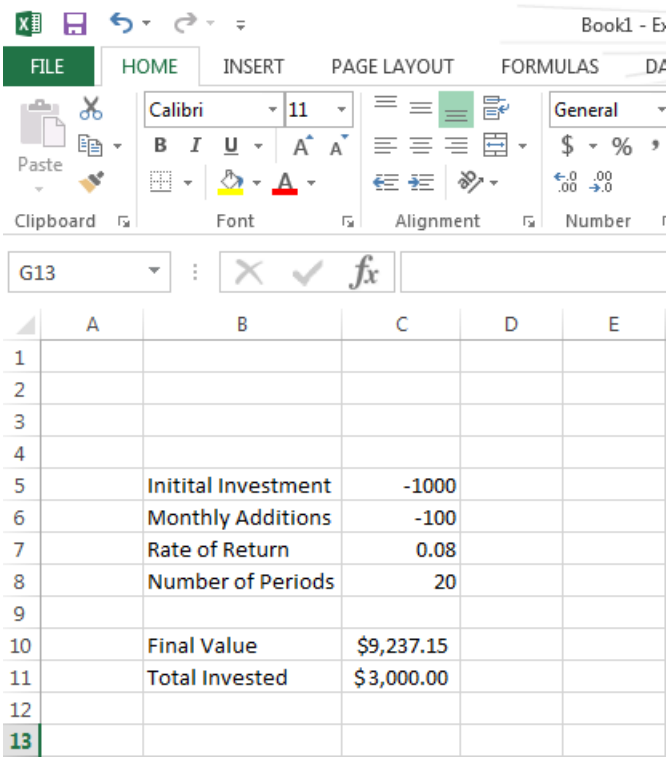
Solution:
Correct input of cells



A.

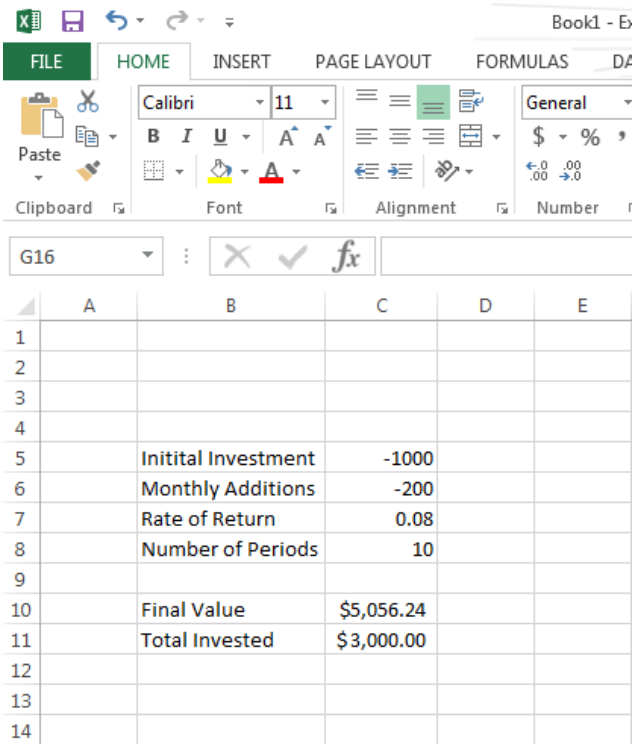
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	A	B	C	D	E
1					
2					
3					
4					
5		Initital Investment	-1000		
6		Monthly Additions	-100		
7		Rate of Return	0.08		
8		Number of Periods	20		
9					
10		Final Value	$9,237.15		
11		Total Invested	$3,000.00		
12					
13					

B.



	A	B	C	D	E
1					
2					
3					
4					
5		Initital Investment	-1000		
6		Monthly Additions	-200		
7		Rate of Return	0.08		
8		Number of Periods	10		
9					
10		Final Value	$5,056.24		
11		Total Invested	$3,000.00		
12					
13					
14					

C. The difference in returns is nearly $4,000, even though exactly the same amount is invested in each scenario. The difference shows the power of compounding. Even though the monthly

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payments are greater in Part B than in Part A ($200 compared to $100), Part A results in nearly $4,000 more because the number of periods is twice that of Part B.

2. *Exploration Activity*—Ask students to find and research three investment companies that offer access to index funds and mutual funds. Have students describe the differences in the fees and expense ratios associated with each company/type of fund.
Sample Solution: Students could discuss Vanguard, iShares, etc. Students will find that index funds often have much lower fees because they do not need to be actively managed.

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SOLUTIONS MANUAL

Web Chapter 1

Financial Decision Making

Questions

1. Explain the following terms:
   i. Compound returns
   ii. Principal
   iii. Rate of return on an investment
   iv. Holding period

   Answer:

   i. **Compound returns** are generated when short-term returns are repeatedly reinvested, thereby causing an investment to earn returns on *both* the initial investment *and* on past investment returns.

   ii. An investor's **principal** is the value of her initial investment.

   iii. The **rate of return on investment** is calculated by (i) dividing the final value of an investment by the initial investment (one year earlier), and (ii) subtracting one from the ratio.

   iv. The time delay between the initial investment and the final withdrawal is referred to as the **holding period.**

   A-head: INVESTMENT RETURNS
   Concept: Compound returns, principal, interest, holding period

2. Suppose you choose an investment that has historically generated an average nominal return of 5 percent per year. Explain how inflation and risk may affect your future real rate of return on this investment.

   Answer:

   Inflation reduces the buying power of money. Any appreciation in the value of the final balance will need to be adjusted to account for rising prices. In other words, if the prices of goods and services increase during the holding period, the real rate of return on the initial investment is lower than the nominal rate of return. The real rate of return is the nominal rate of return minus the inflation rate.

   Risk implies that the return on the investment is not guaranteed. So the rate of return that you experience may be greater or lower than the historical average rate of return.

   A-head: INVESTMENT RETURNS
   Concept: Inflation, risk

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3. Explain the following terms:
   i. Securities
   ii. Bonds
   iii. Stocks
   iv. Stock market index

   Answer:

   i. Bonds, stocks, and other financial claims that can be traded among investors are called securities.
   ii. Bonds are long-term loans made to a borrower (debtor) by a lender (creditor).
   iii. Stocks, also known as shares or equity, are ownership rights in a corporation.
   iv. A stock market index is an average of the prices of many stocks.

   A-head: INVESTMENT RETURNS
   Concept: Securities, stock market index

4. Given that shares are riskier than bonds, why do investors invest in equity?

   Answer: Equity investors are rewarded for taking on higher risk with an average rate of return that is greater than the average rate of return on bonds. Although equity returns fluctuate from year to year, investors who are willing to bear the additional risk of investing in shares also benefit from a higher average return.

   A-head: INVESTMENT RETURNS
   Concept: Risk

5. What is a patent race?

   Answer: A patent race refers to a winner-take-all race. Suppose two investors are racing to develop an invention or to patent a discovery. The investor who develops the invention first or files the patent first will reap all the benefits. Although the other investors may have invested the same amount of money in research and development as the investor who filed the patent, they will not get any return on their investment.

   A-head: DIVERSIFICATION
   Concept: Patent race

6. What is meant by diversifying an investment portfolio? What are the advantages of diversification?

   Answer: Diversification means that investors spread their investment across more than one asset. Diversification allows investors to reduce risk as individual assets are hit by different economic shocks. Putting a little bit of money in all of these different investment baskets reduces exposure to any single shock.

   A-head: DIVERSIFICATION
   Concept: Diversification

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7. Which types of investment accounts are investors likely to choose if they are trying to minimize risk? Why?

   Answer: Bank accounts insured by the Federal Deposit Insurance Corporation are the safest way of storing and investing money. Investors trying to minimize risk will invest in FDIC-insured certificates of deposit or money market deposit accounts.

   A-head: INVESTMENT ACCOUNTS
   Concept: Bank accounts

8. What is the difference between directly holding stock in a company like Apple and investing in a mutual fund that holds Apple stock?

   Answer:

   - Some investors purchase Apple shares directly and hold them in a brokerage account.
   - Most investors buy pre-mixed pools of assets, called mutual funds. A mutual fund is a pool of money that is collected from many investors. Mutual funds typically invest in hundreds of stocks, bonds, and/or short-term money market instruments.

   A-head: INVESTMENT ACCOUNTS
   Concept: Brokerage accounts

9. The following questions are about mutual funds:

   i. What are index funds?

   ii. What is an expense ratio? How do expense ratios affect the value of an investor's portfolio?

   Answer:

   i. An index fund is a mutual fund that is passively managed, which means that the mutual fund manager simply tries to track the return of an index, like the Standard & Poor's 500 stock index.

   A-head: INVESTMENT ACCOUNTS
   Concept: Mutual funds

   ii. Expense ratios are annual fees charged by mutual funds in order to pay mutual fund managers and to pay other record-keeping and marketing costs of the fund. Expense ratios make a very big difference in the long-run performance of investments. Paying an annual fee of even 1 percent will reduce the annual rate of return on the investment from say, 10 percent to 10 – 1 = 9 percent.

   A-head: INVESTMENT ACCOUNTS; CHOICE AND CONSEQUENCE: OVERLOOKING FEES
   Concept: Expense ratios

10. What are the four core ways that households save for retirement?

    Answer: There are four core types of retirement savings plans:

    - Social Security: Social Security is a mandatory retirement savings program. Each worker pays a Social Security payroll tax into a general government account called the Social Security trust fund. Using these funds, the Social Security trust fund pays out benefits to those workers who are currently retired.
    - Defined benefit pension plans: Defined benefit pensions are contractually specified employment benefits, in which the employer promises to pay the employee a fixed annuity after

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retirement. The magnitude of the annuity is adjusted to reflect years of service at the employer and the level of the employee's salary.

- Defined contribution pension plans: Defined contribution pensions are individual accounts that are owned and controlled by the employee. In most cases, the employee decides how much to contribute to these accounts, and most employers match these contributions. These accounts are commonly referred to as 401(k) accounts.
- Individual Retirement Accounts (IRA): IRAs are retirement savings accounts that anyone can set up; they are usually not sponsored by a person's employer. If an individual does not contribute to her employer's defined contribution savings plan, then she can use an IRA to save for retirement.

A-head: INVESTMENT ACCOUNTS
Concept: Retirement savings plans

11. How easy is it for fund managers and investment management companies to outperform or "beat" the stock market once their fees are taken into account?

    Answer: When a single stock is picked at *random*, there is a 50 percent chance that the stock will outperform the total stock market in the next year. Consequently, it is possible to outperform the stock market in a single year even if the investment manager has no skill. It has been discovered that successful historical asset managers tend to perform *no better* in the next period than pure chance would predict.

    A-head: INVESTMENT ACCOUNTS
    Concept: Outperforming the stock market

12. How could return-chasing explain why many of Enron's employees lost most of their retirement savings when Enron went bankrupt?

    Answer: Return-chasing occurs when people invest in assets that have realized a high rate of return in the past. Return-chasing explains why many of Enron's employees chose to forgo the benefits of diversification and invested the overwhelming majority of their retirement savings in Enron stock. Enron stock had gone up by a factor of 10 in the decade before Enron went bankrupt—that's a 1,000 percent return. This led Enron employees to mistakenly believe that Enron stock was a great investment for the future. Consequently, employees allocated more and more of their contributions to employer stock, under the assumption that Enron stock prices would continue to increase in the future.

    A-head: EVIDENCE-BASED ECONOMICS: DO INVESTORS CHASE HISTORICAL RETURNS?
    Concept: Return chasing

Problems

1. Congratulations! You have just won a $1,000,000 (delayed) prize in the lottery. Your state offers you the following alternatives: you can take $750,000 now, or 10 years from now you can receive the full $1,000,000. The delay isn't a problem, because you weren't planning to use any of the prize money for at least 10 years.

    If you take the lump sum now, you figure you can invest it at an annually compounded rate of 3 percent.

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Should you take the $750,000 now, or wait to get the full $1,000,000 in 10 years? Why or why not? Show any calculations.

Answer: You should take the $750,000 now.

Here are the relevant calculations:

$\$750{,}000 \times (1 + 0.03)^{10} = \$1{,}007{,}937.$

So you would be $7,937 better off by taking the smaller amount now than receiving the full prize in 10 years. This assumes that you will, in fact, achieve an annually compounded return of 3 percent for the next 10 years.

A-head: INVESTMENT RETURNS
Concept: Comparing future values
Difficulty: Easy/Moderate
Problem-type: Calculation

2. Ten years ago, you set aside $1,000. For the first 6 years, you earned a return of 6 percent per year, but for the following 4 years, that rate of return dropped to 3 percent. How much money do you now have at the end of the 10 years?

   Answer: At the end of the first 6 years, you would have $\$1{,}000 \times (1 + 0.06)^6$.

   After investing that money for an additional 4 years, you will have a total of

   $[\$1{,}000 \times (1.06)^6] \times (1.03)^4 = [\$1{,}000 \times 1.4185] \times 1.1255 = \$1{,}596.56.$

   A-head: INVESTMENT RETURNS
   Concept: Finding the future value at differing interest rates
   Difficulty: Easy/Moderate
   Problem-type: Calculation

3. You get your first job when you are 23. Prudently, you set aside $5,000 of your earnings to open an IRA.

   a. You know that stocks have returned a nominal 10 percent per year on *average* historically. If you keep your money invested in a portfolio of stocks that returns 10 percent per year until you retire 40 years later at age 63, how many dollars will that $5,000 have turned into?

   b. Assuming an inflation rate of 3 percent, how much will that $5,000 have turned into in real terms? In other words, redo the previous calculation, taking inflation into account.

   c. Given this investment plan, should you depend on having that much money available in the IRA account when you retire? Why or why not?

   Answer:

   a. $Final\,Value = \$5{,}000 \times (1 + 0.10)^{40} = \$226{,}296.28$

   b. $r = i - \pi = 10\% - 3\% = 7\%$

      $\$5{,}000 \times (1 + 0.07)^{40} = \$74{,}872.29$

      This means that your purchasing power grew by a factor of 15 (15 × $5,000 = $75,000), and you didn't have to do anything but postpone consumption. Of course, even if interest rates were 0 percent, and there were no interest at all, it's still worth putting money away because the only way to have money in retirement is to save.

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c. As discussed in the section entitled Risky Returns, investing in stocks is inherently risky. Whether you end up with a great deal of money or very little depends on whether your particular holding period happens to be period with high or low returns.

A-head: INVESTMENT RETURNS; RISKY RETURNS
Concept: Compound returns; Risky returns
Difficulty: Easy
Problem-type: Hypothetical real-world scenario

4. Ernest calculates that he will need $220,000 to provide for his 8-year-old daughter's college tuition and expenses. Due to a recent inheritance, he will have some money to put aside now but will not be able to add to it over time. He is confident that he can realize a return of 5 percent, compounded annually, on the money he puts aside. Assume his daughter will start college at the age of 18.

   Calculate how much money Ernest needs to invest now in order to fund his daughter's college education.

   Answer: We can start with the formula given in the chapter:

$$(\text{Initial Investment}) \times (1 + r)^T = \$220{,}000.$$

   where $r = 0.05$ is the rate of return, and $T = 18 - 8 = 10$ is the number of years the money is invested (in other words, T is the holding period).

   So, all we really need to do is to solve the above equation for the Initial Investment:

$$\begin{aligned}\text{Initial Investment} &= \frac{\$220{,}000}{(1+r)^T} \\ &= \frac{\$220{,}000}{(1+0.05)^{10}} \\ &= \$135{,}060.92\end{aligned}$$

   So Ernest needs to invest $135,060.92 of his inheritance at 5 percent in order to realize a final value of $220,000 after a 10-year holding period.

   A-head: INVESTMENT RETURNS
   Concept: Finding the present value given the future value
   Difficulty: Hard
   Problem-type: Hypothetical real-world scenario; calculation

5. The following table shows the nominal return on the 10-year Treasury bond as well as the 3-month Treasury bill from year-end 1999 to year-end 2016.

Year	3-MonthT-Bill Rate (Annualized)	10-Year Treasury Bond Total Return
2000	5.76%	16.66%
2001	3.67%	5.57%
2002	1.66%	15.12%
2003	1.03%	0.38%
2004	1.23%	4.49%
2005	3.01%	2.87%
2006	4.68%	1.96%

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2007	4.64%	10.21%
2008	1.59%	20.10%
2009	0.14%	-11.12%
2010	0.13%	8.46%
2011	0.03%	16.04%
2012	0.05%	2.97%
2013	0.07%	-9.10%
2014	0.05%	10.75%
2015	0.21%	1.28%
2016	0.51%	0.69%

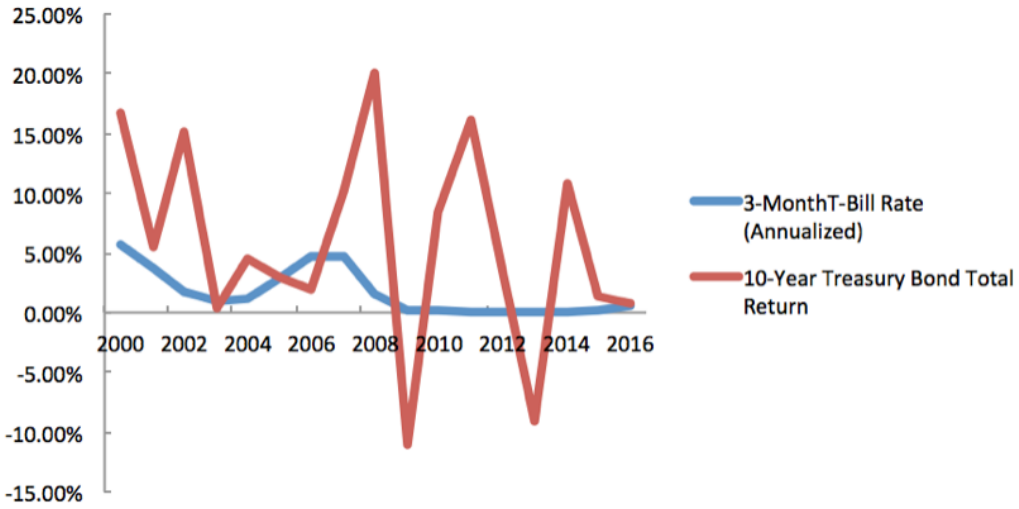
Source: NYU Stern Historical Return data compiled by Aswath Damodaran. 10-Year Treasury total return includes coupon payments and price appreciation

a. Use the data points to plot a graph for both the data series.

b. Which security has given a higher rate of return over this period? Why do you think this is the case?

Answer:

a. The following graph plots the returns on Treasury bonds and bills listed in the table.



b. The return on the 10-year Treasury bond is usually higher than the return on the 3-month Treasury bill. This is because long-term loans are riskier than short-term loans. Bond investors are rewarded for bearing this risk with a rate of return that usually exceeds the rate of return on money market accounts, or short-term loans.

A-head: RISKY RETURNS
Concept: Treasury bills, bonds
Difficulty: Moderate/Hard
Problem-type: Data-based problem

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6. The following table shows data on the nominal return in the Standard & Poor's 500 stock market index (including dividends and price appreciation) and the return on the 3-month Treasury bill. The table reports returns from year-end 1999 to year-end 2016.

Year	3-MonthT-Bill Rate (Annualized)	Return on S&P Index (Including Dividends)
2000	5.76%	-9.03%
2001	3.67%	-11.85%
2002	1.66%	-21.97%
2003	1.03%	28.36%
2004	1.23%	10.74%
2005	3.01%	4.83%
2006	4.68%	15.61%
2007	4.64%	5.48%
2008	1.59%	-36.55%
2009	0.14%	25.94%
2010	0.13%	14.82%
2011	0.03%	2.10%
2012	0.05%	15.89%
2013	0.07%	32.15%
2014	0.05%	13.52%
2015	0.21%	1.38%
2016	0.51%	11.74%

Source: NYU Stern Historical Return data, compiled by Aswath Damodaran. Returns on S&P 500 are equal-weighted and include dividends

a. Use the data points to plot a graph for both the data series.

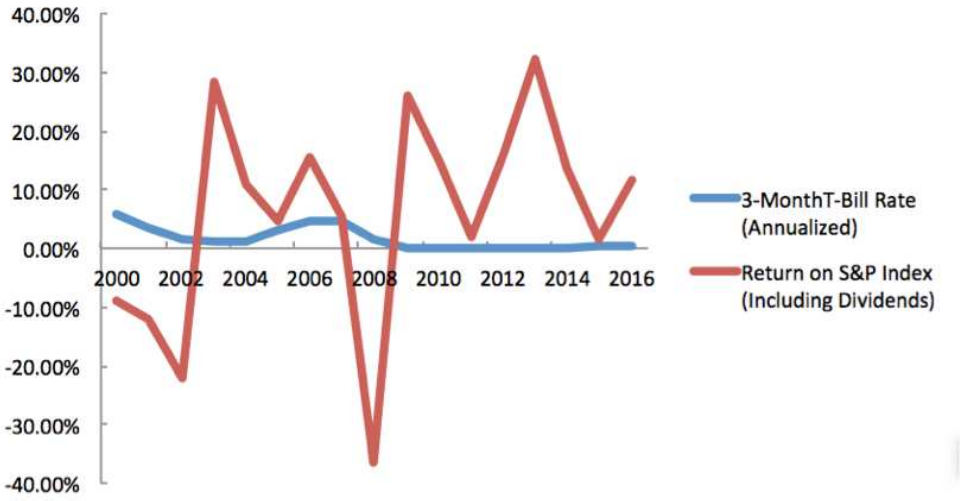
b. What does Standard & Poor's 500 represent? Would it have been riskier to invest in the S&P 500 or the 3-month Treasury bill during this period? Why?

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Answer:

a. The following graph shows the annual return in the S&P 500 and the 3-month Treasury bill.



b. The Standard and Poor's 500 is a stock market index that summarizes the value of 500 of the largest U.S. companies, representing about 75 percent of the value of all companies traded on U.S. stock exchanges. The variability of the returns of the S&P 500 stock index is higher than the variability of the annual returns of holding 3-month Treasury bills. Stocks are, in general, riskier than corporate bonds as companies make payments to shareholders only after making payments to bondholders. This means that shareholders are the ones who primarily suffer when a company earns less income. Moreover, lending to the government is less risky than lending to a corporation. Putting these observations together, 3-month Treasury bill returns are less risky than short-term corporate bonds, which are less risky than corporate shares. Because shares are therefore riskier than 3-month Treasury bills, shares offer higher returns in order to compensate for the higher level of risk. Although equity investors receive a higher return on *average*, the return on equity also fluctuates a lot, even going negative from time to time.

Link to graph: http://www.research.stlouisfed.org/fred2/graph/?g=t1w

A-head: RISKY RETURNS
Concept: Stock market index, Treasury bonds, risk
Difficulty: Moderate/Hard
Problem-type: Data-based problem

7. The following table shows the income distribution for American households in terms of percentiles in the United States in 2015.

Percentile	Income
10	13,259
20	22,800
40	43,511
50	56,516
60	72,001

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80	117,002
90	162,180
95	214,462

a. What was the median income in 2015? What does this number mean?

b. Suppose you are told that, in 2015, 60 percent of the population earned an average income of $72,001. Refer to the table and explain whether you would agree with this statement or not.

Answer:

a. The median in a distribution is the 50th percentile. The median household income in 2015 was $56,516. This number divides the distribution into half, which means that 50 percent of the U.S. households earned less than $56,516, while the remaining 50 percent earned more than $56,516.

b. No, the statement is incorrect. The 60th percentile is a cutoff that divides the data so that 60 percent of the population is below the cutoff. This means that, of the total number of households in the country, 60 percent of the households earned less than $72,001, while the rest of the 40 percent of the households earned more than this amount.

Data credit: United States Census Bureau

A-head: RISKY RETURNS
Concept: Percentiles
Difficulty: Moderate/Hard
Problem-type: Calculation problem

8. Alexander Graham Bell was credited with inventing the telephone in 1876. What many do not know is that Bell filed for the telephone patent hours before Elisha Gray, who also had a prototype for the telephone.

a. Since Bell filed the patent first, his company went on to earn millions of dollars in profits from the sales of the telephone. Because Elisha Gray's patent came second, he did not earn profits from his invention. What is this situation called?

b. Suppose you are an investor who was willing to invest in either Bell's or Gray's telephone companies. You expect that the value of the company that files the patent first will double in value. Assume that each inventor had an equal chance of filing the telephone patent. If you did not know who would file the patent first, what investment strategy would minimize your risk?

Answer:

a. This is an example of a patent race, where the winner takes all. Only the inventor who files the patent first reaps all the profits from the invention. Other companies or inventors do not gain, although they may have spent the same or more time and money on a similar invention.

b. Given that either company has an equal chance of filing the patent and doubling its value, you should invest an equal amount of money in both companies. By diversifying your investment across both companies, you reduce the risk that you face if you invest in only one company and happen to pick the company that loses.

A-head: DIVERSIFICATION
Concept: Patent race; diversification
Difficulty: Easy/Moderate
Problem-type: Real world scenario

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9. You have $100 to invest, and you are considering two stocks. In the next year, each stock will either have a return of +30 percent or –10 percent. Assume as well that the performance of one stock is unrelated to the performance of the other (in other words, the stock returns are uncorrelated). The table shows the resulting four possibilities, depending on whether each of the two stocks gains or loses value. (To read the table, note that the first outcome listed in each cell is for Stock 1, and the second outcome in each cell is for Stock 2.)

		Stock 2	
		Gain	**Lose**
Stock 1	**Gain**	Stock 1 Gain Stock 2 Gain	Stock 1 Gain Stock 2 Lose
	Lose	Stock 1 Lose Stock 2 Gain	Stock 1 Lose Stock 2 Lose

Assume that the probability of Stock 1 gaining is 50 percent. Assume that the probability of Stock 2 gaining is 50 percent. Assume that each of the four possibilities listed in the table above is 25 percent.

a. If you put all of your money into Stock 1 or Stock 2, what is the average return that you will receive? (*Hint*: average the returns of +30 percent and –10 percent.)

b. If you split your money equally between the two stocks ($50 in Stock 1 and $50 in Stock 2), what would be your total return at the end of the year in each of the boxes above? Fill out the following table to indicate the total return you would have in each of the four possible situations. (*Hint*: average the returns of the two investments in each box.)

		Stock 2	
		Gain	**Lose**
Stock 1	**Gain**		
	Lose		

c. If you split your money between the two stocks, what is the average return that you will receive? (*Hint*: take the total return for each box in part (b) and calculate the average across the four boxes giving each box equal weight.)

d. Is there any benefit in splitting your money between the two stocks? How does this relate to the concept of diversification?

Answer:

a. There is a one-half chance that you will gain 30 percent, and a one-half chance that you will lose 10 percent, so the average return is

$$0.5 \times 30\% + 0.5 \times (-10\%) = 10\%.$$

b. Because half of your portfolio is in each stock, we multiply the returns for that stock by their portfolio weight (0.5) in each situation.

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		Stock 2	
		Gain	**Lose**
Stock 1	**Gain**	$0.5\times 30\%+0.5\times 30\%=30\%$	$0.5\times 30\%+0.5\times(-10\%)=10\%$
	Lose	$0.5\times(-10\%)+0.5\times 1.2=10\%$	$0.5\times(-10\%)+0.5\times(-10\%)=-10\%$

c. There is a 25 percent chance you will end up in each of the four possibilities, so the expected value is

$$0.25\times 30\%+0.25\times 10\%+0.25\times 10\%+0.25\times(-10\%)=10\%$$

d. We saw in parts a and c that the expected value of your investment is the same whether you invest in a single stock or split your money between the two stocks. However, there is less volatility in your payout if you diversify by investing half your money in both stocks rather than investing all of your money in a single stock. In other words, if you invest all of your money in a single stock, you will either win big or lose big. However, if you split your money between the two stocks, there is a third possibility that one stock will gain and the other one will lose, and the two effects will cancel each other out. This leads to a less volatile return. When you are planning for retirement, it is very important, when budgeting, to know approximately how much money you will have. Finding out that all of your stocks have lost value at the same time can be quite a blow. Therefore, people are advised to diversify so that they do not have "all of their eggs in one basket."

A-head: RISKY RETURNS; DIVERSIFICATION
Concept: Risky returns; Diversification
Difficulty: Moderate/Hard
Problem-type: Calculation

10. Suppose that a mutual fund, Washington Peak Strategic Bond Fund, believes it has hit upon a winning investment strategy. The fund uses an active management strategy to try to outperform the bond market. According to Washington Peak's prospectus, investors need to pay fees of 2 percent annually. Based on the historical success of their active investment strategy, the strategy is projected to generate annual returns (once fees are paid) of 8 percent. A friend of yours is considering investing in Washington Peak and asks you for investment advice. What would you suggest?

Answer: One of the problems with Washington Peak's investment strategy is the lack of diversification. By investing most of the fund's money in one investment strategy, Peak will not be able to diversify its returns. It should therefore not be a *large* fraction of your friend's total investment portfolio. Second, Peak's traders base their strategy on historical data. It is not necessarily the case that historical trends will continue to play out in the future. This fact introduces some additional risk. The third factor that your friend will need to consider is the expense ratio that Washington Peak is charging. An expense ratio of 2 percent is generally considered to be very high for a mutual fund. High expense ratios lower the net annual return that your friend receives on his investment.

A-head: RISKY RETURNS; DIVERSIFICATION; INVESTMENT ACCOUNTS
Concept: Diversification, expense ratios
Difficulty: Easy/Moderate
Problem-type: Fictional 'real-world' scenario

11. Tom, a government employee, has a defined benefit pension. He has worked for his employer for 35 years before retiring at age 65. His final salary was $85,000. Calculate how much of his final preretirement income a standard defined benefit pension plan would replace.

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Answer: Using the formula given in the chapter, Tom's pension would equal:

$$0.02 \times 35 \times \$85{,}000 = \$59{,}500.$$

This would replace \$59,500/\$85,000 = 0.70 or 70 percent of his preretirement income.

A-head: INVESTMENT ACCOUNTS
Concept: Retirement savings plans
Difficulty: Easy
Problem-type: Hypothetical real-world scenario

12. Recency bias refers to a psychological bias whereby people believe that recent past trends and patterns will continue in the future. How would recency bias explain why investors chase returns? Does return-chasing lead investors to realize a higher rate of return on investments?

Answer: Return-chasing involves investing in assets that have realized a high rate of return in the past. Recency bias could explain return-chasing. Recency bias leads people to mistakenly believe that recent past trends and patterns will continue into the future, leading people to chase recent historical returns. As discussed in the Evidence-Based Economics feature in the chapter, research has shown that return-chasing does not usually benefit investors. At 154 of the largest U.S. corporations, employees did not benefit from return chasing.

A-head: EVIDENCE-BASED ECONOMICS: DO INVESTORS CHASE HISTORICAL RETURNS?
Concept: Return chasing
Difficulty: Easy/Moderate
Problem-type: Fictional 'real-world' scenario

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