Leseaufträge «Mikroökonomik I»

Modul 2: Konsument und Nachfrage

Unit 1:

- Budgetbeschränkung

Quellen:

- **Chapter 4 – Rational Consumer Choice**
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CHAPTER 4

RATIONAL CONSUMER CHOICE

It is Saturday night and you have decided to eat out at a new restaurant in town. The waitress hands you the menu, and there is a lot of choice. How are you going to decide what to eat?

The more you analyse this seemingly simple problem, the less simple it can seem. You need to think about which dish looks most tasty, what is best for your diet, etc. All of this then needs to be weighed against the relative prices of the dishes. Maybe you prefer beef steak to pizza, but are you willing to pay an extra €10 for steak?

Actually, suppose you do not need to worry about price because it is a friend's birthday and she has offered to pay the bill. Is the problem any easier? Despite your friend's generosity things may have got a bit trickier. What if you are willing to pay an extra €10 for steak, but do not want to feel guilty for choosing the most expensive item on the menu? It is your friend's birthday, after all.

And while we are asking all these questions, there is a lot more we might want to ask, such as why you chose to go out to your friend's birthday party rather than stay at home watching TV or reading more of your economic textbooks. Why did you get the bus rather than walk? And why, after much deliberation, did you buy the cheapest present you could think of?

CHAPTER PREVIEW

Our task in this chapter is to set forth the economist's basic model for answering questions such as the ones posed above. This model is known as the theory of *rational consumer choice*. It underlies all individual purchase decisions, which in turn add up to the demand curves we worked with in the preceding chapter.

Rational choice theory begins with the assumption that consumers enter the marketplace with well-defined preferences. Taking prices as given, their task is to allocate their incomes to best serve these preferences. Two steps are required to carry out this task. Step 1 is to describe the various combinations of goods the consumer is *able* to buy. These combinations depend on both her income level and the prices of the goods. Step 2 then is to select from among the feasible combinations the particular one that she *prefers* to all others. Analysis of step 2 requires some means of describing her preferences; in particular, a summary of her ranking of the desirability of all feasible combinations. Formal development of these two elements of the theory will occupy our attention throughout this chapter. Because the first element—describing the set of possibilities—is much less abstract than the second, let us begin with it.

THE OPPORTUNITY SET OR BUDGET CONSTRAINT

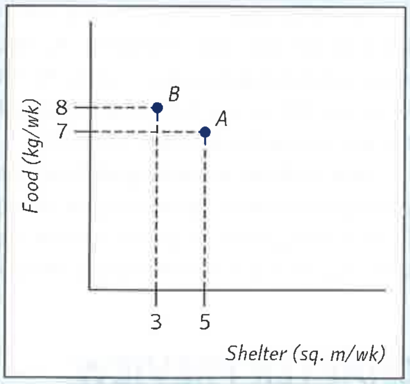
bundle a particular combination of two or more goods.

For simplicity, we start by considering a world with only two goods,[1] shelter and food. A **bundle** of goods is the term used to describe a particular combination of shelter, measured in square metres per week, and food, measured in kilograms per week. Thus, in Figure 4.1, one bundle (bundle A) might consist of 5 sq. m/wk of shelter and 7 kg/wk of food, while another (bundle B) consists of 3 sq. m/wk of shelter and 8 kg/wk of food. For brevity, we use (5, 7) to denote bundle A and (3, 8) to denote bundle B. More generally, (S_0, F_0) will denote the bundle with S_0 sq. m/wk of shelter and F_0 kg/wk of food. By convention, the first number of the pair in any bundle represents the good measured along the horizontal axis.

Note that the units on both axes are *flows,* which means physical quantities per unit of time—kilograms per week, square metres per week. Consumption is always measured as a flow. It is important to keep track of the time dimension because without it there would be no way to evaluate whether a given quantity of consumption was large or small. (Suppose all you know is that your food consumption is 4 kg. If that is how much you eat each day, it is a lot. But if that is all you eat in a month, you are not likely to survive for long.)[2]

Suppose the consumer's income is M = €100/wk, all of which she spends on some combination of food and shelter. (Note that income is also a flow.) Suppose further that the prices of shelter and food are P_S = €5/sq. m and P_F = €10/kg, respectively. If the consumer spent all her income on shelter, she could buy M/P_S = (€100/wk) ÷ (€5/sq. m) = 20 sq. m/wk. That is, she could buy the bundle consisting of 20 sq. m/wk of shelter and 0 kg/wk of food, denoted (20, 0). Alternatively, suppose the consumer spent all her income on food. She would then get the

FIGURE 4.1
Two Bundles of Goods
A bundle is a specific combination of goods. Bundle A has 5 units of shelter and 7 units of food. Bundle B has 3 units of shelter and 8 units of food.



[1]As economists use the term, a 'good' may refer to either a product or a service.
[2]The flow aspect of consumption also helps us alleviate any concern about goods not being divisible. If you consume 1.5 kg/mo, then you consume 18 kg/yr, which is a whole number.

bundle consisting of M/P_F = (€100/wk) ÷ (€10/kg), which is 10 kg/wk of food and 0 sq. m/wk of shelter, denoted (0, 10).

Note that the units in which consumption goods are measured are subject to the standard rules of arithmetic. For example, when we simplify the expression on the right-hand side of the equation M/P_S = (€100/wk) ÷ (€5/sq. m), we are essentially dividing one fraction by another, so we follow the standard rule of inverting the fraction in the denominator and multiplying it by the fraction in the numerator: (sq. m/€5) × (€100/wk) = (€100 × sq. m)/(€5 × wk). After dividing both the numerator and denominator of the fraction on the right-hand side of this last equation by €5, we have 20 sq. m/wk, which is the maximum amount of shelter the consumer can buy with an income of €100/wk. Similarly, M/P_F = (€100/wk) ÷ (€10/kg) simplifies to 10 kg/wk, the maximum amount of food the consumer can purchase with an income of €100/wk.

In Figure 4.2 these polar cases are labelled *K* and *L*, respectively. The consumer is also able to purchase any other bundle that lies along the straight line that joins points *K* and *L*. You can verify, for example, that the bundle (12, 4) is affordable. This line is called the **budget constraint** and is labelled *B* in the diagram.

budget constraint the set of all bundles that exactly exhausts the consumer's income at given prices. Also called the *budget line*.

Recall the maxim from high school algebra that the slope of a straight line is its 'rise' over its 'run' (the change in its vertical position divided by the corresponding change in its horizontal position). Here, note that the slope of the budget constraint is its vertical intercept (the rise) divided by its horizontal intercept (the corresponding run): −(10 kg/wk)/(20 sq. m/wk) = $-\frac{1}{2}$ kg/sq. m. (Note again how the units obey the standard rules of arithmetic.) The minus sign signifies that the budget line falls as it moves to the right—that it has a negative slope. More generally, if M denotes the consumer's weekly income, and P_S and P_F denote the prices of shelter and food, respectively, the horizontal and vertical intercepts will be given by (M/P_S) and (M/P_F), respectively. Thus the general formula for the slope of the budget constraint is given by $-(M/P_F)/(M/P_S) = -P_S/P_F$, which is simply the negative of the price ratio of the two goods. Given their respective prices, it is the rate at which food can be exchanged for shelter. Thus, in Figure 4.2, 1 kg of food can be exchanged for 2 sq. m of shelter. In the language of opportunity cost from Chapter 1, we would say that the opportunity cost of an additional square metre of shelter is $P_S/P_F = \frac{1}{2}$ kg of food.

In addition to being able to buy any of the bundles along her budget constraint, the consumer is also able to purchase any bundle that lies within the *budget triangle* bounded by it and

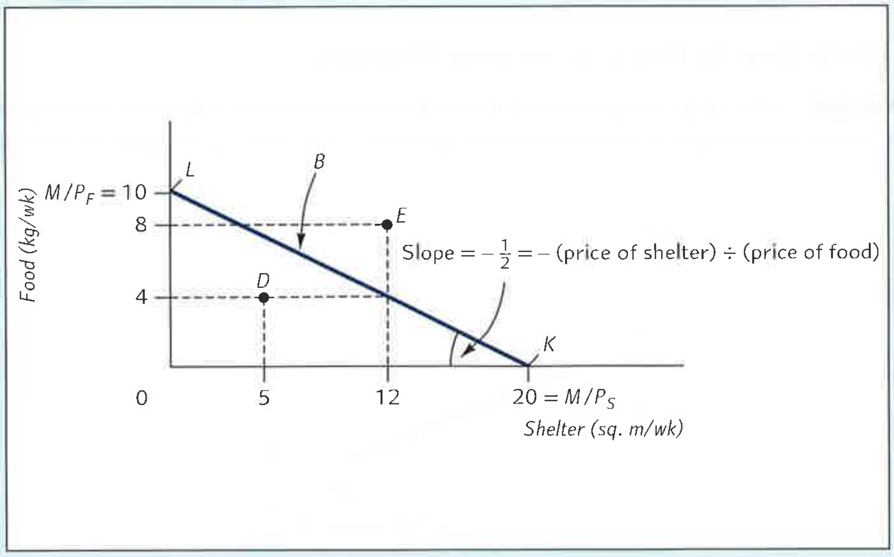


FIGURE 4.2
The Budget Constraint, or Budget Line
Line *B* describes the set of all bundles the consumer can purchase for given values of income and prices. Its slope is the negative of the price of shelter divided by the price of food. In absolute value, this slope is the opportunity cost of an additional unit of shelter—the number of units of food that must be sacrificed in order to purchase one additional unit of shelter at market prices.

the two axes. D is one such bundle in Figure 4.2. Bundle D costs €65/wk, which is well below the consumer's income of €100/wk. The bundles on or within the budget triangle are also referred to as the *feasible set*, or **affordable set**. Bundles like E that lie outside the budget triangle are said to be *infeasible*, or *unaffordable*. At a cost of €140/wk, E is simply beyond the consumer's reach.

affordable set bundles on or below the budget constraint; bundles for which the required expenditure at given prices is less than or equal to the income available.

If S and F denote the quantities of shelter and food, respectively, the budget constraint must satisfy the following equation:

$$P_S S + P_F F = M \tag{4.1}$$

which says simply that the consumer's weekly expenditure on shelter ($P_S S$) plus her weekly expenditure on food ($P_F F$) must add up to her weekly income (M). To express the budget constraint in the manner conventionally used to represent the formula for a straight line, we solve Equation 4.1 for F in terms of S, which yields

$$F = \frac{M}{P_F} - \frac{P_S}{P_F} S \tag{4.2}$$

Equation 4.2 is another way of seeing that the vertical intercept of the budget constraint is given by M/P_F and its slope by $-(P_S/P_F)$. The equation for the budget constraint in Figure 4.2 is $F = 10 - \frac{1}{2} S$.

ECONOMIC NATURALIST 4.1

Why do some students not spend enough time on their studies?

As the introduction to Chapter 1 already highlighted, money is not the only constraint a person faces. Time is another. Fortunately, it is easy enough to adapt our model of the budget constraint to accommodate that.

To illustrate, suppose that you are deciding what to do in your free time. You have 10 hours to spare a week and can spend it either reading your microeconomics textbook or playing football. Reading a chapter of your textbook would take 2 hours while a game of football would take 30 minutes.

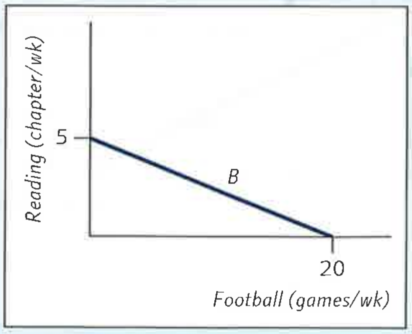
Then we can think of your income as $M = 10$ hrs/wk. The price of reading your textbook is $P_T = 2$ hrs/chapter and the price of playing football is $P_F = 0.5$ hrs/game. The corresponding budget constraint is given in Figure 4.3.

Things get a bit more complicated if there are multiple constraints. If a game of football, for example, usually ends with beer and pizza we need to take account of both the monetary cost of playing football as well as the time cost. This gives us two budget constraints. The feasible set is now those bundles that lie on or below *both* the monetary and time budget constraint. ■

Budget Shifts Due to Price or Income Changes

Price Changes The slope and position of the budget constraint are fully determined by the consumer's income and the prices of the respective goods. Change any one of these factors and

FIGURE 4.3
A Time Budget Constraint
The Line B describes the set of bundles the consumer can afford given the available free time.



we have a new budget constraint. Figure 4.4 shows the effect of an increase in the price of shelter from P_{S1} = €5/sq. m to P_{S2} = €10. Since both weekly income and the price of food are unchanged, the vertical intercept of the consumer's budget constraint stays the same. The rise in the price of shelter rotates the budget constraint inward about this intercept, as shown in the diagram.

Note in Figure 4.4 that even though the price of food has not changed, the new budget constraint, B_2, curtails not only the amount of shelter the consumer can buy but also the amount of food.[3]

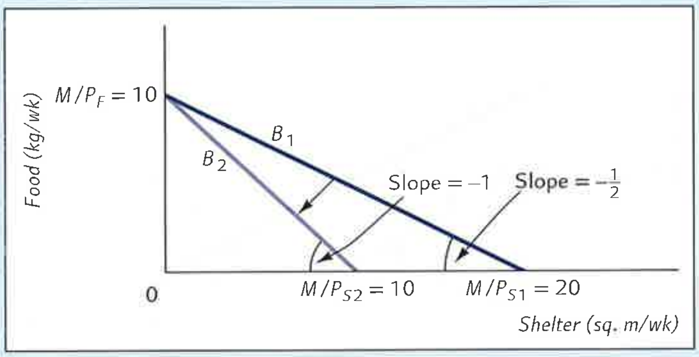


FIGURE 4.4
The Effect of a Rise in the Price of Shelter
When shelter goes up in price, the vertical intercept of the budget constraint remains the same. The original budget constraint rotates inward about this intercept.

EXERCISE 4.1 Show the effect on the budget constraint B_1 in Figure 4.4 of a fall in the price of shelter from €5/sq. m to €4/sq. m.

In Exercise 4.1, you saw that a fall in the price of shelter again leaves the vertical intercept of the budget constraint unchanged. This time the budget constraint rotates outward. Note also in Exercise 4.1 that, although the price of food remains unchanged, the new budget constraint enables the consumer to buy bundles that contain not only more shelter but also more food than she could afford on the original budget constraint.

The following exercise illustrates how changing the price of the good on the vertical axis affects the budget constraint.

EXERCISE 4.2 Show the effect on the budget constraint B_1 in Figure 4.4 of a rise in the price of food from €10/kg to €20/kg.

When we change the price of only one good, we necessarily change the slope of the budget constraint, $-P_S/P_F$. The same is true if we change both prices by different proportions. But as Exercise 4.3 will illustrate, changing both prices by exactly the same proportion gives rise to a new budget constraint with the same slope as before.

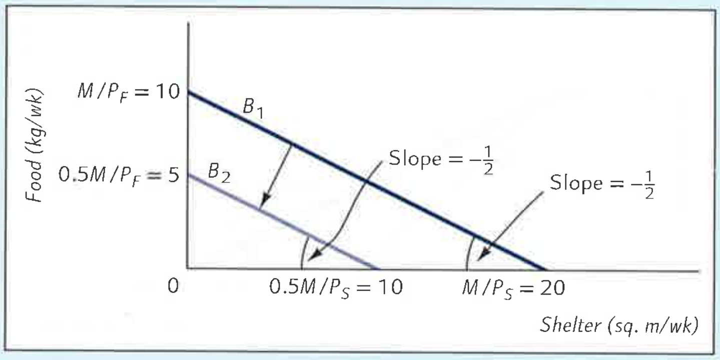
EXERCISE 4.3 Show the effect on the budget constraint B_1 in Figure 4.4 of a rise in the price of food from €10/kg to €20/kg and a rise in the price of shelter from €5/sq. m to €10/sq. m.

Note from Exercise 4.3 that the effect of doubling the prices of both food and shelter is to shift the budget constraint inward and parallel to the original budget constraint. The important lesson of this exercise is that the slope of a budget constraint tells us only about *relative prices*, nothing about prices in absolute terms. When the prices of food and shelter change in the same proportion, the opportunity cost of shelter in terms of food remains the same as before.

[3]The single exception to this statement involves the vertical intercept (0, 10), which lies on both the original and the new budget constraints.

Income Changes The effect of a change in income is much like the effect of an equal proportional change in all prices. Suppose, for example, that our hypothetical consumer's income is cut by half, from €100/wk to €50/wk. The horizontal intercept of the consumer's budget constraint then falls from 20 sq. m/wk to 10 sq. m/wk, and the vertical intercept falls from 10 kg/wk to 5 kg/wk, as shown in Figure 4.5. Thus the new budget, B_2, is parallel to the old, B_1, each with a slope of $-\frac{1}{2}$. In terms of its effect on what the consumer can buy, cutting income by one-half is thus no different from doubling each price. Precisely the same budget constraint results from both changes.

FIGURE 4.5
The Effect of Cutting Income by Half
Both horizontal and vertical intercepts fall by half. The new budget constraint has the same slope as the old but is closer to the origin.



EXERCISE 4.4 Show the effect on the budget constraint B_1 in Figure 4.5 of an increase in income from €100/wk to €120/wk.

Exercise 4.4 illustrates that an increase in income shifts the budget constraint parallel outward. As in the case of an income reduction, the slope of the budget constraint remains the same.

Budgets Involving More Than Two Goods

In the examples discussed so far, the consumer could buy only two different goods. No consumer faces such narrow options. In its most general form, the consumer budgeting problem can be posed as a choice between not two but N different goods, where N can be an indefinitely large number. With only two goods ($N = 2$), the budget constraint is a straight line, as we just saw. With three goods ($N = 3$), it is a plane. When we have more than three goods, the budget constraint becomes what mathematicians call a *hyperplane*, or *multidimensional plane*. It is difficult to represent this multidimensional case geometrically. We are just not very good at visualizing surfaces that have more than three dimensions.

The nineteenth-century economist Alfred Marshall proposed a disarmingly simple solution to this problem. It is to view the consumer's choice as being one between a particular good—call it X—and an amalgam of other goods, denoted Y. This amalgam is generally called the **composite good.** By convention, the units of the composite good are defined so that its price is €1 per unit. This convention enables us to think of the composite good as the amount of income the consumer has left over after buying the good X. Equivalently, it is the amount the consumer spends on goods other than X. For the moment, all the examples we consider will be ones in which consumers spend all their incomes. In Chapter 16 we will use the rational choice model to analyse the decision to save.

composite good in a choice between a good X and numerous other goods, the amount of money the consumer spends on those other goods.

To illustrate how the composite good concept is used, suppose the consumer has an income of €M/wk, and the price of X is P_X. The consumer's budget constraint may then be represented as a straight line in the X, Y plane, as shown in Figure 4.6. Because the price of a unit of the composite good is €1, a consumer who devotes all his income to it will be able to buy M units. All this means is that he will have €M available to spend on other goods if he buys no X. Alternatively, if

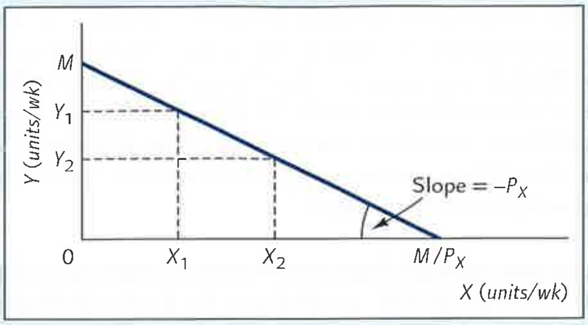


FIGURE 4.6
The Budget Constraint with the Composite Good
The vertical axis measures the amount of money spent each week on all goods other than X.

he spends his entire income on X, he will be able to purchase the bundle $(M/P_X, 0)$. Since the price of Y is assumed to be €1/unit, the slope of the budget constraint is simply $-P_X$.

As before, the budget constraint summarizes the various combinations of bundles that exhaust the consumer's income. Thus, the consumer can have X_1 units of X and Y_1 units of the composite good in Figure 4.6, or X_2 and Y_2, or any other combination that lies on the budget constraint.

Non-Linear Budget Constraints

The budget constraints we have seen so far have been straight lines. When relative prices are constant, the opportunity cost of one good in terms of any other is the same, no matter what bundle of goods we already have. But often budget constraints are not straight lines. To illustrate, consider the following example of quantity discounts.

EXAMPLE 4.1 The Gigawatt Power Company charges €0.10 per kilowatt-hour (kWh) for the first 1,000 kWh of power purchased by a residential customer each month, but only €0.05/kWh for all additional kWh. For a residential customer with a monthly income of €400, graph the budget constraint for electric power and the composite good.

If the consumer buys no electric power, he will have €400/mo to spend on other goods. Thus the vertical intercept of his budget constraint is (0, 400). As shown in Figure 4.7, for each of the first 1,000 kWh he buys, he must give up €0.10, which means that the slope of his budget constraint starts out at $-\frac{1}{10}$. At 1,000 kWh/mo, the price falls to €0.05/kWh, which means that the slope of his budget constraint from that point rightward is only $-\frac{1}{20}$. ◆

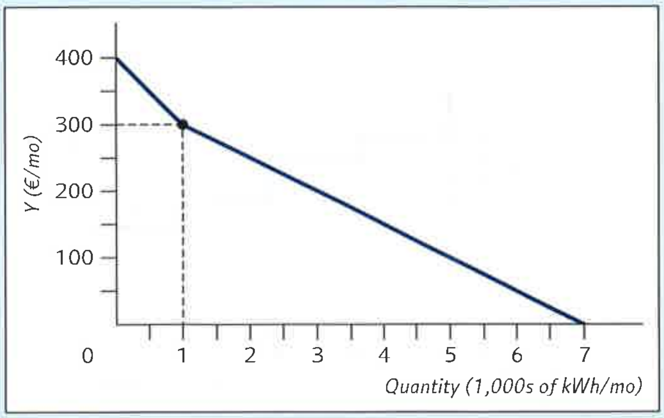


FIGURE 4.7
A Quantity Discount Gives Rise to a Non-Linear Budget Constraint
Once electric power consumption reaches 1,000 kWh/mo, the opportunity cost of additional power falls from €0.10/kWh to €0.05/kWh.

Note that along the budget constraint shown in Figure 4.7, the opportunity cost of electricity depends on how much the consumer has already purchased. Consider a consumer who now uses 1,020 kWh each month and is trying to decide whether to leave his front porch light on all night, which would result in additional consumption of 20 kWh/mo. Leaving his light on will cost him an extra €1/mo. Had his usual consumption been only 980 kWh/mo, however, the cost of leaving the front porch light on would have been €2/mo. On the basis of this difference, we can predict that people who already use a lot of electricity (more than 1,000 kWh/mo) should be more likely than others to leave their porch lights burning at night.

EXERCISE 4.5 Suppose instead Gigawatt Power Company charged €0.05/kWh for the first 1,000 kWh of power purchased by a residential consumer each month, but €0.10/kWh each for all additional kilowatt-hours. For a residential consumer with a monthly income of €400, graph the budget constraint for electric power and the composite good. What if the rate jumps to €0.10/kWh for *all* kilowatt-hours if power consumption in a month exceeds 1,000 kWh (where the higher rate applies to all, not just the additional, kilowatt-hours)?

Non-linear budget constraints are not uncommon (see Economic Naturalist 4.2). For instance, any offers of the form, 'buy one get one free', 'free delivery if you spend over €50 or '20% off if you spend over €50', cause the budget constraint to be non-linear. Two-part tariffs where there is a lump sum to use the service, for example a gym or phone network, as well as cost per unit used, also cause the budget constraint to be non-linear. In Chapters 6 and 13 we shall look at why it may be in a firm's interest to price in this way.

ECONOMIC NATURALIST 4.2

Why do bulk buy discounts lead to food waste?

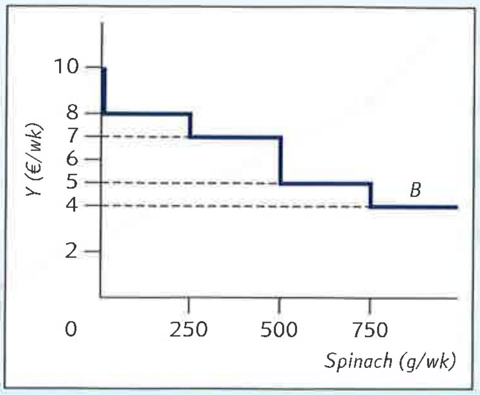
A trip to the local supermarket reveals that non-linear pricing is the norm rather than exception. To explain, let us think about Popeye buying spinach at his favourite supermarket.

He goes to the supermarket once a week. Fresh spinach comes in 250g bags and lasts a week before going off. A bag costs €2 but the supermarket is running a 'buy one get one half price' offer. Popeye has €10 spending money.

If Popeye consumes 1g of spinach, then he has to buy a 250g bag. So, the bundle containing 1g of spinach and €8 is on his budget constraint. But, clearly so is the bundle containing 250g of spinach and €8. If Popeye consumes 251g of spinach, then he has to buy two 250g bags. This 'first' bag costs €2 and the 'second' €1. So, the bundle containing 251g of spinach at €7 is affordable. Continuing this reasoning we can derive the budget constraint depicted in Figure 4.8.

Clearly this budget constraint is non-linear. The offer means that the first 250g costs €2 but the second 250g only €1. More noteworthy is that the first gram costs €2 but the next 249g cost

FIGURE 4.8
Budget Constraint of Popeye
Because spinach comes in 250 g bags that only last one week the budget constraint is non-linear. For example, it costs the same to consume 1 g/wk as 250 g/wk of spinach.



nothing. If something is free then it is a relatively simple decision to take it. Less clear is whether the spinach will be eaten. Recent studies suggest that over a third of bagged salad is thrown away by customers. Making the budget constraint more linear by, say, reducing the size of bags and the number of special offers would help alleviate waste. ■

To recapitulate briefly, the budget constraint or budget line summarizes the combinations of bundles that the consumer is able to buy. Its position is determined jointly by income and prices. From the set of feasible bundles, the consumer's task is to pick the particular one she likes best. To identify this bundle, we need some means of summarizing the consumer's preferences over all possible bundles she might consume. We now turn to this task.

CONSUMER PREFERENCES

For simplicity, let us again begin by considering a world with only two goods: shelter and food. A **preference ordering** enables the consumer to rank any two bundles of goods in terms of their desirability, or order of preference. Consider two bundles, *A* and *B*. For concreteness, suppose that *A* contains 12 sq. m/wk of shelter and 8 kg/wk of food, while *B* has 10 sq. m/wk of shelter and 10 kg/wk of food. Knowing nothing about a consumer's preferences, we can say nothing about which of these bundles he will prefer. *A* has more shelter but less food than *B*. Someone who spends a lot of time at home would probably choose *A*, while someone with a rapid metabolism might be more likely to choose *B*.

preference ordering a ranking of all possible consumption bundles in order of preference.

The preference ordering enables the consumer to rank pairs of bundles but not to make more precise quantitative statements about their relative desirability. Thus, the consumer might be able to say that he prefers bundle *A* to *B* but not that *A* provides twice as much satisfaction as *B*.

Preference orderings often differ widely among consumers. One person will like Rachmaninoff, another the Red Hot Chili Peppers. Despite these differences, however, most preference orderings share several important features. Economists generally assume five simple properties of preference orderings. These properties allow us to construct the concise analytical representation of preferences we need for the budget allocation problem. We shall introduce these five properties over the next couple of pages. Here are the first two.

1. Completeness A preference ordering is *complete* if it enables the consumer to rank all possible combinations of goods and services. For any two bundles *A* and *B*, the consumer is able to make one of three possible statements: (1) *A* is preferred to *B*, (2) *B* is preferred to *A*, or (3) *A* and *B* are equally attractive. Taken literally, the completeness assumption is never satisfied, for there are many goods we know too little about to be able to evaluate. It is nonetheless a useful simplifying assumption for the analysis of choices among bundles of goods with which consumers are familiar. Its real intent is to rule out instances like the one portrayed in the fable of Buridan's ass. The hungry animal was unable to choose between two bales of hay in front of him and starved to death as a result.

2. Transitivity If, at current prices, you like steak better than hamburger and hamburger better than hot dogs, you are probably someone who likes steak better than hot dogs. To say that a consumer's preference ordering is *transitive* means that, for any three bundles *A*, *B* and *C*, if he prefers *A* to *B* and prefers *B* to *C*, then he always prefers *A* to *C*.

The preference relationship is thus assumed to be like the relationship used to compare heights of people. If O'Neal is taller than Nowitzki and Nowitzki is taller than Bryant, we know that O'Neal must be taller than Bryant. Not all comparative relationships are transitive. This is shown by the relationship 'defeats in football'. Some seasons, Manchester United beat Arsenal, and Arsenal beat Chelsea, but that does not tell us that Manchester United will necessarily beat Chelsea.