CHAPTER 1

Microfoundations: Concepts for Making Consumer Decisions

Introduction

You are about to plunge into the world of *practical* economics. This chapter will introduce you to (and make you an expert in!) economic concepts which are useful in making practical personal finance and consumer decisions. In fact, we will claim that you can't make wise personal finance decisions without knowledge of these concepts.

This chapter deals with economic concepts related to the individual, so-called "microeconomics." Not all microeconomic concepts are discussed. Only those concepts which are most relevant to personal decision-making are explored.

You'll learn many useful ideas in this chapter, but perhaps the most important idea is discounting. The concept of discounting simply asserts that a dollar in the future is worth less than a dollar today. Discounting will show you how to convert future dollars in such a way that they are comparable to present dollars. Discounting is critically important when analyzing any consumer decision which involves costs and/or benefits over time. Also, you must understand discounting in order to understand how any consumer loan, like a mortgage or auto loan, is set up.

And now, as they say, "away we go!"

1. Are Prices "Really" What They Seem?

Economic decisions, whether they relate to consumers or to firms, revolve around prices. For consumers, the price of a product measures the amount of resources (money) which the consumer must give up to purchase the product.

What could be easier than understanding prices? Simply look at the price posted or listed on a car, house, dress, or hammer and that's what you must pay to buy the product.

LIST PRICE

For many consumer products this is true. But for many other consumer products, especially so-called consumer durable products (cars, homes, furniture), the list price is only part of the total price. For these products, the total price is paid over a number of years, and usually includes finance costs (e.g., mortgage or loan), fuel costs, and maintenance and repair costs. As will be seen, this complicates your task in deciding whether purchasing the product is worth the price.

You must also be careful in comparing the prices of many financial products. Life insurance is a good example. The annual price paid for one type of life insurance policy, called whole life insurance, purchases both protection and an investment fund. In contrast, annual prices paid for another type of policy, called a term policy, purchases only protection. Since the price paid in each case is purchasing different things, the annual price can't be used to compare the cost of the policies.

Prices: One Time and Over Time

Time can play tricks with us, and it's no different in economics. Dealing with time in economics is a very important task.

Time can play tricks with prices. When examining and comparing prices at *one point in time*, there's no problem. You can come to conclusions about the prices of one product compared to another product very easily. For example, let's say the price of pork is $2.00 per pound today and the price of ground beef is $1.75 per pound today. These prices are nominal prices today.

NOMINAL PRICE

In the above example you can readily say that the price of pork is *relatively* more expensive than the price of beef. In fact, you can construct the *relative* price of pork compared to beef. Here, let the price of beef be indexed at the 1.00, and then let the price of pork be $\frac{\$2.00}{\$1.75}$ or 1.14. The relative price of one product compared to another compares the prices free of any money units. Simply choose the product with the lowest price and assign it the value 1.00. Then the relative price of more expensive products show how much more expensive, on a percentage basis, the other products are compared to the lowest priced product. Table 1-1 gives you some more examples.

INCREASE/DECREASE IN RELATIVE PRICE

Calculating relative prices is most helpful when looking at price changes over time. Most prices are always rising, so everything is becoming more expensive, right? Not necessarily. Prices change at different paces. Those prices increasing faster become *relatively* more expensive, while those prices increasing at a slower rate, or decreasing, become relatively less expensive. Products whose prices relatively increased are said to have had an increase in their *relative price*. Products whose prices have relatively decreased are said to have had a decrease in their relative price. Sometimes you will see the term "real price" substituted for "relative price."

Table 1-1 Calculating relative prices.

Product	Price Per Pound	Relative Price	Meaning
Pork	$2.00	$\frac{\$2.00}{\$1.75} = 1.14$	Pork is 14% more expensive per pound than beef.
Chicken	$2.20	$\frac{\$2.20}{\$1.75} = 1.26$	Chicken is 26% more expensive per pound than beef.
Ground Beef	$1.75	$\frac{\$1.75}{\$1.75} = 1.00$	Ground beef is the least expensive.

Table 1-2 gives examples of calculating changes in relative prices. A decision must first be made about what base to be used for the calculations. Two alternative bases are usually used, the Consumer Price Index (CPI) or the average hourly wage. The CPI is an index value which represents the average price of all consumer goods and services (more on the CPI later). The actual CPI index number has no meaning itself except that higher values mean average consumer prices are higher. The hourly wage, of course, does have intuitive meaning since it represents income derived from working an hour.

The left-most panel of Table 1-2 gives the nominal, or actual dollar, prices of four food products for 1990, 2000, and 2010, the CPI for each year, and the hourly wage. By just looking at these numbers, you'd conclude that all the food prices rose from 2000 to 2010, from 1990 to 2000 milk and bread became more expensive while eggs and steak became less expensive.

The second panel in Table 1-2 calculates relative prices using the CPI as the base. To get the numbers, simply divide the nominal price by the year's CPI (e.g., for eggs in 2000, 0.006 = $0.96/172.2). Look at the relative prices for steak in 1990 and 2010. Relative steak prices fell from 0.026 to 0.020. This means that, although steak price rose from $3.42/lb in 1990 to $4.30/lb in 2010, this was a *slower* increase than the increase in the average price for all consumer goods and services. Therefore, relatively speaking, steak actually became less expensive by 25 percent (the drop from 0.026 to 0.020 is a 25 percent fall). Looking at it another way, the increase in nominal steak prices from $3.42/lb to $4.30/lb was a 26 percent increase. But the increase in the CPI from 130.7 to 218.1 was a 69 percent increase. So steak increased in price less than half as much as the CPI increased.

You'll probably like the third panel of Table 1-2 better where relative prices are calculated using the average wage rate as a base. Again, divide the nominal price by the average wage rate for that year to get the relative price (e.g., for round steak in 2010, 0.231 = $4.30/$18.61). These values do have intuitive meaning because they represent the fraction of an hour necessary to work in order to buy the product. In fact, if the entries in this panel are multiplied by 60 minutes, then the result is the number of minutes that must be worked to purchase the product. These results are shown in the right-most panel of Table 1-2. Only milk became relatively more expensive between 1990 and 2010.

So What?

Why bother calculating changes in relative prices? It might be nice to know that a product hasn't increased in price as fast as other products or wages, but, big deal—if the price has increased, it still costs more.

THE "GOOD" OLD DAYS

There are two reasons why changes in relative prices are important. First, only by examining changes in relative prices can you decide how

Table 1-2 Calculating changes in relative prices.

	Nominal Prices			Relative Prices[a] (Using CPI as base)			Relative Prices[b] (Using wage rate base)			Minutes necessary to Work to Purchase Product[c]		
Product	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**
Round steak, 1 lb.	$3.42	$3.28	$4.30	0.026	0.019	0.020	0.317	0.229	0.231	19	14	14
Fresh milk, 1 qt.	$1.39	$2.29	$3.32	0.011	0.013	0.015	0.129	0.160	0.178	8	10	11
Eggs, 1 doz.	$1.00	$0.96	$1.79	0.008	0.006	0.008	0.093	0.067	0.096	6	4	6
Bread, 1 loaf	$0.70	$0.99	$1.39	0.005	0.006	0.006	0.065	0.069	0.075	4	4	4
Consumer Price Index	130.7	172.2	218.1									
Average hourly wage in manufacturing	10.78	14.32	18.61									

[a]Nominal price divided by Consumer Price Index for that year.
[b]Nominal price divided by average hourly wage for that year.
[c]Relative price using wage rate as base multiplied by 60 minutes.
All nominal prices are national averages.

Data source: Statistical Abstract of the United States, various years.

your standard of living (or the standards of living of consumers in general), have changed. Think of it this way. All prices, wages, and incomes tend to increase over time. If you only looked at changes in nominal prices you'd think, "Wow, things are always getting more and more expensive—it sure was better in the good old days." This, in fact, is a false observation. Over most time periods wages and incomes have more than kept up with prices, meaning that average standards of living have increased. Another way of saving the same thing is that it has taken progressively less time for the average person to work to earn common consumer products.

But a more important reason for understanding relative prices is that it's relative prices that matter. A product has increased in price only if its relative price has increased. It's in your interest to judge the change in a product's price by the change in its *relative* price, not its nominal price. In fact, research shows that this is exactly what consumers do (see CONSUMER TOPIC: Do Consumers Respond to Relative Prices?).

CONSUMER TOPIC

DO CONSUMERS RESPOND TO RELATIVE PRICES?

What's important in predicting the quantity of a product which we'll buy is not how the product's nominal price has changed, but how it's changed relative to other prices.

The theory that relative prices matter has been most extensively tested for food products. A study by Eales and Unnevehr examined how consumers responded to changes in the relative prices of various meats over the period 1965–85. In this study Eales and Unnevehr examined the price change in a particular meat *relative* to changes in the average price of all foods. Here are some of their results:

> An increase of 10% in the relative price of chicken results in a 2.8% *decline* in the quantity of whole chickens purchased, a 0.5% increase in the quantity of beef purchased, and a 0.1% increase in the quantity of pork purchased.
>
> An increase of 10% in the relative price of beef results in a 5.7% *decline* in the quantity of hamburger purchased, a 2.5% increase in the quantity of chicken purchased, and a 3.1% increase in the quantity of pork purchased.
>
> An increase of 10% in the relative price of pork results in a 7.6% *decline* in the quantity of pork purchased, a 1.7% increase in the quantity of beef purchased, and a 0.2% increase in the quantity of chicken purchased.

The results make sense. When the relative price of a meat product increases, consumers shift out of buying that product and instead buy substitute meats.

Reference: Eales, James S. and Laurian J. Unnevehr, "Demand for Beer and Chicken Products: Separability and Structural Change," *American Journal of Agricultural Economics*, Vol. 70, No. 3, August 1988, pp. 521–532.

The Bottom Line

Deciphering prices is not as easy as at first glance. The annual price of consumer durable goods, like homes and cars, includes finance, energy, and maintenance costs. Changes in relative prices should be used to judge what products have become more expensive and less expensive. Relative prices measure whether a product's price has increased faster or slower than all prices or average wages.

2. What's Your Time Worth?

You've heard the expression, "time is money." It's more than a cliche; it's an expression which has much economic meaning.

The reason that time has a value is because it is limited. There are only 24 hours in a day, 7 days in a week, and 365 days in a year, and 70 to 80 years in the average lifetime. You can't make more time or recover lost time. You use time to do everything—work, play, eat, sleep. Furthermore, when you're using time to do one activity (such as work), you can't use it to do something else (like sleep). There are always many alternative uses of time.

Pricing Your Time

Since time is a limited resource, and since time is a necessary input into any activity, time has a price. The price of your time in any activity depends on what else you could do with that time. For example, if an hour you spend watching TV could have been spent working, then the price of an hour of TV viewing is the wage rate (after taxes) less the pleasure you get from TV viewing over working. But if the hour you spend watching TV could have been used exercising, then the price of an hour of TV watching is the value you could have received from exercising less the immediate pleasure you receive from TV viewing over exercising.

VALUE OF TIME RELATED TO WAGE RATE

The price of time therefore varies from individual to individual and activity to activity. As a rule of thumb, researchers have usually measured the value of time as a fraction of the individual's wage rate (see CONSUMER TOPIC: How Is the Value of Time Measured?). The fraction is higher the less the displeasure the individual gets from working, This means that professional workers probably value their time at a higher rate than other workers for two reasons. First, their wage rate is higher, and second, they probably enjoy their work more than nonprofessional workers.

CONSUMER TOPIC

HOW IS THE VALUE OF TIME MEASURED?

Researchers in two fields of economics have been interested in measuring the value of time. One field is transportation economics. Here the interest has been in measuring the value of time of commuters. Such studies have policy implications for efforts to encourage commuters to switch from autos to mass transit.

The transportation studies estimate commuters' value of time by observing what commuters are willing to pay for a faster mode of transportation. For example, researchers compare commuters' willingness to pay tolls in order to take a faster route, or compare the costs of a faster, yet more expensive, private auto to cheaper, yet more time-consuming, public transportation. These studies have concluded that commuters value their travel time at 20 to 70 percent of their wage rate.

Another area of interest to researchers is the value consumers place on their time spent in household chores (e.g., meal preparation, cleaning, yard work). Here researchers have used two alternative methods to estimate the value of time. One method is called the replacement cost approach. The replacement cost approach estimates the value of time in household work as the cost of hiring someone to get the work done. The other method is the opportunity cost approach. This method estimates the value of time in household work as the wage rate at which a person would just be indifferent between spending an hour in household work or spending an hour working on the job.

Zick and Bryant have estimated the value of time in household work using the opportunity cost approach.

Using a sample of 1,475 households in 11 states who completed time-use diaries, Zick and Bryant estimated the opportunity cost wage at $4.45/hr. for employed consumers and $3.95 for non-employed consumers. Inflated to 2012 the wages are $16.57 and $14.71 respectively.

References: Zick, Cathleen D. and W. Keith Bryant. "Alternative Strategies for Pricing Home Work Time," *Home Economics Research Journal*, Vol. 12, No. 2, December 1983, pp. 133–144.

Gronau, Reuben. "The Effect of Traveling Time on the Demand for Passenger Transportation," *Journal of Political Economy*, Vol. 78, No. 2, March/April 1970, pp. 377–394.

Dewees, D. N. "The Impact of Urban Transportation Investment on Land Value," *Research Report No. 11*, University of Toronto-York University Joint Program in Transportation, February 1973.

Implications

SPENDING MONEY TO SAVE TIME

One major implication of the fact that time has a price is that consumers are often willing to spend money to save time. A consumer may spend $500 on a plane ride taking 3 hours rather than spend $150 to drive the same distance yet take 8 hours. A major reason for the increased sales

of convenience foods that cost more per serving than home-prepared meals is that households with both parents working have a higher time price than "traditional" households with one spouse working in the marketplace.

How do you know if it's wise to spend money to save time? The answer is simple. If the money you spend to save an hour of time is less than the price of that hour of time to you, it's wise to spend money to save time. For example, a business executive might spend $300 to save an hour of travel, but if during that hour the executive can do $1000 of work for the company, then spending the money to save time is wise. An evaluation of the benefits and costs of convenience foods is given in an accompanying CONSUMER TOPIC.

SHOPPING AROUND

Another implication of the realization that time has a price is in shopping. Frequently you hear the advice "shop around" and "comparison shop." But since shopping takes time, now you know that shopping and comparison shopping are not costless. You want to shop only up to the point where the benefits from shopping (getting lower prices and saving money) are only slightly more than the costs of shopping. (We'll talk much more about this later in Chapter 11.)

CONSUMER TOPIC

ARE CONVENIENCE FOODS REALLY MORE EXPENSIVE?

Convenience foods cost more in money price, but is their total cost really more expensive? The total cost of any meal includes the money paid to buy the food plus the time cost of preparing the food for eating. Convenience foods cost more to purchase, but their preparation time is much less than for non-convenience (home-prepared) foods. Therefore, the total cost of convenience foods may actually be less than the total cost of home-prepared foods for consumers with a high value of time.

A study by Odland, Vettel, and Davis found that the total cost per serving of selected convenience foods was competitive with home-prepared foods, especially for high wage jobs. For example, they found frozen turkey and beef tip dinners were both less costly per serving for consumers with managerial and professional jobs.

The study computed the total cost per serving for three different wage levels, clerical, average, and managerial-professional. The study assumed a value of time equal to 100 percent of the wage rate for each job type. However, if managerial and professional workers enjoy their job better than clerical or average workers, then the relative advantage of convenience foods for them will be even greater (why?).

Reference: Odland, Dianne D., Ruth S. Vettel, and Carole A. Davis. "Convenience and the Cost of the 'Newer' Frozen Plate Dinners and Entrees." *Family Economics Review*, No. 1, 1986, U. S. Dept. of Agriculture.

Finally, the fact that saving time is valued by consumers means that services which do save consumers time will be more costly. Convenience food, already discussed, is an example. Another example is real estate brokers. Real estate brokers earn their commissions because they save homebuyers time in finding homes with the desired characteristics.

The Bottom Line

Time is valuable—if it weren't, why do you drive to school or work rather than walk. The price of an hour of your time is the value of what that hour could be used for in the next best alternative.

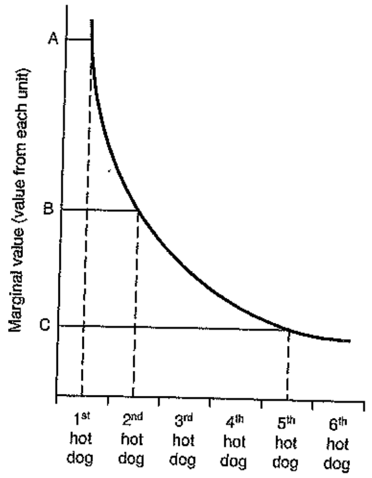
3. Why Isn't the Tenth Hot Dog as Good as the First?

Did you ever wonder why eating the tenth hot dog isn't as good as eating the first? Did you ever wonder why the fifth day of visiting your parents or in-laws isn't as enjoyable as the first day? Did you ever wonder why watching your third football game on Sunday isn't quite as much fun as watching the first game?

DECLINING MARGINAL VALUE

The answer to all these questions is summed-up in one phrase: *declining marginal value*. Declining marginal value simply means that we get less pleasure from additional units of a product or service than from the earlier units. The first hot dog tastes really good and gives you much eating pleasure. The second hot dog tastes almost, but not quite, as good and gives you a little less pleasure than the first. The fifth hot dog still gives you pleasure, but much less than the first or second. The tenth hot dog may in fact give you displeasure if it makes you sick! The idea of declining marginal value is shown in Figure 1-1.

Figure 1-1. Declining marginal value.



The idea of declining marginal value has some important and interesting implications for consumers. First the concept is the major reason why consumers buy more of a product or service when its relative price falls. Look at Figure 1-1 again. If the price of a hot dog is equivalent to A (the value you put on the first hot dog), then you'll only buy one hot dog. You wouldn't buy the second hot dog because the value you put on the second hot dog (B) is less than the price equivalent to A. However, if the price of hot dogs fell to that equivalent to B, and if all hot dogs cost B, then you would buy two hot dogs because the value to you of the first hot dog is greater than B, and the value to you of the second hot dog is B. So the rule is that consumers will purchase units of a good or service up to the point where the value the consumer places on the last unit bought exactly equals the price per unit of the good or service. A second implication has to do with pricing strategies of sellers. Notice in Figure 1-1 that you're willing to pay the equivalent of A for the first hot dog but only the equivalent of B for the second hot dog. If sellers charge the price equivalent of B for all hot dogs, then you'll buy two hot dogs but you'll actually get a gift on the first hot dog. The gift is that you were willing to pay the equivalent of A for the first hot dog, but you only paid the equivalent of B.

PRICING STRATEGIES

Sellers recognize that these "gifts" occur if all units of a good or service are sold at the same price. Some sellers can't do anything about it. Other sellers try to do something about it by selling units of a product in a package. The package is priced in such a way as to charge the consumer the maximum value he or she would be willing to pay for each unit. For example, in Figure 1-1, if a package of two hot dogs were sold, the total price would be A + B, not B + B. In this way the seller "extracts" the maximum price the consumer is willing to pay.

The Bottom Line

As you consume more units of a product, the value you put on the last unit consumed falls from the value of earlier units. This is why consumers buy more units of a product when the price falls. This is also why sellers frequently sell products only in packages of many units.

4. Why Should You Worry about Supply and Demand?

You've probably heard the comment that the most important concepts in economics are supply and demand. Most economic situations can be broken down into supply and demand.

But why should consumers worry about supply and demand? Aren't supply and demand concepts that businessmen and women, plant managers, CEOs (chief executive officers), and government policymakers should worry about, but not consumers?

To be honest, learning about supply and demand won't help you make wise consumer decisions in the same way that learning about compound interest and discounting will. However, learning about supply and demand will help you anticipate changes in the economy which do have a profound effect on your personal economic situation. For example, understanding supply and demand will help you realize:

- why fuel prices will jump when unexpected cold weather hits,
- why orange juice prices rise when a severe freeze hits Florida,

- why grocery prices fall when a new supermarket enters the neighborhood, and
- why health care costs increase when government medical payments to consumers expand.

Demand

The concept *demand* refers to the quantity of a product which a consumer, or group of consumers, will purchase at a given price. Generally, when the price rises consumers purchase less of the product; conversely, when the price falls consumers purchase more of the product. Of course, the "prices" should be relative prices, especially when compared at different points in time. (Why?)

DEMAND CURVE

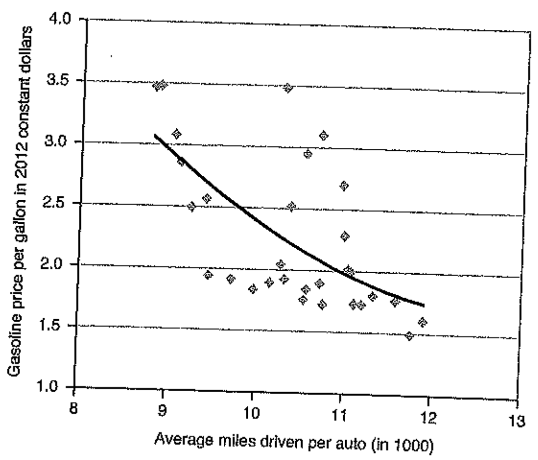
A *demand curve* shows the relationship between the price of a product and the quantity of that product which consumers purchase. You've already seen a demand curve. The "declining marginal value" curve in Figure 1-1 is really a demand curve.

As an example of an actual demand curve, look at the relationship between relative gasoline prices per gallon and average miles driven per auto in Figure 1-2. The points on the graph represent combinations of the price of driving and mileage consumption from 1980 to 2009. In general, mileage driven increased as the relative price fell. If an "average" line is drawn through the points in Figure 1-2 (note the line), the result is the so-called "downward sloping" demand curve. That is, consumption increases as relative price falls, and consumption decreases as the relative price rises.

SUBSTITUTION EFFECT

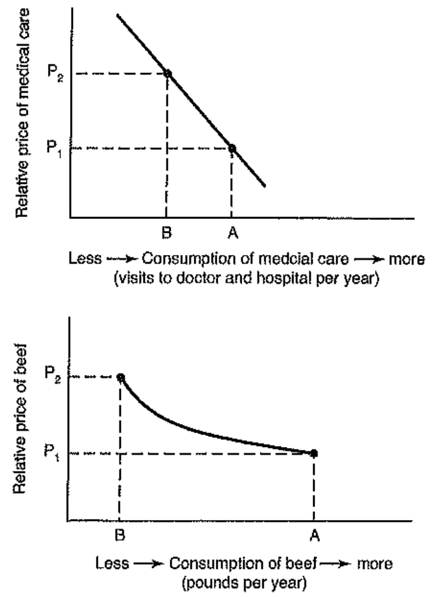
There are two reasons why consumers buy less of a product when its relative price increases. Suppose the price of gasoline rises, with all other prices and consumer income remaining the same. Gasoline is now relatively more expensive than other consumer products. Consumers therefore have an incentive to use more of other consumer products, especially those which are substitutes for gasoline, and less of gasoline. For example, when the relative price of gasoline rose in the mid and late 2000s, consumers were motivated to reduce single passenger and single purpose driving trips and substitute greater use of public transit, car-pooling, and multi-purpose trips. Similarly, when the relative price of oil rose during the same period, consumers bought less oil and more natural gas and wood for home heating. This is called the "substitution effect."

Figure 1-2. The relationship between the relative price of gasoline and miles driven by consumers 1980–2009.



Data source: Statistical Abstract of the United States, various years.

Figure 1-3. Demand curves for medical care and beef.



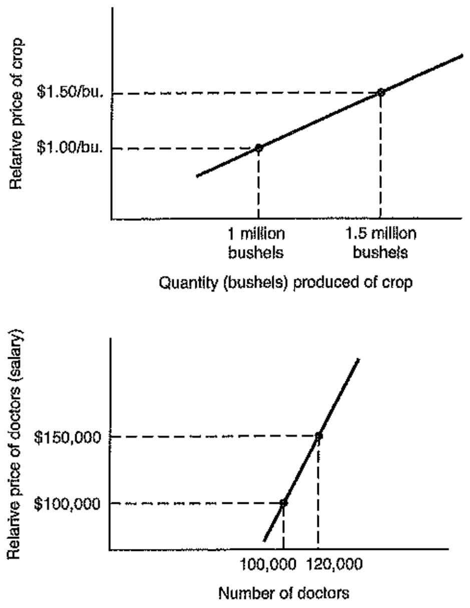
Of course, the availability of substitutes for a product whose price has risen and the size of other costs associated with switching from one product to another limit the degree to which consumers can reduce the consumption of a product whose relative price has risen. Consumer products that have few substitutes show less responsiveness to price changes than consumer products which have many substitutes. Compare the demand curves for medical care and beef in Figure 1-3. The demand curve for medical care is very "steep," meaning that consumption changes little as the relative price changes (notice that consumption of medical care only falls from A to B when price rises from P1 to P2). This is because there are few substitutes for medical care. In contrast, the demand curve for beef is very "flat." Consumption changes a lot when relative price changes (see the effect of price rising from P1 to P2). This is because there are many substitutes for beef.

The second impact of a relative price change is on the purchasing power of a consumer's income. When the relative price of a consumer product rises and the consumer's income remains the same, it means the consumer's income will not "go as far"—that is, it falls in purchasing power. The consumer reacts by buying less of all consumer products, including the product whose price rose.

Supply

Producers of consumer products react in an opposite way to changes in the relative price of their products than do consumers. Initially, with no change in the costs of their inputs (e.g., labor, machines), producers reap higher profits when the price received for their product rises. Motivated by more profits, producers strive to manufacture a greater quantity of their products. This gives rise to a positive relationship between the relative price of a consumer product and the quantity of that product which a producer manufactures—that is, the higher the relative price the greater the quantity manufactured. Eventually, in order to produce additional amounts of a product, the producer must compete for additional inputs, such as labor and investment funds, that are being used elsewhere. This "bidding" increases the relative price of those inputs. The producer stops increasing the manufacture of additional quantities of products when the higher cost of inputs "wipes out" any extra profit made on these additional quantities.

Figure 1-4. Supply curves.



SUPPLY CURVE

Similar to a demand curve, a "supply curve" can be drawn for producers of consumer products. The supply curve merely shows combinations of relative price of a product and quantity of that product which a producer, or group of producers, manufactures. Since producers manufacture more of the product when its relative price rises, supply curves usually slope "upward."

Two supply curves are illustrated in Figure 1-4. The ease and cost of manufacturing additional quantities of a product determine the shape of the supply curve. For example, it is relatively easy and inexpensive for farmers to increase acreage devoted to the production of given crops in response to higher relative prices for those crops. Therefore, the supply of many crops is very responsive to changes in relative price. Such a supply curve is illustrated in the upper part of Figure 1-4. In contrast, increasing the supply of doctors requires long periods of costly education and internship. Therefore, the supply of doctors is not as responsive as crops to changes in relative price. The doctor supply curve is like that illustrated in the bottom part of Figure 1-4.

The Market

The meeting of consumers desiring to purchase a product and producers desiring to sell that product is called the market for the product. The market has two major functions. First, it establishes the price at which the product will be sold. Second, it is the place where trades take place between consumers and producers. Generally, consumers trade money to producers in return for products.

How the Market Operates

In ancient times most markets were physical locations where consumers and producers came together to make trades. Prices were established by consumers and producers arguing over the "worth" of products in

an atmosphere similar to today's auctions. If producers found that their products weren't selling, they would lower the price which they'd be willing to accept from consumers. Conversely, if producers found that their products were selling rapidly, they could raise the price which they'd be willing to accept.

Today, some markets still exist in which consumers and producers come together to bid and argue over prices and to make trades. The New York Stock Exchange and tobacco markets are good examples. However, with rapid communication devices, like the Internet, available today, many markets don't require consumers (buyers) and producers (sellers) to be in the same physical location. Furthermore, many markets today are more "polite" than their ancient counterparts. Consumers and producers infrequently argue about prices. Nevertheless, consumers collectively do have an impact on prices. If a producer posts a price for a product which is higher than the price which many consumere are willing to pay, then some consumers simply won't buy the product (and instead will buy substitutes) and others will reduce their purchases of the product. The net result is that the producer finds he can't sell all of the product which he wanted to at the posted price. In order to sell more of his product, the producer lowers the relative price.

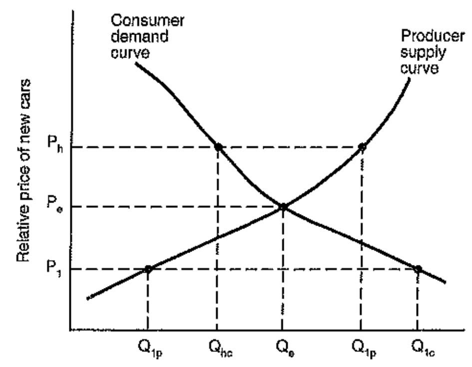
On the other hand, what if the posted price is less than the maximum price which many consumers are willing to pay for the product? In this case the available supply of the product is purchased at a rapid rate. The producer finds that he can raise the product's relative price and still sell the available supply.

The Equilibrium Price

The price of a product will ultimately settle at that price for which the quantity of the product that consumers want to buy exactly equals the quantity of the product that producers want to manufacture and sell. In economics jargon, this price is called the "equilibrium price."

The equilibrium price can be illustrated by combining the consumer demand curve for a product and the producer supply curve for the same product. In this case the demand curve is for all consumers and the supply curve is for all producers manufacturing the product. Consider the market for new cars. Given the demand and supply curves for new cars in Figure 1-5, the equilibrium price for new cars is P_e and the corresponding quantity of new cars

Figure 1-5. Equilibrium price.



sold is Q_e. Why is P_e the equilibrium price? At prices higher than the equilibrium price, say P_h, producers desire to sell more new cars, Q_{hp}, than consumers are willing to buy, Q_{hc}, Inventories therefore increase at dealers' lots. In an effort to sell more cars prices are lowered, perhaps through gimmicks such as rebate plans and special financing. This happened in the 1990–91 recession as dealers found their cars overpriced and sales slipping.

In contrast, what if the price of new cars is below the equilibrium price at, for example, P_l. Then consumers want to buy more cars, Q_{lc}, than producers are willing to sell, Q_{lp}. Cars are being sold faster than dealers can restock them. Many consumers are willing to offer higher prices in order to be assured of purchasing a car. The higher offered prices also encourage producers to manufacture more cars. Therefore, price rises toward the equilibrium price, P_e.

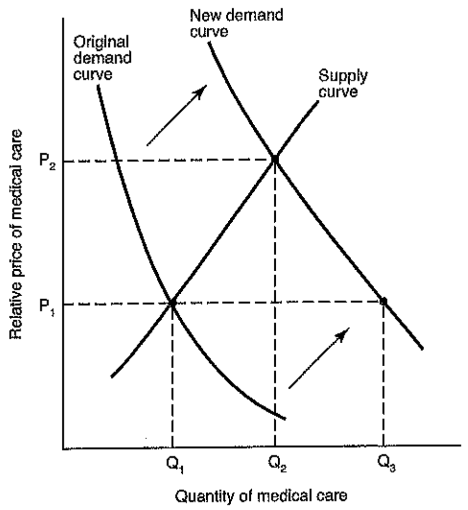
How Markets Change

This is the part of this topic that you'll find most interesting and useful. Unfortunately, you had to read everything prior to this to get to this point!

Markets are rarely in equilibrium. In most cases prices and quantities are moving toward equilibrium. Markets move out of equilibrium when something happens to make either demand, supply, or both change. For example, suppose the federal government institutes a national health insurance plan which effectively reduces the price of medical care paid by consumers but does not affect the costs to doctors and hospitals of providing medical care. Medical care is therefore relatively cheaper to consumers, and consumers will therefore desire to purchase more medical care at every level of prices charged by doctors and hospitals. In essence, the demand curve for medical care has moved outward as shown in Figure 1-6. Initially, with the same price (P_1) charged by doctors and hospitals, excess demand for medical care occurs—that is, doctors' waiting rooms and hospitals become more crowded. This is seen by the difference between Q_3, the new quantity of medical care desired by consumers at price P_1, and Q_1, the quantity of medical care desired by consumers at

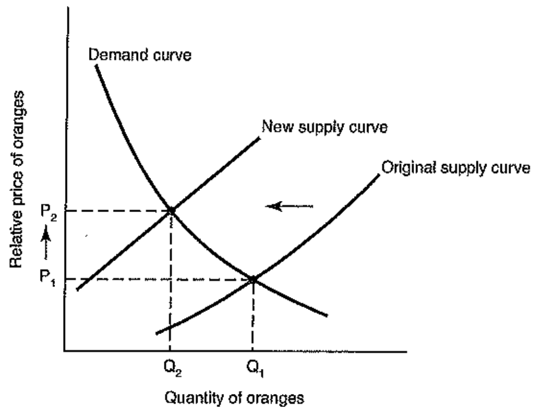
NATIONAL HEALTH INSURANCE

Figure 1-6. Impact of a national health insurance plan.



price P_1 before the institution of national health insurance. Increased competition among consumers for medical care ultimately pushes the relative price of medical care up. The higher relative price of medical care encourages more individuals to become doctors and encourages the expansion of hospitals. Ultimately, the new equilibrium price and quantity of medical care is P_2 and Q_2 respectively. The market movement from P_1,Q_1 to P_2,Q_2 may, however, take years to occur in the case of medical care. This is because of the long time it takes to train new doctors.

Figure 1-7. Impact of a damaging freeze on the orange crop.



ORANGE CROP FREEZE

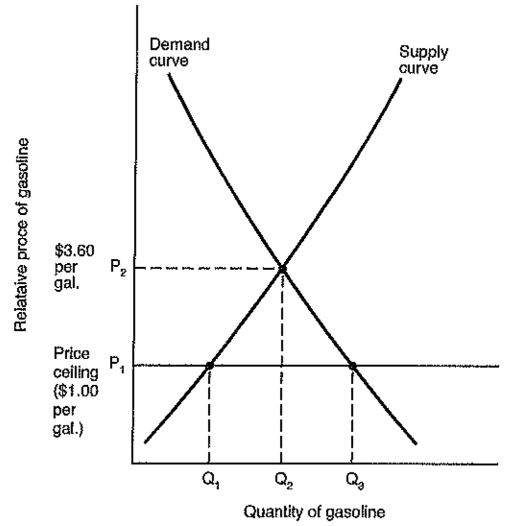
As another example of a change in market equilibrium, this time from the supply side, consider what happens if an unexpected freeze in Florida significantly damages the orange crop. Growers can now only supply a reduced number of oranges at every level of prices. This is depicted by a backward shift in the supply curve for oranges, as in Figure 1-7. Increased consumer competition for the now more limited supply of oranges means that the equilibrium price rises to P_2.

GAS PRICE CONTROLS

As a final example (promise!) of market changes, consider what would happen if the government reinstituted price controls on gasoline. Suppose the government said that, by law, gasoline could not be sold for more than $1.00 per gallon. This is considerably below the market price of approximately $3.60 per gallon (in 2012). What would happen?

Since $1.00 per gallon is less than the market price, gasoline is now relatively cheaper after the government decree. Consumers, collectively therefore desire to purchase more gasoline than they did at $3.60 per gallon. In Figure 1-8, consumers desire to purchase quantity Q_3 rather than quantity Q_2. But where will the extra gasoline come from? In fact, producers of gasoline will supply less gasoline (Q_1) at $1.00 per gallon

Figure 1-8. Impact of gasoline price controls.



than the quantity they supplied (Q_2) at \$3.60 per gallon. A shortage, the difference between Q_3 and Q_1, therefore results from the price ceiling.

TIME PRICE

How is the shortage resolved? A "black," or underground, market could develop that would sell gasoline above the ceiling. For most consumers, however, the shortage is resolved through a rise in the *time price* associated with purchasing gasoline. Fear of not being able to purchase gasoline motivates consumers to line up at gas pumps before the supply runs dry. Long lines at gas stations increase the waiting time associated with obtaining gas and hence increase the time costs of purchasing gas. The higher time cost motivates consumers to use less gasoline in order to avoid the waiting lines. The higher time cost effectively substitutes for a higher monetary cost.

So What?

Now that you know about demand curves, supply curves, markets, and equilibrium prices, what practical use are these concepts to you? Can the concepts help you in managing your personal financial affairs?

FORECASTING

The major practical usefulness of the concepts is in forecasting. You now know four things related to supply and demand:

- Anything that increases demand for a product without increasing supply to the same extent will result in a relative price increase;
- Anything that decreases demand for a product without decreasing supply to the same extent will result in a relative price decrease;
- Anything that increases supply of a product without increasing demand to the same extent will result in a relative price decrease; and
- Anything that decreases supply of a product without decreasing demand to the same extent will result in a relative price increase.

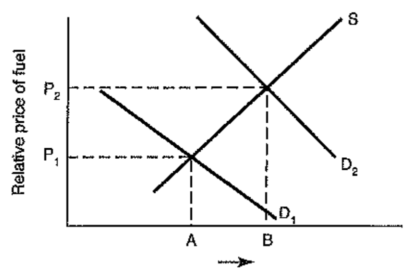
Let's see how a consumer could put these ideas to practical use with two examples:

A COLD SNAP

Suppose severe and unexpected cold weather hits in December. Average temperatures are several degrees below normal. To stay warm, consumers initially increase their consumption of fuel, including natural gas, oil, and electricity. Should consumers expect fuel prices to rise?

Yes, fuel prices will rise, and perhaps dramatically. The unexpected cold weather increases demand for fuel at every price and shifts the demand curve outward (Figure 1-9A). Fuel prices will rise, and the extent of the rise will depend on how responsive the supply of

Figure 1-9A. Effects of severe cold weather.



C O N S U M E R   T O P I C

MORE COMPETITION LOWERS SUPERMARKET PRICES

OK, you say, economic theory implies that more firms competing for consumers' business in a given market will mean lower prices for consumers. That sounds good, but is there any evidence it actually happens in the real world?

One piece of evidence comes from a study done by Walden on supermarkets in Raleigh, North Carolina. Walden examined the impact of a new store opening in a given market area on the prices charged by six existing stores. The prices of 22 commonly purchased supermarket products were followed for 32 weeks prior to the new store opening and for 16 weeks after the opening.

The findings supported the implications of the simple model of supply and demand. Prices for half of the products were lower at the six existing stores after the opening of the new store. Furthermore, the drop in price was greater for existing stores located *closer* to the new store than for existing stores located farther from the new store. This is logical since stores located closer to each other should be stronger competitors. Prices for most of the other products showed no sensitivity to entry of the new store.

Reference: Walden, Michael L. "Testing Implications of Spatial Economics Models: Some Evidence from Food Retailing," *The Journal of Consumer Affairs,* Vol. 24, No. 1, Summer 1990, pp. 24–43.

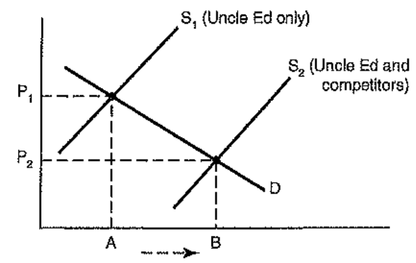
fuel is to price changes. Over a short period of time, such as a month, the supply of fuel is probably not very responsive, so in this situation consumers should plan to budget much more money for fuel costs.

Now consider an investment example. Suppose your Uncle Ed opens the first video store in town. The store is a success and Uncle Ed makes big profits. You invest some money in Uncle Ed's store and are very pleased with the returns on your investment. Uncle Ed's relative price and quantity of videos rented is shown as P_1 and A on Figure 1-9B.

AN INVESTMENT

But Uncle Ed's big profits likely won't last. Why? Observing Uncle Ed's profits, competitors will set up other video stores in town. This will shift the supply curve to the right (S_2 in Figure 1-9B) and lower prices to P_2. Uncle Ed's profits, and the return on your investment, will fall.

Figure 1-9B. Uncle Ed's large profits won't last.



The Bottom Line

One can use supply and demand curves to forecast changes in relative prices. Anything that increases demand more than supply will increase the relative price, and anything that increases supply more than demand will decrease the relative price. An individual consumer can't have an impact on supply and demand, but understanding supply and demand will give clues about where prices are headed.

5. Why Should You Always Look Over Your Shoulder (Economically Speaking)?

Wouldn't life be great if each of us had all the money and time we wanted. Then we could buy and do everything we wanted, and there would be no reason for economic decision-making. In fact, there would be no reason for economics, or for this book, because economics is the science which deals with making decisions about scarce resources. If money and time are unlimited, then there's no need to worry about prioritizing purchases or deciding what is best to buy.

But consumer resources—mainly time and money—are limited, and so consumers must worry about using those resources in the best way to reach whatever goals they have. One way to keep yourself honest in this endeavor is to understand and use the concept of *opportunity cost.* Opportunity cost recognizes that when you spend time or money on any product, you're *giving up* the ability to spend that same time and money on something else. Therefore, the opportunity cost of spending money or time on any product or activity is the *value* of the next best product or activity you could obtain with that same amount of time or money. Some examples of opportunity cost are:

OPPORTUNITY COST

- the opportunity cost to John, a college student, of going to the movies for two hours is the benefit from studying for those two hours,
- the opportunity cost to Sally of buying a $35,000 Jeep Grand Cherokee is the investment she could make with that money,
- the opportunity cost to George and Jennifer of having a child is the value of making a downpayment on a new house.

Opportunity cost is the economic equivalent of looking over your shoulder at other uses for your time and money. Opportunity cost forces you to recognize your missed opportunities. Opportunity cost doesn't mean that spending money or time on any product or activity is "bad" or "wrong"—that requires evaluation, which will come in later chapters. Instead, opportunity cost makes you realize that nothing is free—there's always some other use for your resources.

IS ANYTHING "FREE"?

For example, even if someone gives you free tickets to the baseball game, the game still isn't free. There's an opportunity cost to your time spent at the game!

At this point you may say, "Come on, if I hadn't gone to the baseball game, I wouldn't have done something 'constructive'—I would have slept or watched TV." That's OK. The opportunity cost of some expenditure of time or money doesn't have to be something "constructive" or "self-improving" or "dull." The opportunity cost of any expenditure is simply the value of your next best use of that time and money, and that next best use can be anything you want. But keep yourself honest—recognize all your other opportunities. Also, you can calculate a number of opportunity costs for any number of alternative uses of your time and money.

Applications to Consumer Decision-making

The concept of opportunity cost is applicable to many consumer decisions. It will be used many times in future chapters. Here is a preview.

HOUSE DOWN-PAYMENT

- Down-payment on purchase of a house: Most of us make a down-payment when buying a house. Obviously the down-payment is part of the cost of the house. But understanding the concept of opportunity cost makes you realize that the cost of the down-payment doesn't stop when the house is bought. The down-payment money could have been invested and earned interest each year. These annual interest earnings are an opportunity cost of the down-payment and should be counted as an annual cost of the house.

CASH OR CREDIT

- You pay cash for a new TV rather than using credit. You save hundreds of dollars in credit interest costs and are very proud of yourself for doing so. But remembering the concept of opportunity cost takes some of the luster off that pride. Using your own money isn't costless, because you could have invested that money and earned interest. These interest earnings which you give up are one opportunity cost of paying with cash. In fact, if the interest rate you earn on the cash is greater than the interest rate charged for credit, then using credit may be cheaper (more on this in Chapter 5).

SHOPPING

- Shopping by comparing unit prices: This is the commonly recommended method of shopping (for example, in a supermarket) and will result in the lowest money cost. But there's an opportunity cost to this shopping technique which is the extra time required as compared to other shopping methods. When the cost of time is added to the money cost of unit price shopping, it may not be the cheapest technique, especially for high income consumers.

COUPONS

- Clipping coupons is also recommended, as the "smart" way to shop and save money. But again, coupon clipping and organization takes time, and when the opportunity cost of that time is considered, coupon clipping may not be wise.

"But I Won't Invest—I'll Waste the Money!"

This is a common response to the recommendation that foregone interest earnings be used as an opportunity cost to spending money on some consumer product or service. You might say, "If I don't pay cash for the TV, I'll simply spend the money on something frivolous."

There are two responses to this comment. First, if you spend the money on something else (whatever that is), rather than investing, then it must be that the value of that expenditure is greater than the value you'd get from investing. No one knows better than you what you like and don't like and what gives you the most pleasure. The opportunity cost should then be measured as the value of that other expenditure. If you use the foregone interest earnings as the opportunity cost, you'll actually be underestimating the true opportunity cost!

Second, although you may not invest the money, you could, so investing is an alternative for which an opportunity cost can be easily constructed. It allows you to consider "what might have been."

The Bottom Line

Your resources of time and money are limited, so there are always many alternative uses for them. The idea of "opportunity cost" keeps you honest by forcing you to consider what else you might have done with a particular expenditure of time or money.

6. Why Doesn't Everyone Earn the Same Amount of Money?

Money and time are the consumer's two resources. We all have the same amount of time per week or year (although life spans vary), but wages and incomes vary quite a bit (see Table 1-3).

In a nutshell, wages and incomes vary primarily due to differences in worker skills, training, talents, and experiences, and due to differences in the amenities and characteristics of alternative jobs.

TRAINING

In general, wages are higher for jobs which require more skill and training. Highly skilled jobs are more valuable to the employer, and the employer passes these benefits on to the employee in the form of higher wages. Jobs which require more training must pay higher wages in order to entice people to undergo the training and probably put up with low pay during the training period. For example, many fewer people would be motivated to undergo the eight to ten years of medical school training at little or no pay unless they anticipated that a high-paying job would be the result. Education is one of the best predictors of earnings (see CONSUMER TOPIC).

Table 1-3 Average salaries of workers in selected occupations, 2010.

Occupation	Median pay
Dentists	$146,920
Civil engineers	$77,560
Architects	$72,550
Personal financial advisors	$64,750
Accountants	$61,690
High school teachers	$53,230
Insurance agents	$46,770
Social workers	$42,480
Travel agents	$31,870
Retail sales workers	$20,990

Data source: U.S. Bureau of Labor Statistics, Occupational Outlook Handbook: http://www.bls.gov/ooh/

CONSUMER TOPIC

THE INCREASING RETURNS TO EDUCATION

Education is a major determinant of earnings. One study calculated that 42 percent of the differences in wage rates could be explained by educational differences (Fearn, Stone, and Allen).

In the 1970s college graduates could expect to earn 29 to 41 percent more than high school graduates, depending on years of experience. By the mid-1990s the average earnings premium of college graduates over high school graduates had risen to over 80 percent.

Why has a college education become more valuable. One answer is surprising, while a second answer is more well-known. The well-known answer is that the demand for college educated workers has increased as professional and technical jobs have grown at faster rates than manufacturing and other manual jobs. The surprising answer is that the relative supply of new college graduates actually fell in the 1980s. The percentage of males aged 25–34 with a college degree fell from 28½ percent in 1979 to 26.2 percent in 1987, and the percentage of females aged 25–34 with a college degree fell from 27.2 percent in 1979 to 26.7 percent in 1987. By 1996 the percentage of both genders aged 25–34 with a college degree stood

(*continued on next page*)

CONSUMER TOPIC

(continued from previous page)

at 26.5%. Thus the rise in the earnings premium associated with a college degree seems to have resulted from the classic situation of demand increasing faster than supply.

Does this mean that everyone should get a college degree? No. Many consumers' talents are in occupations which don't require college training. These consumers would be unhappy and unproductive in a college-trained occupation. However, this doesn't deny the fact that the most assured way of earning more income is with more education.

References: Fearn, Robert M., Paul S. Stone, and Steven G. Allen. *Employment and Wage Changes in North Carolina*, Economics Information Report No. 60, North Carolina State University, January 1980.

Katz, Lawrence F. and Ana L. Revenga. "Changes in the Structure of Wages: The U. S. Versus Japan." NBER Working Paper No. 3021, National Bureau of Economic Research, Cambridge, Massachusetts, July 1989.

Mankin, N. Gregory, *Principal of Economics*, Fort Worth, Texas, The Dryden Press, 1998, p. 404.

If you have unique and extraordinary skills and talents for jobs which are in high demand, then you really have it made. There will be few or no substitutes for these types of people, so you have a "corner on the market" and can command very high wages. Sports superstars, top box office actors and actresses, and elite corporate executives are examples of such people.

WORK ENVIRONMENT

Wage differentials also compensate workers for differences in the quality of the working environment. This is best explained with an example. Take the jobs of two accountants with the exact same training and experience. One accountant, Adam, takes a teaching job at the University of Santa Barbara, which is located on the coast of California in a beautiful temperate environment. The other accountant, Beth, takes a high pressure-high stress job with a New York City accounting firm. Adam teaches three classes a day, does research of his own choosing, and has the job security provided by tenure. Beth must constantly worry about keeping old accounts and getting new ones and can be fired with no notice.

You shouldn't be surprised that Beth's initial salary is higher than Adam's. When comparing jobs with the same skill and training requirements, higher wages will be paid for those jobs which have more stress

and risk or which are located in less appealing places. Lower wages will be paid for those jobs having more security and serenity and which are located in pleasant and popular places.

The Bottom Line

Jobs which require more education or training, which are riskier, or which have less desirable work environments will pay higher wages and salaries. Also, workers who have unique skills for jobs which are in high demand will earn high incomes.

7. Does Inflation Doom Us to an Existence of Poverty?

You know what inflation means—it means prices are rising and it's more expensive to buy products and services. The inflation rate simply is the percentage increase in prices.

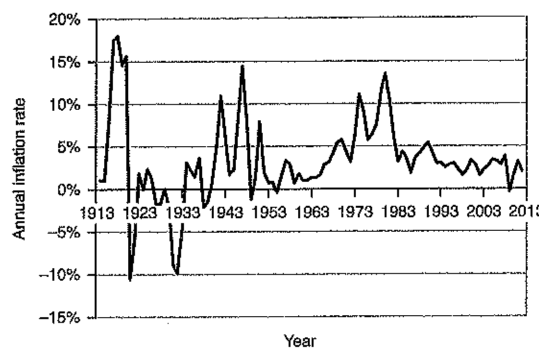
We can talk about an inflation rate for a single product or service or for a number of products and services. Generally, the latter is more widely used. You frequently hear quoted the inflation rate for consumer products and services, the inflation rate for producer products, or the inflation rate for all products and services. In fact, when "the" inflation rate is mentioned, it always refers to one of these broad measures.

Inflation Isn't New

Inflation isn't a new phenomenon. As Figure 1-10 shows, rising prices are the rule rather than the exception. Inflation rates are highest after wars and before recessions (more on this later in the next chapter).

Inflation means the purchasing power of the dollar declines. Table 1-4 shows how the dollar's purchasing power declines over time at different average annual inflation rates. For example, with an annual inflation rate of 4 percent per year, having a dollar 15 years from now would be like having 56¢ today. However, if the annual inflation rate is 8 percent per year, having a dollar 15 years from now would be like having only 32¢ today.

Figure 1-10. Historical inflation rates.



Source: U.S. Bureau of Labor Statistics, Consumer Price Index: http://www.bls.gov/cpi/home.htm

Table 1-4 Inflation rates and purchasing power of the dollar.

	What a dollar will be worth after N years and annual inflation rate of:					
	2%	4%	6%	8%	10%	15%
5 yrs.	91¢	82¢	75¢	68¢	62¢	50¢
10 yrs.	82	68	56	46	39	25
15 yrs.	74	56	42	32	24	12
20 yrs.	67	46	31	21	15	6
25 yrs.	61	38	23	15	9	3
30 yrs.	55	31	17	10	6	2
35 yrs.	50	25	13	7	4	1
40 yrs.	45	21	10	5	2	1/3

CONSUMER TOPIC

WHERE IS IT CHEAPER TO LIVE?

We frequently talk about inflation and the cost-of-living in national terms. But the cost-of-living varies by where you live in the nation. In general, it's cheaper to live in rural areas than in urban areas, and it's cheaper to live in the Southeast and Southwest than in the East and Midwest.

An excellent source of local cost-of-living data is the Cost of Living Index by the Council for Community and Economic Research (C2ER), formerly American Chamber of Commerce Researchers Association (ACCRA). The Cost of Living Index is published quarterly for several hundred locations nationwide.

The Cost of Living Index can be used to compare salaries of alternative jobs in different locations. Suppose Joe Simpson earns $50,000 in his job in Columbia, Missouri. He is offered a similar job in Hartford, Connecticut. He finds in 2012, the cost of living index is 94.2 for Columbia, Missouri, and 124.6 for Hartford, Connecticut. Thus the cost of living in Hartford is 32.3% (124.6/94.2 - 1) higher than in Columbia. Therefore, Joe would need a salary of at least $66,150 ($50,000*1.323) in Hartford to be comparable to his salary in Columbia.

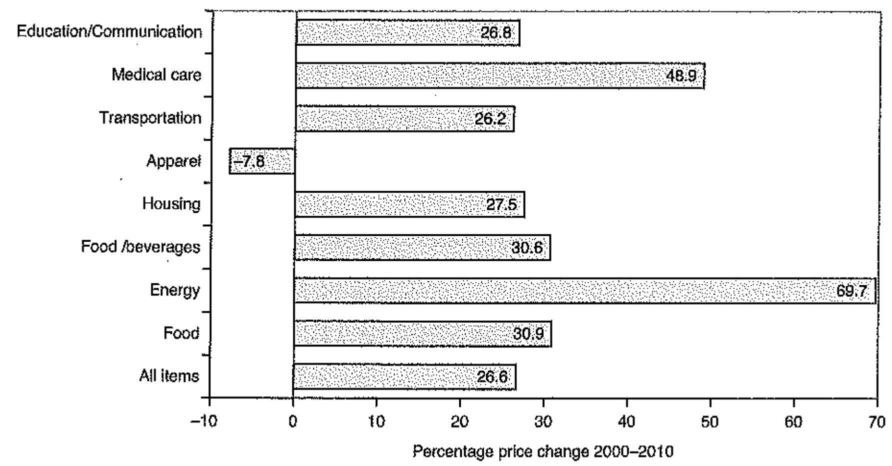
ESCALATING INFLATION

DISINFLATION

DEFLATION

When inflation rates are rising, that is, when prices are increasing at increasing rates each year, we refer to this situation as *escalating inflation*. The period 1975–1980 is a good example of escalating inflation (see Figure 1-10). When inflation rates are falling, meaning prices are rising but at successively lower rates each year, we say *disinflation* is occurring. The periods 1980–1986 and 1990–1998 are examples of disinflation. During years when prices actually fall, we say *deflation* is occurring. Since 1929, deflation has occurred in 1933, 1939, 1949, and 1955.

Figure 1-11. What's up, what's not (in relative price) in the 2000s.



Data source: Statistical Abstract of the United States, 2012.

REAL PRICE INCREASE/DECREASE

Not all prices change at the same rate. If a product's price rises *faster* than the inflation rate for all prices, then that product has had a *relative*, or *real*, price increase. If a product's price rises slower than the inflation rate for all prices, then that product has had a relative, or real, price decrease. You already learned about relative price changes in *Are Prices "Really" What They Seem?* Figure 1-11 shows products which have experienced relative price increases and relative price decreases in the 2000s. Energy and medical care became relatively more expensive in the 2000s, apparel became less expensive both in relative and nominal prices, and the other categories had price increases very similar to the overall increase for all goods and services.

Coping with Inflation

Is inflation bad? That is, is it bad for the dollar's purchasing power to decline each year?

Most of you would say yes, but the answer is "not necessarily." As long as consumer incomes rise at the inflation rate or higher, then rising prices don't reduce consumers' standard of living. Fortunately, this has been the case in most of the recent decades (see Table 1-5). Over most years, increases in consumer income more than compensated for inflation in prices. An exception is the 1980s when wage rates didn't keep up with inflation. Personal income still rose because more people (primarily females) chose to work.

Many wage contracts are now indexed to the average inflation rate. Social Security payments are indexed to a National Wage Index, which is higher than the inflation rate for most years.

Table 1-5 Increases in prices and incomes.

	1960s[a]	1970s[b]	1980s[c]	2000s[d]	2000s[e]
1. Increase in consumer prices, (% CPI)	31.1%	112.4%	58.6%	31.8%	26.6%
2. Increase in after-tax personal income (%)	78.6%	141.8%	84.5%	61.6%	38.0%
3. Increase in wage rate	54.4%	102.3%	68.0%	52.9%	29.6%
4. Increase in after-inflation after-tax personal income (2-1)	47.5%	29.4%	25.9%	29.9%	11.4%
5. Increase in after-inflation wage rate (3-1)	23.3%	−10.1%	9.4%	21.2%	3.0%

[a]1960–1970
[b]1970–1980
[c]1980–1990
[d]1990–2000
[e]2000–2010

Data source: Consumer Price Index from the US Bureau of Labor Statistics. Per capital disposable income data from US Department of Commerce, Bureau of Economic Analysis. National wage index from the Social Security Bureau.

This doesn't mean you can ignore inflation. One reason is that your wage and income may not keep up with inflation, so inflation may reduce your standard of living. Certainly you must be concerned about keeping your income at pace with inflation. When negotiating wage or salary increases with your boss, make sure you're aware of the latest inflation statistics. If your boss doesn't give you a raise at least equal to the inflation rate, then you've really received a pay cut!

Understanding inflation and keeping track of it will also prevent you from being misled by claims of future wealth. For example, an insurance agent demonstrates how an insurance policy will provide you with $200,000 in 30 years. Yet if inflation averages 4 percent a year for the next 30 years, then $200,000 will only be worth $62,000 in purchasing power. Also, as you will see later, inflation is very important to keep in mind when making decisions about investments. Ignoring inflation can lead to disaster for your investment portfolio.

The Bottom Line

Inflation has always been with us and will always be with us. Inflation by itself is not bad or disastrous. As long as your wages and income at least keep pace with inflation, your standard of living won't suffer with inflation.

8. How Is Inflation Measured?

Inflation is an important, although not welcome, part of consumers' lives. As you will see in this book, it is very important for you to account for inflation in many consumer financial decisions.

How is inflation measured, and where do you go to get information on inflation? There are two commonly used measures of inflation, the Producer Price Index (PPI) and the Consumer Price Index (CPI). The PPI measures the average prices of inputs used by the producers of products. The PPI includes the prices of products such as corn, crude oil, copper, concrete, nails, and lumber. Approximately 70,000 industrial prices go into the calculation of the PPI. A major omission in the PPI is the price of services used in the production process.

PPI

CPI

As consumers we are most interested in the prices of consumer goods and services. Therefore the Consumer Price Index is the most relevant measure of inflation for consumers. The rest of the topic will be devoted to understanding the measurement and use of the Consumer Price Index.

Measurement of the Consumer Price Index

The Consumer Price Index, or CPI, is an index, or average, measure of prices of goods and services bought by consumers at some point in time. *Inflation* is measured by the *change* in the CPI over some time period, and the *inflation rate* is measured by the *percentage change* in the CPI over a time period.

The federal government constructs the CPI by first collecting prices for 80,000 items across the country. The prices are then averaged together to form one price. But in the averaging process, all goods and services aren't treated equally, since some are a more important part of consumer spending than others. So, before the prices are averaged, they are "weighted" by their importance in the average consumer's budget. For example, the price of electricity receives a greater weight than the price of a can of carrots.

Price information for the CPI is collected monthly. Information used to form the "weights" is collected quarterly by the Consumer Expenditure Survey, which is another U.S. government survey.

WEIGHTING

As the name implies, the Consumer Price Index is an index number. For example, in January 2013 the Consumer Price Index for all consumer items stood at 230.28 using 100 for 1982–84. No meaning can be given to this number by itself. Instead, any CPI number must be used in combination with another CPI number. For example, the all-item CPI number in January 2012 was 226.67. Therefore, from January 2012 to January 2013 the all-item CPI rose from 226.67 to 230.28. This represented a

1.6 percentage increase. Therefore, from January 2012 to January 2013 the rate of inflation, as measured by the Consumer Price Index, was 1.6 percent.

Using the Consumer Price Index

There are two beneficial uses of the CPI. One is to calculate the overall, or all-item, rate of inflation, and the second is to calculate the rate of inflation for a particular consumer item.

Table 1-6 gives the all-item CPI for December 2009 and December 2012 as well as the CPI for individual spending items. To calculate the annual rate of inflation (in percentage terms) simply perform this calculation:

$$\frac{\text{CPI this year}}{\text{CPI last year}} - 1 = \text{Annual rate of inflation}$$

For example, calculating the annual rate of inflation from December 2011 to December 2012 results in:

$$\frac{229.6}{225.7} - 1 = 1.7\%$$

INDIVIDUAL ITEM INFLATION RATES

The annual inflation rate for individual spending items is calculated in the same way. In December 2012 the CPI for "transportation" was 211.9,

Table 1-6 All-item CPI and individual item CPI: December 2009- December 2012 (1982 – 1984 = 100)

	2009	2010	2011	2012
All items	215.9	219.2	225.7	229.6
Food/beverage	218.0	221.3	231.1	235.2
Housing	215.5	216.1	220.2	224.0
Transportation	188.3	198.3	208.6	211.9
Apparel	119.4	118.1	123.5	125.7
Medical care	379.5	391.9	405.6	418.7
Recreation	113.2	112.3	113.5	114.4
Education/ communication	128.9	130.5	132.7	134.7

Data source: US Bureau of Labor Statistics.

CONSUMER TOPIC

THE CPI IN RECENT YEARS

The CPI increased modestly in the 1960s until 1968. From 1968 to 1980 the CPI grew rapidly. In fact, during this period the price level more than doubled. Since 1980, the CPI has grown much more modestly, and starting from the late 1990s the inflation rate has been in the 1 to 4 percent range with the exception of 2009 when inflation rate was negative.

Year	CPI	Annual inflation	Year	CPI	Inflation
1960	29.6	1.7%	1991	136.2	4.2%
1970	38.8	5.7%	1992	140.3	3.0%
1971	40.5	4.4%	1993	144.5	3.0%
1972	41.8	3.2%	1994	148.2	2.6%
1973	44.4	6.2%	1995	152.4	2.8%
1974	49.3	11.0%	1996	156.9	3.0%
1975	53.8	9.1%	1997	160.5	2.3%
1976	56.9	5.8%	1998	163.0	1.6%
1977	60.6	6.5%	1999	166.6	2.2%
1978	65.2	7.6%	2000	172.2	3.4%
1979	72.6	11.3%	2001	177.1	2.8%
1980	82.4	13.5%	2002	179.9	1.6%
1981	90.9	10.3%	2003	184.0	2.3%
1982	96.5	6.2%	2004	188.9	2.7%
1983	99.6	3.2%	2005	195.3	3.4%
1984	103.9	4.3%	2006	201.6	3.2%
1985	107.6	3.6%	2007	207.3	2.8%
1986	109.6	1.9%	2008	215.3	3.8%
1987	113.6	3.6%	2009	214.5	-0.4%
1988	118.3	4.1%	2010	218.1	1.6%
1989	124.0	4.8%	2011	224.9	3.2%
1990	130.7	5.4%	2012	229.6	2.1%

Data source: US Bureau of Labor Statistics.

(continued on next page)

CONSUMER TOPIC

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The CPI values in the table (notice 1982–1984 is used as the base of 100) can be used to compare salaries at vastly different points in time. For example, suppose your father earned $15,000 in 1970. What salary would you have to earn in 2012 to be equivalent to your father's earnings? The answer is $\$15{,}000\times\frac{229.6}{38.8}$, or $88,761. Or, what if your grandfather earned $8,000 in 1960. What salary would you have to earn in 2012 to be equivalent to your grandfather's earnings? The answer is $\$8{,}000\times\frac{229.6}{29.6}=\$62{,}052$.

and in 2011 it was 208.6. Therefore, the annual rate of inflation for "transportation" from December 2011 to December 2012 was

$$\frac{211.9}{208.6}-1=1.6\%$$

INFLATION RATE FOR FALLING PRICE

What if a price falls? The annual rate of iinflation is calculated in the same way. Notice from Table 1-6 that the index for apparel fell from 120.1 in 2010 to 119.5 in 2011. The annual rate of inflation for apparel from December 2009 to December 2010 was then:

$$\frac{118.1}{119.4}-1=-1.1\%$$

INFLATION RATE FOR OVER MANY YEARS

To compute the total rate of inflation over a number of years, do the same calculation. For example, the all-item CPI in was 215.9 in December 2009 and 229.6 for December 2012. The total rate of inflation between December 2009 and December 2012 was

$$\frac{229.6}{215.9}-1=6.3\%$$

What if you have available the *annual* inflation rates for a number of years and you want to calculate a total inflation rate? You will underestimate the total inflation rate if you simply add the annual rates. Why? Because the inflation rate is a percentage increase over the previous year's cost-of-living. Adding the inflation rates implies using the first year's cost-of-living as a base for all of the increases.

Instead, the proper procedure is to multiply the annual inflation rates to compute a total inflation rate. The following example will illustrate the process.

EXAMPLE 1-1: Compute the total inflation rate for the years 2010 to 2012 using the individual annual inflation rates:

2010	1.6%
2011	3.2%
2012	2.1%

Total inflation rate = (1.016 × 1.032 × 1.021 – 1 = 7.1%

Notice this is larger than the simple sum of 6.9%.

INDEX YEAR

The federal government periodically changes the index values. For example, in January 1988 the index values were changed from being based on 1967 = 100 to 1982–84 = 100. The government publishes the CPI before 1988 using both bases. If you want to compare current CPI to CPI before 1988, make sure you use the CPI series with 1982–1984 as the basis.

CONSUMER TOPIC

YOUR INDIVIDUAL INFLATION RATE

The inflation rate calculated from the Consumer Price index is based on average consumer spending patterns. This means that if *your* spending patterns are considerably different than the average spending patterns used by the CPI, then your individual inflation rate may be different than the quoted inflation rate.

You need two sets of information in order to calculate an individual inflation rate. You need the breakdown of your after-tax spending (in percentage terms) in the categories used by the CPI, and you need the inflation rate for each of those spending categories. Multiply the inflation rate in each category by your proportional spending in the category, and add the results for all categories. The sum is your individual inflation rate.

The top of the table shows three spending patterns, that used by the CPI, the spending pattern of Judy, and the spending pattern of Joe. Judy spends relatively more on food, housing, and transportation. Joe spends relatively more on apparel, medical care, and others.

The CPI inflation rate over the December 2011 to December 2012 was 1.7%. The bottom of the table shows how the individual inflation rates for Judy and Joe are calculated. Both are somewhat higher than the "official" inflation rate.

(continued on next page)

CONSUMER TOPIC

	CPI Relative Importance	Judy's After-Tax Spending	Joe's After-Tax Spending
Food /beverages	14.8%	20.0%	13.0%
Housing, incl. utilities	41.5%	38.0%	13.0%
Apparel	3.6%	2.0%	20.0%
Transportation	17.3%	25.0%	13.0%
Medical care	6.6%	6.0%	25.0%
Recreation	6.3%	4.0%	1.0%
Education/ communication	6.4%	3.0%	0.0%
Others	3.5%	2.0%	15.0%
sum	100.0%	100.0%	100.0%

Judy's Inflation Rate

Food /beverages	20.0%	×	1.8%	= 0.4%
Housing, incl. utilities	38.0%	×	1.7%	= 0.7%
Apparel	2.0%	×	1.6%	= 0.0%
Transportation	25.0%	×	1.8%	= 0.4%
Medical care	6.0%	×	3.2%	= 0.2%
Recreation	4.0%	×	0.8%	= 0.0%
Education/communication	3.0%	×	1.5%	= 0.0%
Others	2.0%	×	2.1%	= 0.0%
All items				1.8%

Joe's Inflation Rate

Food /beverages	13.0%	×	1.8%	= 0.2%
Housing, incl. utilities	13.0%	×	1.7%	= 0.2%
Apparel	20.0%	×	1.6%	= 0.3%
Transportation	13.0%	×	1.8%	= 0.2%
Medical care	25.0%	×	3.2%	= 0.8%
Recreation	1.0%	×	0.8%	= 0.0%
Education/communication	0.0%	×	1.5%	= 0.0%
Others	15.0%	×	2.1%	= 0.3%
All items				2.1%

Where to Find the CPI?

The CPI is published each month by the U. S. Bureau of Labor Statistics. Data are available at the U.S. Bureau of Labor Statistics's website at http://www.bls.gov/cpi/

The Bottom Line

Calculate the inflation rate from the Consumer Price Index. Use the inflation rate to track the change in the cost-of-living and to estimate salary increases you need to stay ahead of higher prices.

9. How Can You Adjust for Inflation?

Consider this example. In the last five years yon observe that average consumer prices have risen 25 percent. Your salary has increased from \$30,000 to \$42,000 during the same time period. This works out to be a 40 percent salary increase. Obviously you're better off because your salary has more than kept pace with inflation.

But what if you want to express your salary *today* in terms of the purchasing power of dollars five years ago? This is the same thing as taking out of your salary increase that part that simply kept pace with inflation. How would you do this?

Think of the answer this way. Since consumer prices have increased 25 percent during the past five years, it now takes \$1.25 to equal what \$1.00 could buy five years ago. Therefore, to see what your income is today in terms of the *purchasing power of dollars five years ago*, simply divide your salary today by 1.25. So, your \$42,000 today translates to \$42,000/1.25, or \$33,600 in terms of the purchasing power of dollars five years ago.

General Formulas

A general formula can be written which will allow you to convert any income, or price, in year **B** to an inflation-adjusted income or price in terms of purchasing power from some previous year A. The formula is:

$$\text{Income or price in a later year B in terms of purchasing power in previous year A} = \frac{\text{Income or price in a } \textit{later year } \text{B}}{1 + \text{total inflation rate from year A to year B in decimal terms}}$$

The total inflation rate between year A and year B is simply the total percentage increase in prices. If inflation is measured by the change in an inflation index (e.g., the Consumer Price Index), then the total inflation rate is just the percentage change in that index. "In decimal terms" means to change the percentage number to a decimal number (e.g., 10% becomes .10). The "1" is added in the denominator of the formula to account for the fact that if there is no inflation, then the purchasing power of dollars is the same in years A and B.

IN TERMS OF YESTERDAY'S DOLLARS

Several examples will now reinforce your understanding of the use of this formula.

EXAMPLE 1-2: In 1995 the Consumer Price Index was 152.4. In 1999 the Consumer Price Index was 166.6. In 1995 John's salary was $25,000; in 1999 it was $30,000. What is John's 1999 salary in terms of 1995 dollars?

ANSWER: The total inflation rate between 1995 and 1999 is calculated as:

$\frac{166.6}{152.4} = 1.09$. This means the total inflation rate is 09 percent. In decimal terms this is a total inflation rate of .09.

Year A is 1995 and Year B is 1999. The calculation is:

$$\frac{\text{Salary in Year B (1999)}}{1+\text{total inflation rate from Year A (1995) to Year B (1999)}} = \frac{\$30{,}000}{(1+.09)} = \$27{,}523$$

$27,523 is John's 1999 salary in 1995 dollars.

EXAMPLE 1-3: In 2002 a new 2000 square foot house in Salt Lake City, Utah cost $250,000. By 2012 the price had risen to $350,000. What is the house's price in 2012 in terms of 2002 dollars if the inflation rate from 2002 to 2012 was 27.6%?

ANSWER: The total inflation rate between 2002 and 2012 was 27.6%, or 0.276 in decimal terms.

The calculation is:

$$\frac{\text{House price in Year B (2012)}}{1+\text{total inflation rate from Year A (2002) to Year B (2012)}} = \frac{\$350{,}000}{(1+0.276)} = \$274{,}295$$

$274,295 is the price of a 2000 square food house in 2012 expressed in 2002 dollars.

IN TERMS OF TODAY'S DOLLARS

What if you want to express a previous year's income or price in terms of *today's dollars*. In this case, multiply the previous year's income or price by 1 plus the total inflation rate that has occurred between the two years. The general formula is:

$$\text{Income or price in previous year A in terms of purchasing power in a later year B.} = \text{Income or price in previous year A} \times \text{1+inflation rate from year A to year B}$$

EXAMPLE 1-4: Go back to EXAMPLE 1-2 and express John's 1995 salary in terms of 1999 dollars.

ANSWER: Salary in 1995 × (1 + total inflation rate from 1995 to 1999) = $25,000 × 1.09 = $27,250.
$27,250 is John's 1995 salary in terms of 1999 dollars.

EXAMPLE 1-5: In 2002 gasoline cost $2.00/gallon. In 2012 the price of gasoline was $3.50/gallon. The total inflation rate between 2002 and 2012 was 27.6%. What is the price of gasoline in 2002 in terms of 2012 dollars?

ANSWER: $2.00 × (1 + 0.276) = $2.55. If the price of gasoline increased at the rate of overall inflation, it would have cost $2.55/gallon in 2012 instead of $3.50/gallon. Gasoline became relatively more expensive between 2002 and 2012.

Why Bother?

Why go through these calculations? The simple answer is that it helps us compare incomes and prices between years without the complication of inflation. The calculations allow us to see if prices or incomes are relatively higher or lower between any two years.

BASE YEAR

Does it matter which year is chosen as the base? No, as long as all calculations are made using that year so that results are consistent.

Expressing incomes and prices in inflation-adjusted dollars has become common practice in news reporting and even in political campaigns. Now you know how to do it and what it means!

The Bottom Line

Adjust incomes and prices for inflation by converting dollar amounts to similar "purchasing power" dollars. Then you can determine how incomes and prices have changed *after inflation*.

10. Why Do Interest Rates Exist?

Suppose a stranger wanted to borrow $1,000 from you for a year. Also suppose that prices of all consumer products are expected to be the same a year from now as today (that is, the inflation rate is 0). Would you charge anything for loaning the money?

Before answering, consider some of the costs to you, the lender. First, there is risk that the borrower may not repay the loan, or may not repay the loan on time. This could cause problems for you if you have plans for the use of the money. Second, there is an *opportunity cost* to you of lending money). If you keep the $1,000, you can use it in some way and derive pleasure from it. For example, $1,000 could be used as the down payment on a car, or could purchase 200 movie tickets. By lending the $1,000 for a year, you are giving up the pleasure you could derive from using the $1,000 during that year. Furthermore, your circumstances could be altered significantly during the year such that the pleasure you derive from $1,000 received a year from now is much less than the pleasure you could derive from using the $1,000 now. For example, the worst possibility is that you could die during the year and never be able to enjoy the use of the $1,000.

OPPORTUNITY COST AGAIN

For these reasons, most people must be *paid* in order to give up the use of their money for a certain period of time.[1] Individuals charge interest as the price for loaning money. Generally, the interest price is expressed as an interest rate charged for every dollar loaned per year. For example, if the interest rate is 4 percent, then the borrower of $1,000 (the 1,000 is called the *principal*) for a year must repay the original $1,000 plus the interest payment of $1,000 × .04, or $40. Or, oftentimes, repayments will be scheduled throughout the year. How these are calculated will be discussed in later chapters.

PRINCIPAL

The interest rate that an individual must be paid to give up use of a dollar today, thereby reducing the pleasure that can be purchased today, is not the same for all individuals. People who have a difficult time postponing pleasure, who have a strong desire for pleasure now as compared to pleasure in the future, will only give up a dollar today if a very high interest rate is paid to them. Such individuals are said to have a *high rate of time preference,* meaning they strongly prefer having pleasure now compared to the future. Children and teenagers typically have a high rate of

RATE OF TIME PREFERENCE

[1]Of course, most lending is not done from individual to individual, but is conducted through a middleman, for example a bank or savings and loan association, The middleman acts as a broker who matches funds from individuals desiring to lend money to individuals desiring to borrow money. In this case the middleman must attract the money which he/she lends by paying interest to depositors. Borrowers are charged an interest cost sufficient to cover the interest paid to depositors and the cost of the middleman's operation.

time preference because they haven't learned to be forward-looking. Also, adults who have limited economic opportunities, who can't see their economic lot improving in the future, have a high rate of time preference. In comparison, individuals who have a lower desire for pleasure now as compared to pleasure in the future are said to have a low rate of time preference. Individuals with higher rates of time preference are more likely to borrow and spend, whereas individuals with low rates of time preference are more likely to save and invest. More will be said about the rate of time preference later.

The interest rate that compensates individuals for the opportunity cost of lending money and for the risk associated with those loans is called the *real interest rate*. The real interest rate can be considered as the price to borrowers of borrowing money and the reward to lenders of loaning money. The level of the real interest rate is determined by the interaction of lenders and borrowers. Historically, the real interest rate for low risk loans has averaged 3 to 5 percent annually. The real interest rate for high risk loans may be as high as 10 to 15 percent annually.

REAL INTEREST RATE

Inflation and Interest Rates

Inflation has an impact on interest rates. As already discussed (see *Does Inflation Doom Us to An Existence of Poverty?*), when inflation occurs the purchasing power of dollars declines. Inflation is of critical concern to lenders. A lender gives up dollars today, but will only be repaid with dollars in the future. Lenders will only make loans, and give up dollars today, if they are promised to be repaid more dollars in the future. But since dollars are only valuable for what they can purchase, what the lender's trade really implies is that a lender will only give up *purchasing power* today if he or she is promised to receive more *purchasing power* in the future. Since inflation decreases the purchasing power of dollars, lenders will take inflation into account in their offer to loan dollars.

To help you understand the relationship between inflation and lending, consider this example:

Suppose ABC Bank is willing to lend money at a 4 percent *real* interest rate. This means that for every $1 ABC Bank loaned for a year, it would receive back $1.04. Or, more specifically, for every $1 of purchasing power that ABC Bank loans for a year, it expects to receive back $1.04 of purchasing power. But what if during the year the inflation rate is 10 percent. Today when ABC Bank loans a $1, its purchasing power is still $1. But in a year, it will take $1.10 to buy what $1 buys today, so the purchasing power of $1 next year is only 91¢ $(\frac{\$1}{1.1})$. Therefore, when ABC Bank receives $1.04 from ils borrower at the end of year, the purchasing power of this payment is only ($\frac{\$1.04}{1.10}$). Clearly, under these conditions ABC loses.

How can lenders protect themselves from this damaging effect of inflation? Quite simply. Lenders merely need to insure that the payments they receive are large enough to counteract the effects of inflation. This can be accomplished by the lender adding the expected average annual inflation rate during the term of the loan to the real interest rate. For example, if the real interest rate is 4 percent and the expected average annual inflation rate is 10 percent, then the *nominal interest rate* that lenders will charge is a combination of 10 percent and 4 percent. The nominal interest rate is the observed interest rate, and is a "combination" of the real interest rate and the expected average annual inflation rate during the loan's term.

NOMINAL INTEREST RATE

We must pause here for a moment for a technical point. You may be tempted to "combine" the real interest rate and expected inflation rate by adding them to get the nominal interest rate. As an approximation, this is OK. Technically, however, it is wrong. If r is the real interest rate and i is the expected inflation rate, then the nominal interest rate is:

$$(1+r)\times(1+i)-1$$

or

$$1+r+i+r \bullet i-1$$

or

$$r+i+r \bullet i.$$

The true nominal interest rate ($r + i + r \bullet i$) is greater than the approximation ($r + i$) by the amount $r \bullet i$. This is a minor point, but it makes a difference in financial calculations. For simplicity though, merely calculate the nominal interest rate as the real interest rate plus the expected inflation rate.

Expected Inflation Rates and Mistakes

EXPECTED INFLATION RATE

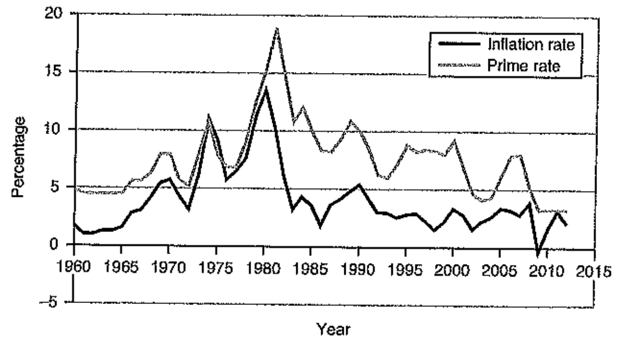
Notice that the inflation rate which lenders add to the real interest rate is the *expected inflation* rate. Loans are made with payments scheduled in the future. As with most economic variables, the inflation rate in the future cannot be predicted exactly. Lenders therefore must guess what the average inflation rate will be during the term of their loan. If it turns out that their guess was too low, then lenders effectively lose money since the purchasing power of loan repayments will be less than expected.

You might think that lenders never underestimate future inflation rates. You're wrong, In the 1970s most lenders didn't anticipate the high inflation rates which would prevail in the late 1970s and early 1980s,

Mortgage lenders, in particular, loaned money at interest rates which turned out to be too low, and they therefore lost money on the loans. This provided a strong motivation for mortgage lenders to move to adjustable rate mortgages, which shift the risk of guessing wrong about inflation to borrower (much more about this later!).

WRONG GUESSES

Figure 1-12. Inflation and interest rates.



Data source: U.S. Bureau of Labor Statistics and Federal Reserve.

Making mistakes about guessing future inflation rates is not something that only lenders, like bankers, have to worry about. You as an individual investor also face the risk of guessing wrong about future inflation. This risk occurs when you purchase an investment which pays a fixed interest rate for a long period of time, like a five year CD or a 30-year bond. If the average inflation rate turns out to be higher than that implicitly assumed in the interest rate of the long term investment, then you effectively lose money.

Interest Rates and Inflation Rates Move Together

Since nominal interest rates incorporate inflation rates, it shouldn't be surprising that nominal interest rates and inflation rates move together (see Figure 1-12). When the inflation rate trends upward, interest rates trend upward, and when the inflation rate trends downward, interest rates trend downward.

Notice from Figure 1-12, however, that the inflation rate usually changes direction before interest rates change direction. This shouldn't be surprising. It takes time for lenders and investors to realize that the direction of the inflation rate has changed. During this "learning period," nominal interest rates will incorporate past inflation rates.

The Bottom Line

The interest rate charged for a loan is compensation to the lender for the opportunity cost related to giving up use of that money *and* for the expected decline in the purchasing power of money due to inflation. Interest rates and the inflation rate move together. Expect interest rates to eventually rise when the inflation rate is on the rise, and look for interest rates to fall when the inflation rate is falling.

11. How Does Money Grow?

When you invest money, whether the investment be in a passbook savings account or bonds or something else, you are, in effect, lending money. For example, if the money is invested in a passbook savings account, those funds are loaned by the bank or savings and loan association to another consumer or to a business. If the money is invested in bonds, the funds are being loaned to a business firm or perhaps a public utility.

In most cases an investment will promise to pay you a specified interest rate each period for a specified number of periods. The period could be a day, month, quarter, or year. Often it will be useful to you to determine how this invested money will grow. The accumulated amount of your investment fund is called the *future value* of the investment.

Calculating the future value of an investment fund depends on whether interest earned from the investment is in turn also invested and earns additional interest. If so, then the future value is formed by *compounding interest*; if not, then the future value is formed by *simple interest*.

Simple Interest

Let's take simple interest first. Let P be the amount invested and let r be the periodic interest rate. Then the interest earned in one period is

$$P \times r,$$

and the accumulated amount (future value) of the investment at the end of one period is

$$P + P \times r.$$

If the investment is held for two periods, then the total interest earned for two periods is

$$P \times r + P \times r, \text{ or } 2 \times P \times r,$$

and the future value of the investment at the end of two periods is

$$P + (2 \times P \times r).$$

In general, the simple interest earned on an investment of P dollars earning a periodic interest rate of r for n periods is

$$n \times (P \times r).$$

Similarly, the future value at the end of n periods is

$$P + (n \times P \times r).$$

EXAMPLE 1-6: John James invests $100 in an investment that pays simple interest of 5 percent per year. How much interest will John earn at the end of the year and what will be the future value of his investment?

ANSWER: Here P is $100, r is 5 percent, and n is 1.

$$\text{Interest earned} = \$100 \times .05 = \$5$$
$$\text{Future value} = \$100 + \$5 = \$105.$$

EXAMPLE 1-7: Alternatively, John James has the opportunity of investing his $100 in an investment that pays simple interest of 2 percent per *month*. How much interest will John earn at the end of *three* months and what will be the future value of his investment at that point?

ANSWER: Here P is $100, r is 2 percent, and n is 3.

$$\text{Interest earned} = 3 \times (\$100 \times .02)$$
$$= 3 \times (\$2) = \$6$$
$$\text{Future value} = \$100 + \$6 = \$106.$$

The Wonderful World of Compound Interest

Figuring interest earnings and future value using compound interest is only slightly more complicated. Compound interest assumes that interest earnings are automatically reinvested at the same interest rate as is paid on the original invested amount.

To see how compound interest works, again consider an investment of P dollars in an investment paying a periodic interest rate of r. At the end of the first period the amount of interest earned is

$$P \times r,$$

and the future value of the investment is

$$P + (P \times r).$$

Notice that, algebraically, the future value amount can be rewritten as:

$$P + (P \times r) = P \times (1 + r).$$

In the second period the full amount of $P \times (1 + r)$ is invested at the interest rate r. The amount of interest earned in the second period is

$$[P \times (1 + r)] \times r,$$

and the future value of the investment at the end of the second period is

$$[P \times (1 + r)] + [P(1 + r)] \times r.$$

In simplifying this expression, notice that $P \times (1 + r)$ can be "factored out" of both terms. This gives:

$$[P \times (1 + r)] + [P \times (1 + r)] \times r = P \times (1 + r) \times (1 + r).$$

Another way of interpreting (and understanding) the result P × (1 + r) × (1 + r) is the following. P is the original amount invested. At the end of the first period the amount P is still in the investment, hence P is multiplied by 1. But also, interest is earned on P which equals P × r, hence P is also multiplied by r. Therefore, the investment accumulation, or future value, at the end of the first period is P × (1 + r). The amount P × (1 + r) now becomes the investment amount at the start of the second period. This amount is still in the investment at the end of the second period, hence

P × (1 + r) is multiplied by 1. Also, interest is earned on P × (1 + r), hence P × (1 + r) is also multiplied by r. Therefore, the future value at the end of the second period is P × (1 + r) × (1 + r).

By the same reasoning, the future value of the investment at the end of the third period is

$$P\times(1+r)\times(1+r)\times(1+r).$$

FUTURE VALUE FORMULA

It should be evident that a general pattern has been formed. In general, the future value of an original investment of P dollars earning a compound interest rate of r per period for n periods is P multiplied by (1 + r) n times, or

$$P\times(1+r)^n,$$

where n, the number of periods that the investment is kept, is a "power function" and indicates the number of times that (1 + r) is used as a multiplier. For example, $P \times (1 + r)^2$ equals P × (1 + r) × (1 + r), and $P \times (1 + r)^4$ equals P × (1 + r) × (1 + r) × (1 + r) × (1 + r). It is important to remember that the "period" of r and of n must be the same. For example, if n is years then r must be the yearly interest rate. If n is months then r must be the monthly interest rate. Also, r is in "decimal form" (e.g., 5 percent is .05).

The interest earned on an investment of P dollars earning a compound interest rate of r per period for n periods is simply

$$P\times(1+r)^n-P.$$

EXAMPLE 1-8: John James invests $100 in an investment paying 6 percent per year compounded annually. What is the future value of the investment and the interest earned after three years?

ANSWER: Here P is $100, r is 6 percent, and n is 3.

Future value = $\$100 \times (1 + .06)^3$

$= \$100 \times 1.06^3 = \$100 \times 1.06 \times 1.06 \times 1.06 = \$119.10$

Interest earned = $119.10 – $100 = $19.10

EXAMPLE 1-9: Judy Davis invests $100 in an investment paying 6 percent annual interest rate compounded monthly (twelve times yearly). What is the future value of the investment after three years?

ANSWER: The period here is in months, so the interest rate must be a monthly rate. An interest rate of 6 percent annually is equivalent to an interest rate of 6/12 or .5 percent monthly. Also three years is equivalent to 36 monthly periods. Therefore, r equals .5 percent, or .005, and n equals 36 in this example.

$$\text{Future value} = 100\times(1+.005)^{36}$$

$$\text{Future value} = \$100\times(1.005)^{36} = \$119.67.$$

FUTURE VALUE TABLES

Future values using compound interest can be calculated as in the above examples. One can use either a calculator with a "power function" or future value tables. A future value table gives values for $(1 + r)^n$ for given values of r and n. The values are termed *future value factors.* Three future value tables are in the Appendix. Appendix Table A-1 gives annual future value factors, that is, n is years and annual compounding is used. Appendix Table A-2 gives monthly future value factors, that is, n is months and monthly compounding is used. (Don't be confused by the fact that the interest rates in Appendix Table A-2 are stated as annual rates. The calculations did convert the annual rates to monthly rates.) Appendix Table A-3 gives sums of monthly future value factors assuming each investment is made at the end of the month (more on this later).

Given values for r and n, the future value of an initial investment of P dollars is found by:

$$\text{Future value} = P\times(\text{future value factor corresponding to r, interest rate, and n, periods}).$$

Similarly, the interest earned is found by:

$$\text{Interest earned} = P\times(\text{future value factor corresponding to r, interest rate, and n, periods}) - P.$$

The following examples show you how to use the future value tables.

EXAMPLE 1-10: You invest $1,000 today in an investment that pays an annual interest rate of 12 percent compounded annually. How much will you have accumulated at the end of three years?

ANSWER: Future value = $1,000 × (future value factor for 12% annual rate and 3 years).

Look in Appendix Table A-1. Find the column headed by 12 (%) and the row headed by 3 (years). The entry is 1.405. This is the future value factor. Therefore, the future value is:

$$\$1,000 \times 1.405 = \$1,405.$$

EXAMPLE 1-11: Yon invest $1,000 today in an investment that pays an annual interest rate of 12 percent compounded monthly. How much will you have accumulated at the end of three years?

ANSWER: Future value = $1,000 × [future value factor for 12% annual rate and 36 months (3 years × 12 months per year)]

Look in Appendix Table A-2. Find the column headed by the annual interest rate of 12 (%) and the row headed by 36 (months). The entry is 1.431. Therefore, the future value is:

$$\$1,000 \times 1.431 = \$1,431.$$

MANY EQUAL INVESTMENTS

The above examples have assumed a single investment of money at the beginning of an investment term. What happens if a number of investments of the same amount are made over an extended period? To see how to work such problems, consider the following examples.

EXAMPLE 1-12: Doris Donaldson plans to invest $200 at the *beginning* of each year in an investment paying an annual interest rate of 8 percent compounded annually. She plans to do this for six years. How much will she have accumulated at the end of six years?

This can be worked as six separate problems, that is, $200 invested for six years at 8 percent, $200 invested for five years at 8 percent, $200 invested for four years at 8 percent, $200 invested for three years at 8 percent, $200 invested for two years at 8 percent, and $200 invested for one year at 8 percent. The total accumulation could be calculated by:

$$\begin{aligned}
&\$200 \times (\text{future value factor for 8\% and 6 yrs.})\\
&+\$200 \times (\text{future value factor for 8\% and 5 yrs.})\\
&+\$200 \times (\text{future value factor for 8\% and 4 yrs.})\\
&+\$200 \times (\text{future value factor for 8\% and 3 yrs.})\\
&+\$200 \times (\text{future value factor for 8\% and 2 yrs.})\\
&+\$200 \times (\text{future value factor for 8\% and 1 yr.})
\end{aligned}$$

OR, using Appendix Table A-1,

$$\begin{aligned}
\$200 \times (1,587) &= \$317.40\\
+\$200 \times (1.469) &= 293.80\\
+\$200 \times (1.360) &= 272.00\\
+\$200 \times (1.260) &= 252.00\\
+\$200 \times (1.166) &= 233.20\\
+\$200 \times (1.080) &= \underline{216.00}\\
&\ \$1,584.40
\end{aligned}$$

Alternatively; the future value factors can first be *summed* and then multiplied by the equal periodic investment:

$$\$200 \times (1.587 + 1.469 + 1.360 + 1.260 + 1.166 + 1.080) =$$
$$\$200 \times 7.922 = \$1,584.40$$

This shortcut can only be taken when the periodic investments are the same in dollar amount.

If Doris invested the $200 at the *end* of each of the six years, then the first $200 would be invested for five years, the second $200 would be invested for four years, the third $200 would be invested for three years, the fourth $200 would be invested for two years, the fifth $200 would be invested for one year, and the last $200 would be added at the end of the six year so no interest would be earned. Using Appendix Table A-1, the calculations are:

$$\begin{aligned}
&\$200 \times 1.469\ (\text{FVF for 8\% and 5 yrs.}) &&= \$293.80\\
&+\$200 \times 1.360\ (\text{FW for 8\% and 4 yrs.}) &&= 272.00\\
&+\$200 \times 1.260\ (\text{FVF for 8\% and 3 yrs.}) &&= 252.00\\
&+\$200 \times 1.166\ (\text{FVF for 8\% and 2 yrs.}) &&= 233.20\\
&+\$200 \times 1.080\ (\text{FVF for 8\% and 1 yr.}) &&= 216.00\\
&+\$200 \times 1.000 &&= \underline{200.00}\\
& && \ \$1,467.00
\end{aligned}$$

Or, summing the future value factors first, $200 × (1.469 + 1.360 + 1.260 + 1.166 + 1.080 + 1.000) = $200 × 7.335 = $1,467.00. The future value ($1,467.00) with end of the year investing is understandably less than the future value ($1,584.40) with beginning of the year investing.

The next example looks at monthly investing.

EXAMPLE 1-13: Stan Simons plans to invest $100 at the end of each month in an investment paying an annual interest rate of 7 percent compounded monthly. Stan plans to do this for ten years. How much will he have accumulated at the end of the ten years?

You certainly want to use a shortcut with this problem since you don't want to do 120 (12 months × 10 years) multiplications or even 120 additions. One can either use a future value factor sum formula or use a table of future value factor sums such as Appendix Table A-3. Appendix Table A-3 *gives monthly future value factor sums* assuming *end* of the month investing. To solve the problem, find the 7 percent column and 120 month row in Appendix Table A-3 and read the future value factor sum (173.085). The accumulation at the end of ten years is thus:

MONTHLY FUTURE VALUE FACTOR SUMS

$$\$100 \times 173.085 = \$17,309$$

How would beginning of the month investing change this result? Figure 1-13 gives the answer. The left side of Figure 1-13 shows investing $200 at the end of each of twelve months at an annual interest rate of 7 percent. The right side of Figure 1-13 shows investing $200 at the beginning of each of twelve months at an annual interest rate of 7 percent. The calculations differ in two ways. The future value factor sum for "beginning of month" investing includes the future value factor for the number of months in the investment term (here 1.072, the FVF for 7% and 12 months). In contrast, the future value factor sum for "end of month" investing includes 1.000, which means the final month's investment earns no interest. Therefore, to convert the future value factor sum for "end of month" investing to the future value factor sum for "beginning of month" investing, perform this operation:

FVFS for beginning of month investing	=	FVFS for end of month investing (Appendix TableA-3)	+	FVF for last month in investment term (Appendix Table A-2) − 1.000

EXAMPLE 1-14: Re-do Stan Simons' investment plan from EXAMPLE 1-13 assuming Stan invests at the *beginning* of each month.

ANSWER: FVFS (7%, 120 mos.) from Appendix Table A-3 = 173.085.
FVFS (7%, month 120) from Appendix Table A-2 = 2.010.
FVFS for beginning of month investing = 173.085 + 2.010 − 1.000 = 174.095
Future value = $100 × 174.095 = $17,409.50.

If a problem does not state whether "end of month" or "beginning of month" investing is done, it is assumed that "end of month" investing is done.

Figure 1-13. End of the month investing vs. beginning of the month investing ($200 per month—annual interest rate, 7%).

Month		End of Month		Beginning of Month
1	Begin		Begin	$200 × 1.072 (FVF, 7%, 12mos.)
	End	$200 ×1.066 (FVF, 7%m 11mos.)	End	
2	Begin		Begin	$200 × 1.066 (FVF, 7%, 11mos.)
	End	$200 ×1.060 (FVF, 7%, 10mos.)	End	
3	Begin		Begin	$200 × 1.060 (FVF, 7%, 10mos.)
	End	$200 ×1.054 (FVF, 7%, 9mos.)	End	
4	Begin		Begin	$200 × 1.054 (FVF, 7%, 9mos.)
	End	$200 ×1.048 (FVF, 7%, 8mos.)	End	
5	Begin		Begin	$200 × 1.048 (FVF, 7%, 8mos.)
	End	$200 ×1.042 (FVF, 7%, 7mos.)	End	
6	Begin		Begin	$200 × 1.042 (FVF, 7%, 7mos.)
	End	$200 ×1.036 (FVF, 7%, 6mos.)	End	
7	Begin		Begin	$200 × 1.036 (FVF, 7%, 6mos.)
	End	$200 ×1.030 (FVF, 7%, 5mos.)	End	
8	Begin		Begin	$200 × 1.030 (FVF, 7%, 5mos.)
	End	$200 ×1.024 (FVF, 7%, 4mos.)	End	
9	Begin		Begin	$200 × 1.024 (FVF, 7%, 4mos.)
	End	$200 ×1.012 (FVF, 7%, 3mos.)	End	
10	Begin		Begin	$200 × 1.018 (FVF, 7%, 3mos.)
	End	$200 ×1.006 (FVF, 7%, 2mos.)	End	
11	Begin		Begin	$200 × 1.012 (FVF, 7%, 2mos.)
	End	$200 ×1.006 (FVF, 7%, 1mos.)	End	
12	Begin		Begin	$200 × 1.006 (FVF, 7%, 1mos.)
	End	$200 ×1.000	End	
		Future value = $200 × (1.066 + 1.060 +1.054 + 1.048 + 1.042 + 1.036 + 1.030 + 1.024 + 1.018 + 1.012 + 1.006 + 1.000) = $200 × 12.396* = $2,479.20.		Future value = $200 × (1.072 + 1.066 + 1.060 + 1.054 + 1.048 + 1.042 + 1.036 + 1.030 + 1.024 + 1.018 + 1.012 + 1.006) = $200 × 12.468* = $2,493.60

*Differs from number in Appendix Table A-3 (12.393 - FVFS, 7%, 12 mos.) due to rounding.

FUTURE VALUE FACTOR SUM FORMULAS

Instead of using the tables, one can also apply the future value factor sum (FVFS) formulas. For beginning of the month (BOM), future value factor sum is

$$FVFS=(1+r)^n+(1+r)^{n-1}+...+(1+r)^1=\frac{(1+r)^{n+1}-1}{r}-1$$

For end of the month (EOM), future value factor sum is

$$FVFS=(1+r)^{n-1}+(1+r)^{n-2}...+(1+r)^0=\frac{(1+r)^n-1}{r}$$

For monthly compounding, r is the monthly interest rate and n is the number of months. For annual compounding, r is the annual interest rate and n is the number of years.

The Bottom Line

The future value of an investment is the amount to which the investment will grow after a certain period of time. Compound interest (paying interest on interest) pays you more than simple interest. Use future value tables or a calculator with a "power" function to find the future value of an investment when compounding is used.

12. Back to the Present: What's a Future Dollar Worth?

If you could read only one topic in this book, this would be the one. (That statement should grab your attention!) The technique of converting future dollars to their current (or present) value is a technique that will be used in all consumer financial decisions. In fact, a thorough understanding of this technique is necessary in order to successfully make any consumer decision that involves spending or receiving money over a period of time.

A DOLLAR IS NOT A DOLLAR IN TIME

A dollar today is worth more than a dollar tomorrow, for two reasons. First, the present is known and certain whereas the future is unknown and uncertain. Therefore, most consumers would rather have a dollar today than delay having it until the future. Furthermore, a dollar today can he used and pleasure purchased with it, whereas the use and pleasure derived from a dollar received in the future is delayed. Second, if inflation occurs between now and the future, the purchasing power of future dollars declines. Therefore, a dollar today is equal to a dollar of purchasing power, but a dollar in the future is equal to less than a dollar of purchasing power. For these two reasons, dollars paid and received at different points in time cannot be considered to be equal.

To reinforce this idea of the changing value of a dollar, consider these practical questions. An IRA (Individual Retirement Account) investment will accumulate for you $1,000,000 at the end of 30 years. Does that mean that you will be a millionaire in today's sense of the term? Or, an insurance policy promises you an endowment (payment) of $50,000 at the end of 20 years. Is that good? What will $50,000 buy then? Consumers have trouble making these comparisons because perceptions about the worth of a dollar are based on current prices, but prices and the value of a dollar will be different in the future.

PRESENT VALUE

DISCOUNTING

Bringing the future value of a dollar back to the present is called finding the present value of a future dollar or sum of money. Finding the *present value* of a sum of money at some future date answers the following question: What amount of money, if invested today until that future date, will yield that future sum of money? The answer is the present value of that future sum of money. Finding the present value of a future amount of money is called *discounting* that future amount. The present value of a future amount of money is the real value of the future amount of money after taking into account expected inflation *and* consumers' preferences for having money today rather than tomorrow. Finding the present value of, or discounting, a future amount of money means finding its value in today's terms.

For example, if the annual interest rate is 7 percent, then the present value of $1,000 received in 10 years is $508.39. Why? Because if $508.39 is invested and earns an annual interest rate of 7 percent compounded annually for 10 years, then its future value is $508.39 × 1.967 (future value factor, 7%, 10 yrs., Appendix Table A-1). If the 7 percent interest rate compensates you both for the opportunity cost of not having $508.39 to use today and for expected inflation, then you would consider having $508.39 today or $1,000 in ten years to be the same.

The Discount Rate

DISCOUNT RATE

The interest rate used in finding the present value of a future sum of money is called the *discount rate*. The discount rate is the rate at which future dollars are traded for present dollars. The higher the discount rate, the less valuable are future dollars compared to present (or current) dollars and the more future dollars are needed to equal one present dollar. Table 1-7 illustrates how the size of the discount rate affects the present value.

Since the discount rate is an interest rate, it is composed of two parts, a real interest rate component and a component for the expected annual inflation rate. As already discussed, the expected annual inflation rate component compensates for the reduced purchasing power of future dollars due to inflation.

The real interest rate component deserves careful discussion. The real interest rate component of the discount rate shows how the consumer,

Table 1-7 Discount rates and present values.

Future value of $1,000 in 5 years.	
If discount rate is:	Present value is:
5%	$784
8%	681
10%	621
15%	497
20%	402

in the absence of inflation, would be willing to trade-off future dollars for present dollars. To emphasize, even if inflation is zero, most of us would rather have dollars now than in the future (if you didn't want to use the dollars, you could always save and invest them). Each consumer's willingness to trade-off the present for the future can be very personalized. As already mentioned, economists give the real rate component of the discount rate, which measures how the consumer values the present compared to the future, a special name, the consumer's *rate of time preference*.

RATE OF TIME PREFERENCE AGAIN

At this point you might he thinking, "This is a bunch of semantics—what practical difference does it make?" Your rate of time preference is important and can explain some important behavior. For example, suppose Joe has a higher rate of time preference than Sally. Both Joe and Sally prefer dollars now to dollars later, but Joe puts a higher value on having dollars now than does Sally. For any given expected inflation rate, Joe's discount rate is higher than Sally's, and the present value of any given future money amount will be lower for Joe than for Sally.

Consumers who have high rates of time preference (who strongly favor the present over the future) are less likely to save and invest and more likely to borrow. In contrast, consumers who have low rates of time preference are more likely to save and invest and less likely to borrow. Table 1-8 gives an example of this for Joe and Sally. Joe's rate of time preference is three times as high as Sally's, and Joe's discount rate is 14 percent compared to Sally's 8 percent rate. Joe and Sally can both borrow money and pay 12 percent interest. Joe's high discount rate makes borrowing advantageous for him, but Sally is better off not borrowing.

TEENS VS. ADULTS

With the rate of time preference concept under your belt, you can now better understand the saving and borrowing behavior of specific consumer groups, For example, teenagers tend to value the present

Table 1-8 Effects of differences in rates of time preference: An example of Joe and Sally.

	Joe	Sally
Rate of time preference	9%	3%
Expected annual inflation rate	5%	5%
Discount rate	14%	8%

Joe and Sally can both borrow $1 today and pay back $1.12 in one year (12% interest).

Joe values $1 today at $1, and values $1.12 next year at $\$1.12\times\frac{1}{1.14}=98¢$.

Joe will borrow values $1.12 next year at

$\$1.12\times\frac{1}{1.08}=\$1.04$. Sally will not borrow.

relative to the future more than do adults, implying that teenagers have high rates of time preference and high discount rates. This may help explain why teenagers are more likely to borrow and less likely to save than adults.

POOR VS. NON-POOR

Due to the uncertainty of their future income and economic situation, it's also thought that the poor have a higher rate of time preference and a higher discount rate than the non-poor. This may help account for the observation that the poor are more willing to borrow at higher interest rates than the non-poor.[2]

What Discount Rate Should You Use?

Selecting a discount rate in the analysis of consumer decisions is important because, as you've seen, the discount rate can significantly affect the present value result. Higher discount rates will favor options which have paybacks weighted to the present versus the future, whereas lower discount rates will favor options with paybacks weighted more to the future.

A standard discount rate used in consumer decision-making is the *interest rate earned on risk-free or low-risk investments*. Examples would be the interest rate earned on U.S. Treasury securities or on an insured CD. This will be the kind of discount rate used in this book.

[2]Andreasen, Alan. *The Disadvantaged Consumer*, The Free Press, 1975, p. 204.

CONSUMER TOPIC

JUNIOR GOES HOME AND TAKES A PAY CUT

The baseball world was shocked and Cincinnati Reds' fans elated when superstar Ken Griffey, Jr. was traded from the Seattle Mariners to the Reds in early 2000. Griffey—nicknamed Junior—has been considered to be one of the best all-around players in the game. He signed a nine year 116.5 million dollar contract with the Reds.

Junior's salary, at $12.9 million ($116.5/9) annually, is comparable to the pay of other big league superstars. But is it really? Half of his $116.5 million total salary is deferred until after 2009. So although Junior is paid, on paper, $116.5 million for nine years of play with the Reds, he doesn't receive all that cash in nine years.

In fact, when the delayed payment of half of Junior's contract is taken into account, the present-value of his salary is calculated at between $9.2 million and $9.3 million per year. Considering that baseball experts estimate Junior could have gotten almost $20 million a year from other teams, he indeed did take a pay cut to play with his hometown team.

Source: Blum, Ronald, "Griffey Contract Slum Baseball," *The Cincinnati Enquirer*, February 12, 2000, www.enquirer.com.

However, you should recognize that if the individual for whom a particular analysis is being done has a very high rate of time preference, then a higher discount rate should be used. Also, if the analysis being done includes very risky outcomes, a high discount rate should be used.

Calculating Present Values

PRESENT VALUE FORMULA

Finding the present value, or discounting, is actually the reverse of calculating the future value. Recall that the formula for finding the future value of an amount of money invested today (P) at compound interest rate r for n periods is:

$$\text{Future value} = P \times (1+r)^n$$

The amount invested today, P, can be considered as the present value. Therefore, this formula can be rewritten as:

$$\text{Future value} = \text{Present value} \times (1+r)^n$$

To solve for the present value, merely perform a simple set of divisions to give:

$$\text{Present value} = \text{future value} \times \frac{1}{(1+r)^n}$$

PRESENT VALUE FACTOR

The term $\frac{1}{(1+r)^n}$ is called the *present value factor* or *discount factor*.

EXAMPLE 1-15: What is the present value of $50,000 to be received in ten years if the discount rate is 12 percent?

$$\begin{aligned}\text{Present value} &= \$50,000 \times \frac{1}{(1+.12)^{10}}\\ &= \$50,000 \times \frac{1}{3.1058}\\ &= \$50,000 \times 3.220\\ &= 16,100.\end{aligned}$$

How should the answer of $16,100 be interpreted? First, $16,100 is the amount which, if invested today for ten years in an investment paying a 12 percent compound annual interest rate, will grow to the amount of $50,000. Also, $16,100 is the purchasing power of $50,000 received in ten years when it takes $1.12 next year to equal $1.00 today.

PRESENT VALUE FACTOR TABLES

The calculation of present value (or discount) factors can be difficult and tedious, especially if a hand calculator with a power function is not available. Fortunately again, tables are available which contain present value factors for given values of r and n. Two such tables are given in the Appendix. Appendix Table A-4 gives present value factors for annual compounding, where n is in years. Appendix Table A-5 gives present value factors for monthly compounding where n is in months. The present value formula for use with Appendix Tables A-4 and A-5 is:

$$\text{Present value} = \text{future value} \times (\text{present value factor for interest rate r and period n}).$$

EXAMPLE 1-16: What is the present value of $50,000 to be received in ten years if the discount rate is 12 percent, using annual compounding.

$$\begin{aligned}\text{Present value} &= \$50,000 \times (\text{present value factor for interest rate}\\ &\quad \text{of 12 percent and 10 years from Appendix}\\ &\quad \text{Table A}-4)\\ &= \$50,000 \times .322\\ &= \$16,100.\end{aligned}$$

EXAMPLE 1-17: What is the present value of $1,000,000 to be received in thirty years if the discount rate is 8 percent, compounded annually?

Present value = \$1,000,000 × (present value factor for interest rate of 8 percent and 30 years from Appendix Table A-4)
= \$1,000,000 × .099
= \$99,000.

EXAMPLE 1-18: What is the present value of \$100,000 paid in two years if the discount rate is 10 percent compounded monthly?

Present value = \$100,000 × (present value factor for interest rate of 10 percent and 24 months from Appendix Table A-5)
= \$100,000 × .819
= \$81,900.

How would you find the present value of a number of payments of equal amount over some time period? You encountered a similar question with calculating a future value. One way is to find the present value of each payment individually and then add them. A shortcut is to first add the present value factors to form a present value factor sum, and then multiply the present value factor sum by the periodic payment. However, this shortcut can be done only when the periodic amounts are equal.

EXAMPLE 1-19: What is the present value of ten annual payments of \$2,000 each. Each payment is made at the end of the year. Use a discount rate of 8 percent compounded annually.

ANSWER:

\$2,000 × (sum of present value factors for 7 percent and years 1 to 10, from Appendix Table A-4).
= \$2,000 × (0.935 + 0.873 + 0.816 + 0.763 + 0.713 + 0.666 + 0.623 + 0.582 + 0.544 + 0.508
= \$2,000 × 7.023
= \$14,046.

EXAMPLE 1-20: You make twelve monthly auto loan payments of \$1.00 each. Each payment is made at the end of the month. What's the present value of all twelve payments using a discount rate of 18 percent compounded monthly?

ANSWER:

\$100 × (sum of present value factors for 18 percent and months 1 to 12, from Appendix Table A-5.
\$100 × (0.985 + 0.971 + 0.956 + 0.942 + 0.928 + 0.915 + 0.901 + 0.888 + 0.875 + 0.862 + 0.849 + 0.836)
= \$100 × 10.899
= \$1,089.90.

The above examples have all assumed payments were made at the *end* of each month or year. What happens if they're made at the beginning of a period? In this case the first payment is not discounted because it occurs now (it's present value factor is 1.000). So discounting occurs with the second payment, meaning the second payment is discounted using the present value factor associated with one period (one month or one year). Likewise, the third payment is discounted using the present value factor associated with the second period. EXAMPLE 1-21 illustrates this.

EXAMPLE 1-21: What is the present value of the twelve monthly \$100 auto loan payments (from EXAMPLE 1-20) if the payments are made at the beginning of each month?

ANSWER:

Month		
1	Begin	\$100 × 1.000 (since payment occurs now) = \$100.00
	End	
2	Begin	\$100 × .985 (PVF,18%,1 mo. from now) = \$98.50
	End	
3	Begin	\$100 × .971 (PVF,18%, 2 mos. from now) = \$97.10
	End	
4	Begin	\$100 × .956 (PVF,18%, 3 mos. from now) = \$95.60
	End	

5 Begin $100 × .942 (PVF,18%, 4 mos. from now) = $94.20
End

6 Begin $100 × .928 (PVF,18%, 5 mos. from now) = $92.80
End

7 Begin $100 × .915 (PVF,18%, 6 mos. from now) = $91.50
End

8 Begin $100 × .901 (PVF,18%, 7 mos. from now) = $90.10
End

9 Begin $100 × .888 (PVF,18%, 8 mos. from now) = $88.80
End

10 Begin $100 × .875 (PVF,18%, 9 mos. from now) = $87.50
End

11 Begin $100 × .862 (PVF,18%, 10 mos. from now) = $86.20
End

12 Begin $100 × .849 (PVF,18%, 11 mos. from now) = $84.90
End

PRESENT VALUE = $1,107.20

Notice that the first month's $100 has a present value of $100 since it occurs now. The second month's $100 is multiplied by the present value factor for month 1 since that payment occurs one month from now. The third month's $100 is multiplied by the present value factor for month 2 since that payment occurs two months from now, etc.

The next example shows what to do when the present value of a large number of future payments is to be calculated.

EXAMPLE 1-22: Tom's monthly mortgage payment for principal and interest is $600. Tom will make 360 monthly payments. Each payment is made at the end of the month. What is the present value of these payments using a discount rate of 10 percent compounded monthly?

ANSWER: To answer this question, you could first add 360 monthly present value factors, then multiply the sum by $600. This is obviously a lot of work to do!

PRESENT VALUE FACTOR SUM TABLE

To shorten your work, *Appendix Table A-6* gives monthly present value factor *sums* for alternative combinations of interest rates and terms, assuming payments are made at the end of each month. Appendix Table A-6

shows that for an annual interest rate of 10 percent and a term of 360 months, the present value factor sum is 113.951. The present value of the 360 monthly payments of $600 each is thus:

$600 × 113.951 = $68,370.60.

Do you think the $68,370.60 is related in any way to the loan amount which Tom borrowed? You'll discover the answer later.

One last point must be addressed which parallels our discussion of future value factor sums. Appendix Table A-6 has monthly present value factor sums assuming payments are made at *the* end of each month. Although end of the month payments are most common, what if payments are made at the *beginning* of each month? Two adjustments must be made to the present value factor sum from Appendix Table A-6. First, add 1.000 because the present value of the first payment is its current value. Second, subtract the present value factor for the last month of the term (from Appendix Table A-5) because the final payment occurs at the beginning of the last month rather than at the end. Thus, the calculation is:

PVFS for beginning of month payments	PVFS for end of month payments (Appendix Table A-6)	+1.000 –	PVF for last month in payment term (from Appendix Table A-5)

EXAMPLE 1-22: Redo the present value of Tom's monthly mortgage payments in EXAMPLE 1-22 assuming payments are made at the beginning of each month.

ANSWER: FVFS for beginning = 113,951 + 1.000 – PVF (10%, of month payments month 360) from Appendix Table A-5

= 113.951 + 1.000 – 0.050

= 114.901

Present value = $600 × 114,901

= $68,940.60

PRESENT VALUE FACTOR SUM FORMULAS

Instead of using the tables, one can also apply the present value factor sum (PVFS) formulas. For beginning of the month (BOM), present value factor sum is

$$\text{PVFS}=\frac{1}{(1+r)^0}+\frac{1}{(1+r)^1}+\ldots+\frac{1}{(1+r)^{n-1}}=1+\frac{1-\frac{1}{(1+r)^{n-1}}}{r}$$

For end of the month (EOM), present value factor sum is

$$\text{PVFS}=\frac{1}{(1+r)^1}+\ldots+\frac{1}{(1+r)^n}=\frac{1-\frac{1}{(1+r)^n}}{r}$$

For monthly compounding, r is the monthly interest rate and n is the number of months. For annual compounding, r is the annual interest rate and n is the number of years.

The Bottom Line

The purchasing power of dollars paid or received at different points in time is not the same. Dollars paid or received in the future are worth less than dollars paid or received today Taking the present value of future dollars (also called discounting) is a way to adjust the value of those dollars to make their purchasing power equivalent to current dollars. In this way the value of dollars paid or received at different points in time can be compared.

13. How Do You Calculate an Average—The Economic Way?

Consider this situation. You've built up a nest egg of $100,000 which you plan to spend over 10 years. How much can you spend each year?

You might be tempted to say the answer is $10,000, since $100,000/10 is $10,000 for each of the ten years. But this is wrong. You'll actually be able to spend more than $10,000 a year. Why?

You've probably guessed the answer. It's because the $100,000 can be invested to earn interest, and the interest earnings will add to what you can spend each year. So when considering money over time, the "economic average" will produce a periodic amount greater than the normal arithmetic average. There's a name (of course) for this economic average. It's called an *annuity*.

Calculating the Annuity

ANNUITY

The equal periodic (e.g., monthly or annual) payment which a sum of money will produce for a specific number of years, when invested at a given interest rate, is called the *annuity*. In deriving a way to calculate

CONSUMER TOPIC

EQUAL PAYMENT PLANS

Equal payment plans (EPP) are frequently offered by energy companies as a way to ease the burden of fuel payments. The EPP works like this. The energy company estimates your bill for the coming year, perhaps by increasing last year's bill by some inflation rate. The estimated annual bill is divided by twelve. This payment becomes your equal monthly payment. You pay it instead of paying your actual bill (based on your actual energy consumption) each month. An important feature of the EPP is that the first EPP payment begins in the summer, typically in July.

Is the EPP a good deal for the consumer? To answer this, look at the example below for a consumer's natural gas bill. This consumer uses natural gas for heating hot water and for heating the home in the winter. Consequently, natural gas consumption is much greater in the winter than in the summer. If the consumer's monthly bill is based on actual consumption, then the monthly bill is much lower in the summer months than in the winter months. If the consumer uses the EPP, the monthly bill is $72.50 each month.

Which payment plan is cheaper? To find out, simply calculate the present value of each payment stream. In the example, an 8 percent annual discount rate is used, and monthly present value factors are taken from Appendix Table A-5.

As the calculations show, the EPP is actually slightly more expensive. The reason is simple. With the EPP, the consumer is pre-paying some of his more costly winter bills in the summer and fall months. Hence, the consumer is losing the opportunity of investing these prepayments and earning interest So the fuel company isn't giving consumers any favors.

The fuel company has an incentive to begin EPPs in an "off-season" month when energy consumption is lowest In the South, where summer energy bills for air conditioning are often higher than winter electricity bills, an EPP for electricity would more likely start in the autumn or winter.

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Payment based on actual consumption	$30	$30	$40	$50	$120	$130	$150	$140	$70	$50	$30	$30
EPP	$72½	$72½	$72½	$72½	$72½	$72½	$72½	$72½	$72½	$72½	$72½	$72½

Present value of payment bated on actual consumption (8% discount rate) = $ 30 × 0.993 + $ 30 × 0.987 + $ 40 × 0.980 + $ 50 × 0.974
+ $120 × 0.967 + $130 × 0.961 + $150 × 0.955 + $140 × 0.948
+ $ 70 × 0.942 + $ 50 × 0.936 + $ 30 × 0.930 + $ 30 × 0.923
= $832.57.

Present value of EPP = $72.50 × 0.993 + $72.50 × 0.987 + $72.50 × 0.980
+ $72.50 × 0.974 + $72.50 × 0.967 + $72.50 × 0.961
+ $72.50 × 0.955 + $72.50 × 0.948 + $72.50 × 0.942
+ $72.50 × 0.936 + $73.50 × 0.930 + $72.50 × 0.923
= $833.46.

the annuity, it's actually best to think of it in reverse. The string of annuity payments, when discounted by the interest rate earned by the original sum of money, will equal that original sum of money. For example, if $100,000 can be invested to earn 8 percent interest, then the annuity payment for 10 years is $14,905.35, where each payment is received at the end of each year. This means that the present value of 10 annual payments of $14,905.35, when discounted by an 8 percent annual interest rate, equals $100,000. To see this, go through the following calculations, using the present value factors from Appendix Table A-4.

$$\$14{,}905.35 \times 0.926 + \$14{,}905.35 \times 0.857 + \$14{,}905.35 \times 0.794 + \$14{,}905.35 \times 0.735 + \$14{,}905.35 \times 0.681 + \$14{,}905.35 \times 0.630 + \$14{,}905.35 \times 0.583 + \$14{,}905.35 \times 0.540 + \$14{,}905.35 \times 0.500 + \$14{,}905.35 \times 0.463,$$

which equals:

$$\$13{,}802.35 + \$12{,}773.89 + \$11{,}834.85 + \$10{,}955.43 + \$10{,}150.54 + \$9{,}390.37 + \$8{,}689.82 + \$8{,}048.89 + \$7{,}452.68 + \$6{,}901.18 = \$100{,}000.$$

Or, use the short-cut method:

$$\$14{,}905.35 \times (0.926 + 0.857 + 0.794 + 0.735 + 0.681 + 0.630 + 0.583 + 0.540 + 0.500 + 0.463)$$

or

$$\$14{,}905.35 \times (6.709) = \$100{,}000.$$

CALCULATING AN ANNUITY PAYMENT

To find an annuity payment, then, simply divide the original amount of money by the sum of the present value factors associated with the interest rate and number of annuity payments.

EXAMPLE 1-24: Melody just received an inheritance of $50,000. Melody wants an equal annual income from this money for eight years. Melody will receive the annual income at the end of each year. How much can Melody receive each year if she can invest at 6 percent compounded annually?

ANSWER: Use Appendix Table A-4. Sum the present value factors under 6 percent for years 1 to 8:

$$0.943 + 0.890 + 0.840 + 0.792 + 0.747 + 0.705 + 0.665 + 0.627 = 6.209.$$

Divide this sum into $50,000:

$$\frac{\$50{,}000}{6.209} = \$8052.83$$

Melody can receive $8052.83 each year for eight years.

Table 1-9 Spreading $50,000 over eight years.

$50,000 × 1.06 = $53,000.00;	$53,000.00 – $8,052.83 = $44,947.17
44,947.17 × 1.06 = 47,644.00;	47,644.00 – 8,052.83 = 39,591.17
39,591.17 × 1.06 = 41,966.64;	41,966.64 – 8,052.83 = 33,913.81
33,913.81 × 1.06 = 35,948.64;	35,948.64 – 8,052.83 = 27,895.81
27,895.81 × 1.06 = 29,569.56;	29,569.56 – 8,052.83 = 21,516.73
21,516.73 × 1.06 = 22,807.73;	22,807.73 – 8,052.83 = 14,754.90
14,754.90 × 1.06 = 15,640.19;	15,640.19 – 8,052.83 = 7,587.36
7,587.36 × 1.06 = 8,042.60;	8,042.60 – 8,052.83 = – 10.23 (due to rounding)

To prove to yourself that $8052.83 can, in fact, be received each year, and at the end of eight years the $50,000 will be exhausted (used up), follow the calculations in Table 1-9.

What if, in EXAMPLE 1-24, the first payment is received immediately, and the remaining payments are received at the beginning of each year. In this case, the first present value factor is 1, so only seven additional present value factors are added from Appendix Table A-4. The annuity payment is thus:

$$\frac{\$50{,}000}{[1.000+0.943+0.890+0.840+0.792+0.747+0.705+0.665]} = \frac{\$50{,}000}{6.582} = \$7{,}596.48.$$

Note that this payment is less than the payment in EXAMPLE 1-24.

MONTHLY ANNUITY PAYMENTS

Monthly annuity payments can also be calculated. In this case monthly present value factors are added and divided into the original sum of money.

EXAMPLE 1-25: What monthly annuity payment can Melody receive for 96 months if she earns a 10 percent annual interest rate compounded monthly on her $50,000 money? Each payment is received at the end of the month.

ANSWER: From Appendix Table A-6, find the present value factor sum for the 10 percent column and 96 month row. This is 65.901. Divide 65.901 into $50,000:

$$\frac{\$50{,}000}{65.901} = \$758.71 \text{ (monthly annuity payment for each of 96 months)}.$$

Appendix Table A-6 helps you in this case by giving the monthly present value factor sums associated with alternative annual interest rates and monthly terms, assuming payments are received at the end of each month.

If the first monthly payment is to be received immediately and the remaining payments are received at the beginning of each month, then a different present value factor must be used. In this case, take the present value factor sum from Appendix Table A-6, add 1.000 (because the first period is received immediately) and subtract the present value factor for the final month (from Appendix Table A-5). That is:

PVFS for beginning of month payments	=	PVFS from Appendix Table A-6	+1.000 –	PVF for final month from Appendix Table A-5

Calculating How Long an Annuity Will Last

The annuity calculation can be done in reverse to find how long a string of annuity payments will last. In this case simply divide the original money amount by the annuity payment. The result is the associated present value factor sum. If the annuity payments are annual, then go to Appendix Table A-4 and begin adding present value factors under the interest rate used until the present value factor sum is reached. Then read-off the corresponding number of years.

If the annuity payments are monthly; then go to Appendix Table A-6 and led the present value factor sum under the interest rate used. Read-off the corresponding number of months.

EXAMPLE 1-26: How long will $5,000 last if annual annuity payments of $1,000 are received and 5 percent interest is earned and payments are received at the end of each year?

ANSWER:

$$\frac{\$5,000}{\$1,000} = 5.00.$$

Under 5 percent in Appendix Table A4,

$$0.952 + 0.907 + 0.864 + 0.823 + 0.784 + 0.746 = 5.076,$$

which is associated with six years. The money will last approximately six years.

EXAMPLE 1-27: How long will $10,000 last if annuity payments of $100 monthly are made and 9 percent interest is earned and payments are received at the end of each month?

ANSWER:

$$\frac{\$10,000}{\$100} = 100.$$

Find 100 in Appendix Table A-6 under 9 percent interest. 100 falls between 98.594 (180 months) and 101.573 (192 months), so take half-way between and say 186 months.

The Bottom Line

An annuity is the equal periodic payment that can be generated over a period of time by a sum of money assuming the sum of money is invested. The annuity is always larger than the simple average because interest in included. You'll revisit annuities later. They're the basis for calculating loan payments!

14. When Is a Dollar in Hand Worth More Than Two Dollars in the Bush?

Consumer economics is filled with uncertainty. Will you get that new job or not? How much extra salary will you receive after earning a master's degree? Will interest rates be higher or lower next year? Will the stock market rise or fall?

Is there any way in which the various outcomes connected with a decision can be averaged when uncertainty is present? Say, for example, that there are three possibilities for your salary next year: it can stay the same at $30,000, you can get a modest raise of 5 percent to $31,500, or you can get a big raise of 10 percent to $33,000. Can you calculate, on average, what your *expected* salary will be next year?

EXPECTED SALARY

The key word here is *expected.* To calculate your expected salary you must know one other piece of information: the *chances*, or probabilities, associated with each of the three outcomes for your salary next year. If you know the chances associated with each outcome, thee you can calculate your *expected*, or probability-weighted, salary using this formula:

NEXT YEAR'S EXPECTED SALARY = $30,000 × (CHANCE OF RECEIVING $30,000 NEXT YEAR)
+ $31,500 × (CHANCE OF RECEIVING $31,500 NEXT YEAR)
+ $33,000 × (CHANCE OF RECEIVING $33,000 NEXT YEAR)

For example, if the chance of receiving $30,000 next year is 20 percent (.20), the chance of receiving $31,500 next year is 50 percent (.50), and the chance of receiving $33,000 next year is 30 percent (.30), then next year's expected salary is:

$$\$30,000 \times (.20) + \$31,500 \times (.50) + \$33,000 \times (.30) = \$31,650.$$

The formula can be generalized for any number of outcomes for a particular situation. For example, if there are eight possible outcomes, multiply each outcome by the chance of it occurring, and then sum all the results. However, make sure the sum of chances is 100 percent.

Calculating the expected value for a number of possible outcomes is most useful in investment analysis. Here the unknown outcome is what rate of return a particular investment (like a stock) may earn. Calculating the expected value is a way to reduce all the outcomes to one number.

EXAMPLE 1-28: Susan just bought Company ABC stock. Of course Susan wants the value of the stock to rise, but there's no assurance it will. Through study and discussion with investment advisors, Susan sees four possible outcomes for the stock in the next year:

There's a 10% chance the stock will go up 20%,
There's a 50% chance the stock will go up 10%,
A 20% chance the stock will not change in value,
A 20% chance the stock will fall in value by 15%.

What's the expected change in the stock's value for next year?

ANSWER: Expected value of change in ABC stock's value:

20% × (.10) + 10% × (.50) + 0% × (.20) - 15% × (.20) = 2% +5% + 0% - 3% = 4%

The *expected* change in the stock's value is 4 percent.

Now we can answer the question heading this chapter (When is a dollar in hand worth more than two dollars in the bush?). The answer is—when the chance of the two dollars in the bush blowing away is more than 50 percent. If, for example, the chance of the two dollars blowing away is 60 percent, then the expected value of the two bush dollars is:

$$\$2 \times .40 + \$0 \times .60 = 80¢.$$

Since 80 cents is less than a dollar in hand, you'd prefer a dollar in hand!

The Bottom Line

Uncertainty exists for many economic outcomes; for example, what your salary will be next year; what return your stocks will earn, where the inflation rate will go. If chances, or probabilities, can be attached to each possible outcome, then the expected outcome (or expected value) can be calculated.

WORDS AND CONCEPTS YOU SHOULD KNOW

Nominal Price-Relative Price
Value of Time
Declining Marginal Value
Demand Curve
Supply Curve
Market
Equilibrium Price
Opportunity Cost
Wage Differences
Inflation Rate
Purchasing Power of the Dollar
Escalating Inflation
Disinflation
Deflation
Producer Price Index
Consumer Price Index
Adjusting for Inflation
Rate of Time Preference
Real Interest Rate
Expected Inflation Rate
Future Value
Simple Interest
Compound Interest
Future Value Factor
Future Value Factor Sums
Present Value
Discounting
Discount Rate
Present Value Factor
Present Value Factor Sums
Annuity
Expected Value

MICROFOUNDATIONS—A SUMMARY

1 Comparing prices.

- At same point in time: Compare nominal prices, or compute relative prices. Relative prices set one price equal to 1.00 and computes other prices relative to 1.00.

Example:	*Pork*	*Chicken*
Nominal price	\$2.00/lb.	\$2.20/lb.
Relative price	1.00	$\frac{\$2.20}{\$2.00} = 1.10$

- Over time: Must compare relative prices. Use a base, either Consumer Price Index or average wage rate.

Example:	*2002*	*2012*
CPI	179.0	229.6
Price of movie ticket	\$8.00	\$9.00
Relative price of movie ticket	$\frac{8.00}{179.9} = 0.044$	$\frac{9.00}{229.6} = 0.039$

Conclusion—Movie tickets became relatively less expensive.

2. Your time is a limited resource—therefore, it has value. The price, or value, of your time in any activity is the value of what else you could do with that time. On average, your time is worth 20 to 70 percent of your wage rate. This has implications for commuting, shopping, and household activities, to name a few.

3. Declining marginal value means you get progressively less pleasure from consumption of additional units of a product or service.

4. A demand curve shows the quantity of a product consumers buy at every price; a supply curve shows the quantity of a product firms produce at every price.
   - The equilibrium price is where demand equals supply.
   - If demand increases faster than supply, price rises.
   - If supply increases faster than demand, price falls.

5. Every use of time or money which we make has an alternative use. The value of that alternative use is called the opportunity cost.

6. On average, jobs which require more skill, training, or experience pay higher wages. Also, jobs which are riskier, or are located in undesirable locations, pay more than the same job with less risk or located in a desirable location.

7. Inflation is a rise in the average price level of consumer goods and services. The inflation rate is the percentage increase in the average price level.
   - Inflation reduces the purchasing power of dollars.
   - A rising inflation rate is called escalating inflation.
   - Disinflation occurs when the inflation rate is falling, but is still positive.
   - Deflation occurs when the average price level falls.
   - A relative price increase occurs when a product's price rises faster than the inflation rate.
   - A relative price decrease occurs when a product's price rises slower than the inflation rate.
   - To keep ahead of inflation, your salary and investments must increase by at least the rate of inflation.

8. The average price level is measured by the Consumer Price Index (CPI). The inflation rate is measured by the percentage change in the CPI.

9. Use these formulas to adjust for inflation in order to compare incomes or prices at different points in time:

$$\text{Income or Price in a later Year B in terms of purchasing power in previous Year A} = \frac{\text{Income or Price in a later Year B}}{\text{1+inflation rate from Year A to Year B}}$$

$$\text{Income or Price in previous Year A in terms of purchasing power in a Year B} = \text{Income or Price in Previous Year A} \times \text{1+inflation rate from Year A to Year B}$$

10. Interest rates are charged on loans to compensate the lender for giving up use of money (real interest rate) and to compensate the lender for losses in purchasing power resulting from future inflation (inflation premium).
    - people who strongly value the present compared to the future have a high rate of time preference and are more likely to borrow.
    - The nominal, or observed, interest rate equals the real interest rate plus the expected inflation rate.

11. When compounding is used, the future value of an original investment, P, is:

$$P\times(1+r)^n, \text{ where}$$

r is the periodic interest rate and n is the number of compounding periods. The amount $(1 + r)^n$ is the future value factor.

Future value factor sum is used when an equal amount of periodical investments are invested. The beginning of the month (BOM) future value factor sum formula is

$$FVFS=(1+r)^n+(1+r)^{n-1}+...+(1+r)^1=\frac{(1+r)^{n+1}-1}{r}-1,$$

And the end of the month (EOM) future value factor sum formula is

$$FVFS=(1+r)^{n-1}+(1+r)^{n-2}...+(1+r)^0=\frac{(1+r)^n-1}{r}.$$

- Appendix Table A-1 gives future value factors for annual compounding.
- Appendix Table A-2 gives future value factors for monthly compounding.
- Appendix Table A-3 gives future value factor sums used when the same amount P is invested at the end of each month for a number of months; multiply the future value factor sum by P to calculate the future value.

12. Finding the present value of a future dollar amount means finding the present dollar amount which, if invested, would grow to that future dollar amount. If the investment interest rate compensates for the rate of time preference and expected inflation, then the present value and future value have the same real value.
    - The formula is:

$$\text{present value} = \text{future value} \times \frac{1}{(1+r)^n}, \text{ where}$$

$$\frac{1}{(1+r)^n} \text{ is the present value factor.}$$

Present value factor sum is used when a series of period payments of the same amount are discounted. The beginning of the month (BOM) present value factor sum formula is

$$PVFS=\frac{1}{(1+r)^0}+\frac{1}{(1+r)^1}+...+\frac{1}{(1+r)^{n-1}}=1+\frac{1-\frac{1}{(1+r)^{n-1}}}{r},$$

and the end of the month (EOM) present value factor sum formula is

$$PVFS=\frac{1}{(1+r)^1}+...+\frac{1}{(1+r)^n}=\frac{1-\frac{1}{(1+r)^n}}{r}.$$

- Appendix Table A-4 gives present value factors for annual compounding.
- Appendix Table A-5 gives present value factors for monthly compounding.
- Appendix Table A-6 gives present value factor sums used to find the present value of a series of the same monthly amounts.

13. An annuity is a series of periodic payments of the same amount derived from an original principal amount and its interest earnings. Divide the original principal amount by a present value factor sum to find the annuity amount.

14. The expected value of an outcome is the sum of each possible outcome multiplied by the probability of the outcome occurring.

Name________________________ Date____________

DISCUSSION QUESTIONS

1. Why is it important for consumers to distinguish between nominal prices and relative prices?
2. Why is your time valuable?
3. Why do top business executives have company provided jets?
4. Do you think there's a connection between the increasing number of women working in the workplace and the growth of the convenience and prepared food industry? If you do, explain the connection.
5. When unexpected cold weather hits and fuel prices rise, most consumers think the price increase is due to greedy oil firms making big profits. What do you think, given what you know about supply and demand?
6. What is your opportunity cost of taking this course?
7. Name some reasons why doctors' salaries are high.
8. The inflation rate will probably never be reduced to zero. Does this mean we are doomed to become poorer and poorer?
9. Why would a salary contract with a "Cost-of-living" escalator be valuable?
10. Your mom says she remembers when a movie ticket cost $1.50 in the "good old days." Your mom wishes she were back in the "good old days." What's wrong with your mom's thinking?
11. Is charging interest on a loan unfair? Why or why not?
12. Why, on any loan, do you always repay more total dollars than you borrowed?
13. Why can't dollars paid or received at different points in time be treated as equal?
14. Discuss one approach that might be used to forecast next year's inflation rate.

Name____ Date ______________________

PROBLEMS

1. The price of unleaded gasoline is $4.00/gallon, the price of diesel is $3.50/gallon, and the price of ethanol is $3.75/gallon. Convert these nominal prices to relative prices using the ethanol price as the base.

2. Use the numbers below to decide if the price of a new car is relatively more expensive in 2010 than in 1990. Calculate how many hours it would take to work to afford a new car in 1990 and in 2010.

	1990	*2010*
Nominal price of a new car	$15,000	$25,000
Nominal average hourly wage	$10.78	$18.61

3. Joan's value of time is $ 10/hour, and Alice's value of time is $2/hour. Making a chicken entree at home costs $1.50 for the inputs and 1 hour of time per serving. Buying the same pre-prepared entree costs $4.50 in money and 10 minutes of time per serving. Calculate which is cheaper, the home prepared entree or the pre-prepared entree, for Joan and for Alice.

4. The $10,000 you use as a downpayment on a house could have been invested in a CD paying an annual interest rate of 7 percent. Therefore, what is one opportunity cost of using the $10,000 as a downpayment?

5. You're promised $1 million in 20 years. If the inflation rate averages 6 percent annually over the next 20 years, what will $1 million be worth then?

6. In 2002 Joe's salary was $50,000. In 2012 Joe's salary was $65,000. Nice increase, right? Not necessarily. In 2002 the CPI was 179.9, and in 2012 it was 229.6. Express Joe's 2012 salary in terms of 2002 dollars. Then, express Joe's 2002 salary in terms of 2012 dollars. Is Joe "really" better off in 2012 than in 2002?

7. If the CPI last year was 225, and the CPI this year (one year later) is 240, what was the inflation rate for the year?

8. Here are the annual inflation rates for the years 2009–2012:

2009: –0.4%

2010: 1.6%

2011: 3.2%

2012: 2.1%

What is the total inflation rate for 2009–2012?

9. If the real interest rate is 4 percent and the expected inflation rate is 7 percent, what is the nominal (observed) interest rate?

10. If Jack invests $1,000 today in an investment paying an annual rate of 10% compounded annually, how much will he have at the end of seven years?

11. If Jack invests $1,000 today in an investment paying an annual rate of 10% compounded monthly, how much will he have at the end of three years?

12. If Jack invests $100 at the end of every month for seven years in an investment paying an annual rate of 10% compounded monthly, how much will he have at the end of seven years? How much will he have if he invests at the beginning of each month?

13. Which is better, having $500 in two years or $750 in five years, if money can be invested at 7 percent, after-taxes, in a riskless investment?

14. What would be equivalent today to receiving $1 million in 20 years, using a discount rate of 8 percent?

15. Sally makes a $300 car payment for 36 months. Each payment is made at the end of the month. Using a 15 percent discount rate, what's the value of those total future payments today?

16. What equal monthly payment will $10,000 generate for 24 months if 6 percent interest can be earned after taxes? The payments are received at the end of each month. What equal monthly payment could be received if each payment is received at the beginning of each month?

17. Byron wants to draw $200 at the end of each month from an initial fund of $20,000. For how many months can he do this if he can earn 9 percent interest after taxes?

18. Melody wants to save $5,000 in five years. How much must she save at the end of each month if she can earn 5 percent after taxes? How much must she save at the end of each month if she can earn 10 percent after taxes?

19. Susan thinks she has a 30 percent chance of getting a GPA of 3.50 this year, a 20 percent change of getting a GPA of 3.00, a 40 percent chance of getting a GPA of 2.50, and a 10 percent chance of getting a GPA of 2.00. What is Susan's expected GPA for this year?

CHAPTER 2

Macrofoundations: What You Can't Control but Should Know About