Intermediate Microeconomics

Learning Note

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Date: November 25, 2019

Version:

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Contents

Chapter 1 The Market

Introduction

- Exogenous & Endogenous
- Demand Curve & Supply Curve
- Competitive Market
- Discriminating Monopolist
- Ordinary Monopolist
- Pareto Efficiency

1.1 Construction a Model

Economics proceeds by developing models of social phenomena. By a model we mean **a simplified representation of reality**.

Definition 1.1. Exogenous Variable

Sth is taken as determined by factors not discussed in this particular model.

Note *In this case, outer-ring apartment is a exogenous variable.*

Definition 1.2. Endogenous Variable

Sth is determined by forces described in the model.

Note *In this case, inner-ring apartment is a endogenous variable.*

1.2 Optimization and Equilibrium

Theorem 1.1. Optimization principle

choose the best patterns of consumption that they can afford.

Theorem 1.2. Optimization principle

Choose the best patterns of consumption that they can afford.

Theorem 1.3. Equilibrium principle

Adjust until the amount that people demand of something is equal to the amount that is supplied.

The second notion is a bit more problematic. It is at least conceivable that at any given time peoples' demands and supplies are not compatible, and hence something must be changing. These changes may take a long time to work themselves out, and, even worse, they may induce other changes that might "destabilize" the whole system.

1.3 The Demand Curve

Definition 1.3. Demand Curve

Maximum amount that he or she would be willing to pay to rent one of the apartments. ♣

Note *Such a curve is an example of a demand curve—a curve that relates the quantity demanded to price. When the market price is above \$500, zero apartments will be rented. When the price is between \$500 and \$490, one apartment will be rented. When it is between \$490 and the third highest reservation price, two apartments will be rented, and so on. The demand curve describes the quantity demanded at each of the possible prices.*

Definition 1.4. Conservative Price

A person's maximum willingness to pay for something that person's reservation price. ♣

1.4 The Supply Curve

Definition 1.5. Short-run Supply Curve

he supply of apartments will be constant at some predetermined level. ♣

1.5 Market Equilibrium

At the price p^* the landlords' and the renters' behaviors are compatible in the sense that the number of apartments demanded by the renters at p^* is equal to the number of apartments supplied by the landlords. This is the equilibrium price in the market for apartments.

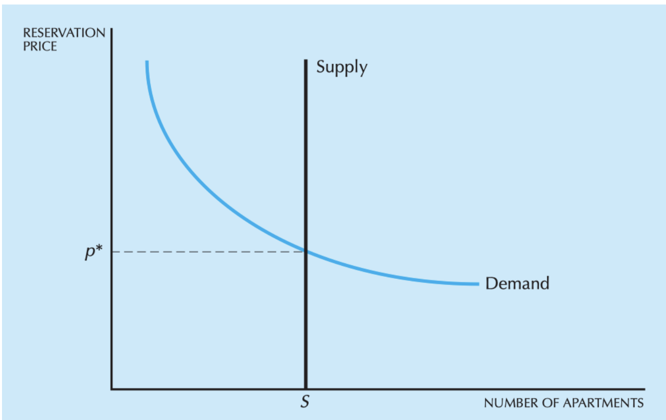

Figure 1.1: Equilibrium in the apartment market

1.6 Comparative Statics

Definition 1.6. Comparative Statics

Involves comparing two "static" equilibria without worrying about how the market moves from one equilibrium to another. ♣

1.7 Other Ways to Allocate Apartments

Definition 1.7. The Discriminating Monopolist

In renting the apartments the landlord could decide to auction them off one by one to the highest bidders. Since this means that different people would end up paying different prices for apartments, we will call this the case of the discriminating monopolist. ♣

Definition 1.8. The Ordinary Monopolist

Rent all apartments at a different price. ♣

Note $Max : pD(p)$

1.8 Rent Control

Definition 1.9. Rent Control

Impose a maximum rent that can be charged for apartments, say $p_m ax$. ♣

1.9 Pareto Efficiency

Definition 1.10. Pareto Efficiency

If we can find a way to make some people better off without making anybody else worse off, we have a Pareto improvement. If an allocation allows for a Pareto improvement, it is called Pareto inefficient; if an allocation is such that no Pareto improvements are possible, it is called Pareto efficient. ♣

1.10 Comparing Ways to Allocate Apartments

Note

- ***Competitive market and discriminating monopolist*** *is Pareto efficiency.*
- ***Ordinary monopolist and rent control*** *exists Pareto improvement.*

Chapter 2 Budget Constraints

Introduction

- Budget Constraints
- Properties of the Budget Set
- Opportunity Cost
- Tax, subsidies and rationing

In this chapter we will examine how to describe what a consumer can afford.

2.1 The Budget Constraint

Definition 2.1. Budget Constrain

$$p_1x_1 + p_2x_2 \leq m \tag{2.1}$$

♣

2.2 Properties of the Budge Set

We can rearrange the budget line in equation 2.1 to give us the formula

$$x_2 = \frac{m}{p_2} - \frac{p_1}{p_2}x_1 \tag{2.2}$$

$$\frac{\Delta x_2}{\Delta x_1} = -\frac{p_1}{p_2} \tag{2.3}$$

Note *This is the formula for a straight line with a vertical intercept of* $\frac{m}{p_2}$ *and a slope of* $-\frac{p_1}{p_2}$.

Definition 2.2. Opportunity Cost

In order to consume more of good 1 you have to give up some consumption of good 2. Giving up the opportunity to consume good 2 is the true economic cost of more good 1 consumption; and that cost is measured by the slope of the budget line.

♣

2.3 Taxes, Subsidies, and Rationing

2.3.1 Taxes

Definition 2.3. Quantity Tax

The consumer has to pay a certain amount to the government for each unit of the good he purchases, which changes the price of good from p to $p + t$. ♣

Definition 2.4. Value Tax

A value tax is usually expressed in percentage terms, which changes the price of good from p to $(1 + \tau)p$. ♣

2.3.2 Subsidies

Definition 2.5. Subsidies

A subsidy is the opposite of a tax. In the case of a quantity subsidy, the government gives an amount to the consumer that depends on the amount of the good purchased, which changes the price of the good from p to $p - s$ ♣

2.3.3 Rationing

Definition 2.6. Rationing

Governments also sometimes impose rationing constraints. This means that the level of consumption of some good is fixed to be no larger than some amount. ♣

Chapter 3 Preferences

Introduction

- Three axioms
- Indifference Curves
- Examples of Preferences
- The Marginal Rate of Substitution

3.1 Consumer Preferences

Proposition 3.1. Symbol of Preferences

- $\succ$: *one bundle is strictly preferred to another*
- $\sim$: *the consumer is indifferent between two bundles of goods*
- $\succeq$: *weakly prefer*

3.2 Assumptions about Preferences

Theorem 3.1. Three Axioms about Consumer Preferences

- ***Complete***: *Any two bundles can be compared*
- ***Reflexive***: *Any bundle is at least as good as itself*
- ***Transitive***: *If* $(x_1, x_2) \succ (y_1, y_2)$ *and* $(y_1, y_2) \succ (z_1, z_2)$, *then we assume that* $(x_1, x_2) \succ (z_1, z_2)$

3.3 Indifference Curves

Theorem 3.2. An important principle about indifference curves

indifference curves representing distinct levels of preference cannot cross.

Proof Indifference curves cannot cross. If they did, X, Y, and Z would all have to be indifferent to each other and thus could not lie on distinct indifference curves.

3.4 Examples of Preferences

3.4.1 Perfect Substitutes

Note *Perfect substitutes. The consumer only cares about the total number of pencils, not about their colors. Thus the indifference curves are straight lines with a slope of -1.*

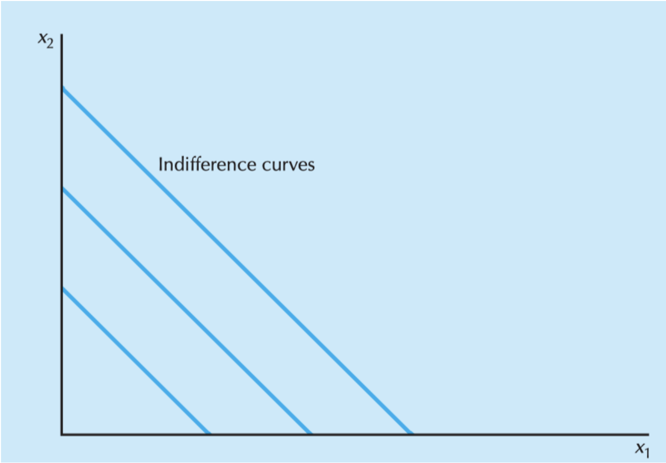

Figure 3.1: Perfect Substitutes

The important fact about perfect substitutes is that the indifference curves have a constant slope.

3.4.2 Perfect complements

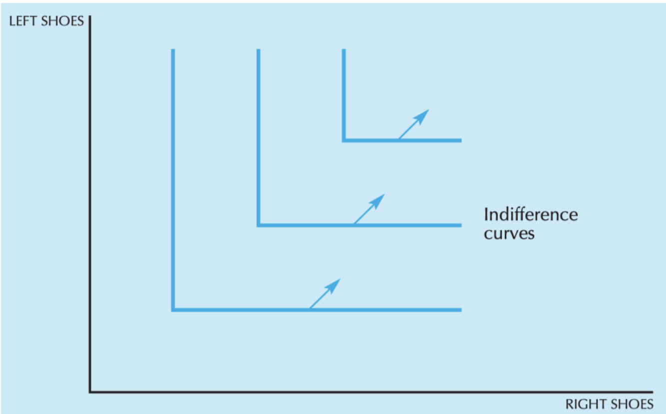

Figure 3.2: Perfect Complement

Note *Perfect complements. The consumer always wants to consume the goods in fixed proportions to each other. Thus the indifference curves are* ***L-shaped***.

3.4.3 Bads

Note *Here anchovies are a "bad" and pepperoni is a "good" for this consumer. Thus the indifference curves have a positive slope.*

3.4.4 Neutrals

Note *The consumer likes pepperoni but is neutral about anchovies, so the indifference curves are vertical lines.*

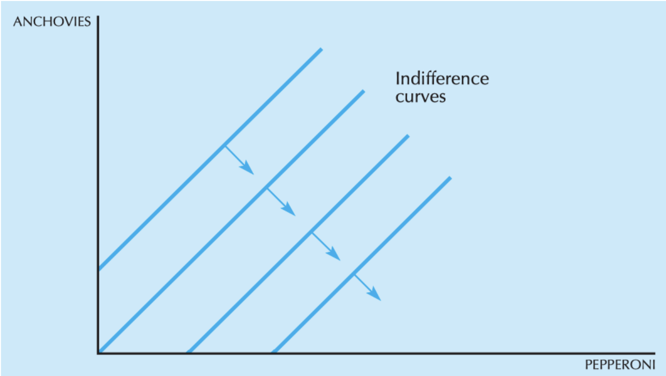

Figure 3.3: Bads

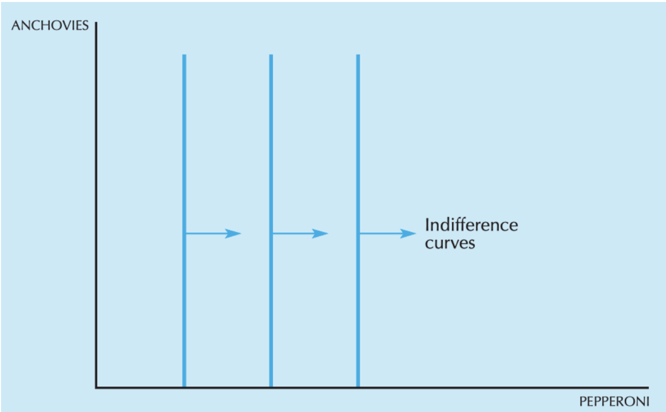

Figure 3.4: Neutral

3.4.5 Satiation

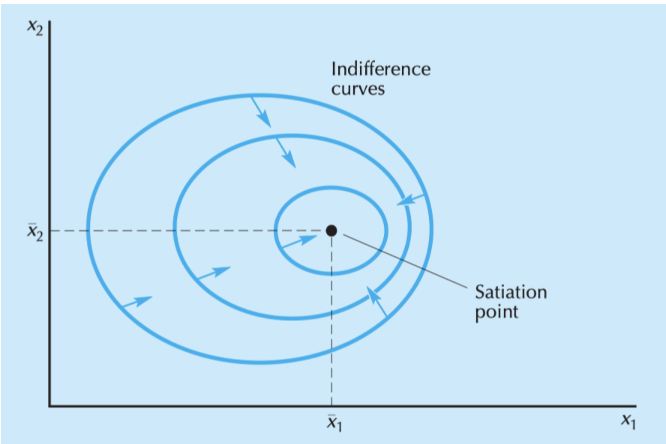

Figure 3.5: Sanitation

Note *The bundle* $(\bar{x}_1, \bar{x}_2)$ *is the satiation point or bliss point, and the indifference curves surround this point.*

3.4.6 Well Behaved Preferences

Proposition 3.2. Hypothesis of Well Behaved Preferences

- *monotonicity of preferences: more is better*
- *average are preferred to extremes: convex set*

♠

3.5 The Marginal Rate of Substitution

Definition 3.1. MRS

he slope of an indifference curve is known as the marginal rate of substitution (MRS). ♣

Note *Thus the slope of the indifference curve, the marginal rate of substitution, measures the rate at which the consumer is just on the margin of trading or not trading. At any rate of exchange other than the* MRS*, the consumer would want to trade one good for the other. But if the rate of exchange equals the* MRS*, the consumer wants to stay put.*

Theorem 3.3. diminishing marginal rate of substitution

This means that the amount of good 1 that the person is willing to give up for an additional amount of good 2 increases the amount of good 1 increases. ♡

Note *Stated in this way, convexity of indifference curves seems very natural: it says that the more you have of one good, the more willing you are to give some of it up in exchange for the other good. (But remember the ice cream and olives example—for some pairs of goods this assumption might not hold!)*

Chapter 4 Utility

Introduction

- Cardinal Utility
- Marginal Utility
- MRS

Definition 4.1. Utility Function

A utility function is a way of assigning a number to every possible consumption bundle such that more-preferred bundles get assigned larger numbers than less-preferred bundles.

Definition 4.2. Ordinal Utility

Emphasis on ordering bundles of goods

Theorem 4.1. monotonic transformation

a monotonic transformation of a utility function is a utility function that represents the same preferences as the original utility function.

Note *Seen from this point of view a monotonic transformation is just a relabeling of indifference curves.*

As long as indifference curves containing more-preferred bundles get a larger label than indifference curves containing less-preferred bundles, the labeling will represent the same preferences

4.0.1 Cardinal Utility

Definition 4.3. Cardinal Utility

Theories of utility that attach a significance to the magnitude of utility.

Note *Since cardinal utility isn't needed to describe choice behavior and there is no compelling way to assign cardinal utilities anyway, we will stick with a purely ordinal utility framework.*

4.1 Some Examples of Utility Function

4.1.1 Perfect Substitute

Remember the red pencil and blue pencil example? All that mattered to the consumer was the total number of pencils.

$$u(x_1, x_2) = ax_1 + bx_2 \tag{4.1}$$

Note *Here a and b are some positive numbers that measure the "value" of goods 1 and 2 to the consumer. Note that the slope of a typical indifference curve is given by* $-\frac{a}{b}$.

4.1.2 Perfect Complements

This is the left shoe–right shoe case. In these preferences the consumer only cares about the number of pairs of shoes he has, so it is natural to choose the number of pairs of shoes as the utility function

$$u(x_1, x_2) = min\{ax_1, bx_2\} \tag{4.2}$$

Note *where a and b are positive numbers that indicate the proportions in which the goods are consumed.*

4.1.3 Quasilinear Preferences

$$u(x_1, x_2) = k = v(x_1) + x_2 \tag{4.3}$$

Note *Quasilinear utility functions are not particularly realistic, but they are very easy to work with.*

Each indifference curve is a vertically shifted version of a single indifference curve.

4.1.4 Cobb-Douglas Preference

$$u(x_1, x_2) = x_1^c x_2^d \tag{4.4}$$

Note *Cobb-Douglas indifference curves look just like the nice convex monotonic indifference curves that we referred to as "well-behaved indifference curves"*

Of course a monotonic transformation of the Cobb-Douglas utility function will represent exactly the same preferences, and it is useful to see a couple of examples of these transformations.

We can always take a monotonic transformation of the Cobb-Douglas utility function that make the exponents sum to 1.

4.2 Marginal Utility

$$MU_1 = \frac{\Delta U}{\Delta x_1} = \frac{u(x_1 + \Delta x_1, x2) - u(x_1, x_2)}{\Delta x_2} \tag{4.5}$$

Note *It is important to realize that the magnitude of marginal utility depends on the magnitude of utility. Thus it depends on the particular way that we choose to measure utility.*

4.3 Marginal Utility and MRS

$$MU_1 \Delta x_1 + MU_2 \Delta x_2 = \Delta U = 0 \tag{4.6}$$

$$MRS = \frac{\Delta x_2}{\Delta x_1} = -\frac{MU_1}{MU_2} \tag{4.7}$$

Note *The ratio of marginal utilities is independent of the particular transformation of the utility function you choose to use.*

Chapter 5 Choice

In this chapter we will put together the budget set and the theory of preferences in order to examine the optimal choice of consumers.

Introduction

- Optimal Choice
- Cobb-Douglas Demand Functions

5.1 Optimal Choice

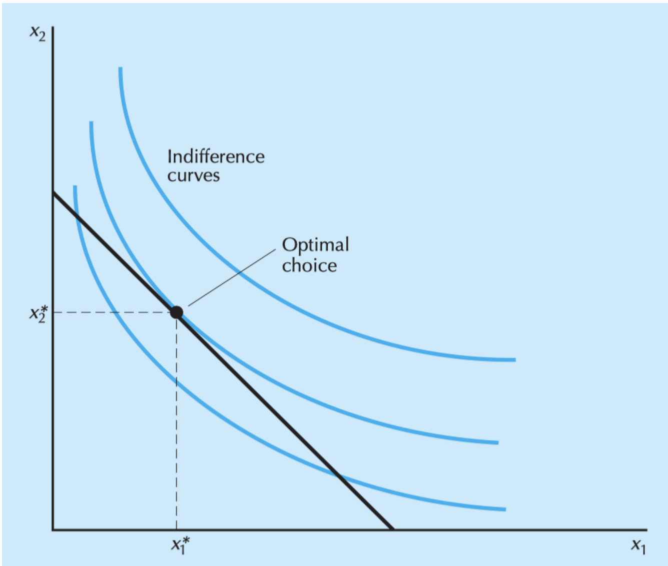

Figure 5.1: Optimal choice

Note *The optimal consumption position is where the indifference curve is* ***tangent*** *to the budget line.*

$$MRS = -\frac{p_1}{p_2} \tag{5.1}$$

5.2 Some Examples

5.2.1 Perfect Substitutes

The case of perfect substitutes is illustrated in Figure 5.2. We have three possible cases.

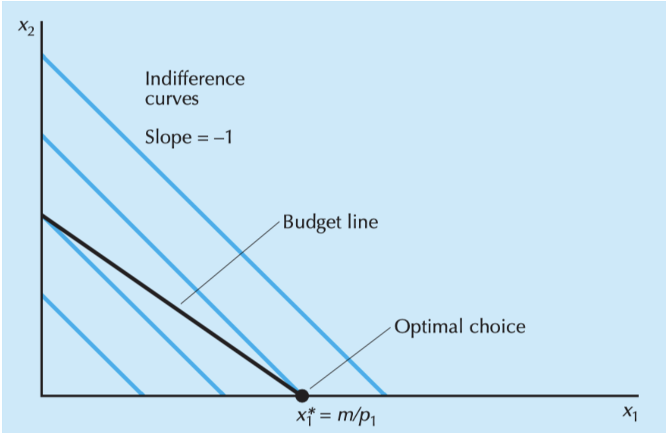

Figure 5.2: Optimal choice with perfect substitutes

$$x_1 = \begin{cases} \frac{m}{p_1} & when\ p_1 < p_2 \\ \text{any number between 0 and } \frac{m}{p_1} & when\ p_1 = p_2 \\ 0 & when\ p_1 > p_2 \end{cases}$$

Note *Optimal choice with perfect substitutes. If the goods are perfect substitutes, the optimal choice will usually be on the boundary.*

5.2.2 Perfect Complements

The case of perfect complements is illustrated in Figure 5.3.

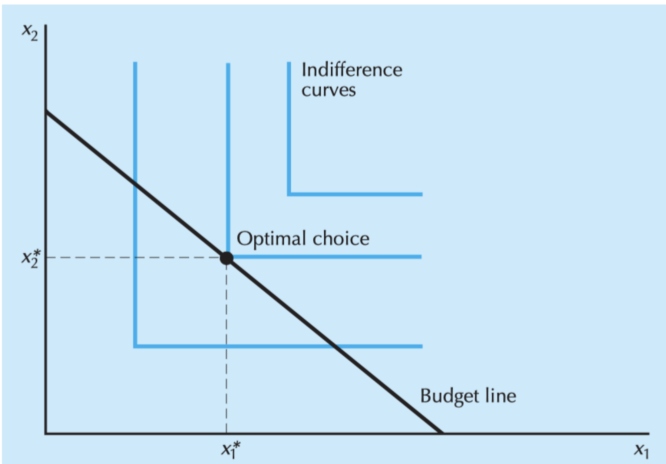

Figure 5.3: Optimal choice with perfect complements

Note *If the goods are perfect complements, the quantities demanded will always lie on the diagonal since the optimal choice occurs where x_1 equals x_2.*

5.2.3 Neutral and Bads

In the case of a neutral good the consumer spends all of her money on the good she likes and doesn't purchase any of the neutral good. The same thing happens if one commodity is a bad.

5.2.4 Cobb-Douglas Preferences

$$x_1 = \frac{c}{c+d}\frac{m}{p_1} \tag{5.2}$$

$$x_2 = \frac{d}{c+d}\frac{m}{p_2} \tag{5.3}$$

Note *Thus the Cobb-Douglas consumer always spends a fixed fraction of his income on each good. The size of the fraction is determined by the exponent in the Cobb-Douglas function.*

This is why it is often convenient to choose a representation of the Cobb-Douglas utility function in which the exponents sum to 1. If $u(x_1, x_2) = x_1^a x_2^{1-a}$*, then we can immediately interpret a as the fraction of income spent on good 1.*

Chapter 6 Demand

Introduction

- Giffen Goods
- Engel Curve
- Demand Curve
- Income Offer Curve
- Price Offer Curve

Definition 6.1. Demand Function

The consumer's demand functions give the optimal amounts of each of the goods as a function of the prices and income faced by the consumer. We write the demand functions as:

$$x_1 = x_1(p_1, p_2, m) \tag{6.1}$$

6.1 Normal and Inferior Goods

Definition 6.2. Normal and Inferior Goods

when $\frac{\Delta x_1}{\Delta m} > 0$*, such a good is called an normal good.*
when $\frac{\Delta x_1}{\Delta m} < 0$*, such a good is called an inferior good.*

6.2 Income Offer Curve and Engel Curves

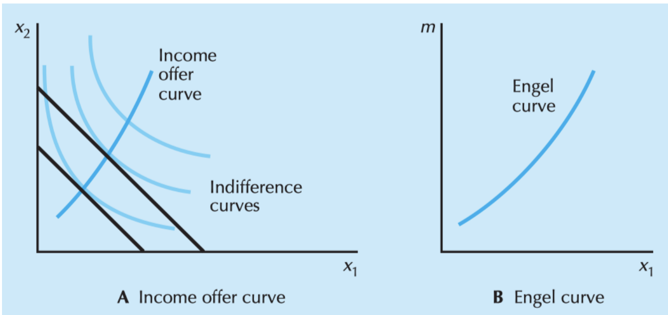

Figure 6.1: Income offer curve and Engel curve

Note *The income offer curve (or income expansion path) shown in panel A depicts the optimal choice at different levels of income and constant prices. When we plot the optimal choice of good 1 against income, m, we get the Engel curve, depicted in panel B.*

6.3 Ordinary Goods and Giffen Goods

Definition 6.3. Giffen Good

Demand for it decreases when its price decreases. ♣

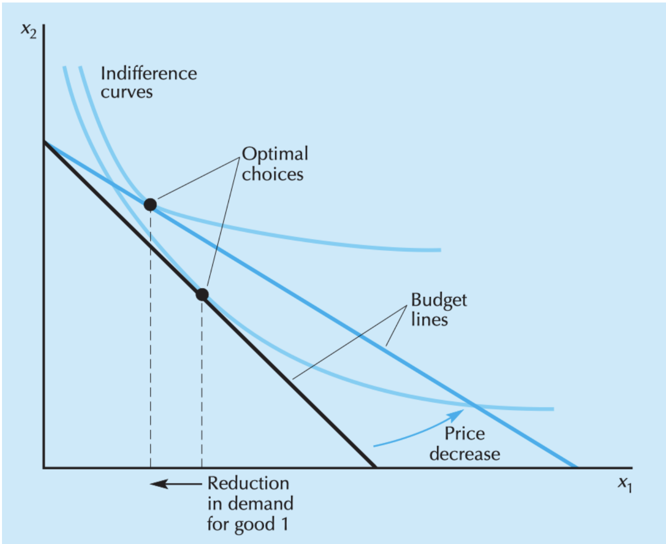

Figure 6.2: A Giffen good

6.4 The Price Offer Curve and the Demand Curve

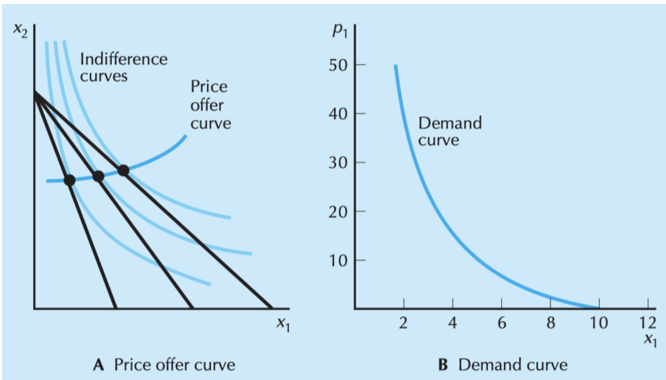

Figure 6.3: The price offer curve and demand curve

Note *Panel A contains a price offer curve, which depicts the optimal choices as the price of good 1 changes. Panel B contains the associated demand curve, which depicts a plot of the optimal choice of good 1 as a function of its price.*

Chapter 7 Revealed Preference

Introduction

- The Principle of Revealed Preference
- Weak Axiom of Revealed Preference (WARP)
- Strong Axiom of Revealed Preference (SARP)
- Paasche quantity index
- Laspeyres quantity index

Theorem 7.1. The Principle of Revealed Preference

Let (x_1, x_2) be the ***chosen bundle*** *when prices are (p_1, p_2), and let (y_1, y_2) be some other bundle such that $p_1x_1 + p_2x_2 \geq p_1y_1 + p_2y_2$. Then if the consumer is choosing the most preferred bundle she can afford, we must have $(x_1, x_2) \succ (y_1, y_2)$.*

Note *When you first encounter this principle, it may seem circular. If X is revealed preferred to Y , doesn't that automatically mean that X is preferred to Y ? The answer is no. "Revealed preferred" just means that X was chosen when Y was affordable; "preference" means that the consumer ranks X ahead of Y . If the consumer chooses the best bundles she can afford, then "revealed preference" implies "preference," but that is a consequence of the model of behavior, not the definitions of the terms.*

Theorem 7.2. Weak Axiom of Revealed Preference (WARP)

If (x_1, x_2) is directly revealed preferred to (y_1, y_2), and the two bundles are not the same, then it cannot happen that (y_1, y_2) is directly revealed preferred to (x_1, x_2) .

Note *In other words, if a bundle (x_1, x_2) is purchased at prices (p_1, p_2) and a different bundle (y_1, y_2) is purchased at prices (q_1, q_2), then if*

$$p_1x_1 + p_2x_2 \geq p_1y_1 + p_2y_2 \tag{7.1}$$

it must ***not*** *be the case that*

$$q_1y_1 + q_2y_2 \geq q_1x_1 + q_2x_2 \tag{7.2}$$

Theorem 7.3. Strong Axiom of Revealed Preference (SARP)

If (x_1, x_2) is revealed preferred to (y_1, y_2) (either directly or indirectly) and (y_1, y_2) is different from (x_1, x_2), then (y_1, y_2) cannot be directly or indirectly revealed preferred to (x_1, x_2) .

Definition 7.1. Paasche quantity index

$$P_q = \frac{p_1^t x_1^t + p_2^t x_2^t}{p_1^t x_1^b + p_2^t x_2^b} \tag{7.3}$$

♣

Definition 7.2. Laspeyres quantity index

$$L_q = \frac{p_1^b x_1^t + p_2^b x_2^t}{p_1^b x_1^b + p_2^b x_2^b} \tag{7.4}$$

♣

Chapter 8 Slutsky Equation

In this chapter, we will break the price movement into two steps: first we will let the relative prices change and adjust money income so as to hold purchasing power constant, then we will let purchasing power adjust while holding the relative prices constant.

Introduction

- ❏ Substitution Effect
- ❏ Income Effect

8.1 The Substitution Effect

Definition 8.1. Substitution Effect

The change in demand due to the change in the rate of exchange between the two goods.

$$\Delta x_1^s = x_1(p_1', m') - x_1(p_1, m) \tag{8.1}$$

♣

8.1.1 Sign of the Substitution Effect

The change in the demand for the good due to the substitution effect must be nonnegative. That is, if $p_1 > p$, then we must have $x_1(p_1, m') \geq x_1(p_1, m)$, so that $\Delta x_1^s \geq 0$.

8.2 The Income Effect

Definition 8.2. Income Effect

The change in demand due to having more purchasing power.

$$\Delta x_1^n = x_1(p_1', m) - x_1(p_1', m') \tag{8.2}$$

♣

8.3 The Total Change in Demand

$$\Delta x_1 = \Delta x_1^s + \Delta x_1^n \tag{8.3}$$

Note *Note carefully the sign on the income effect. Since we are considering a situation where the price rises, this implies a decrease in purchasing power—for a normal good this will imply a decrease in demand.*

On the other hand, if we have an inferior good, it might happen that the income effect outweighs the substitution effect, so that the total change in demand associated with a price increase is actually positive.

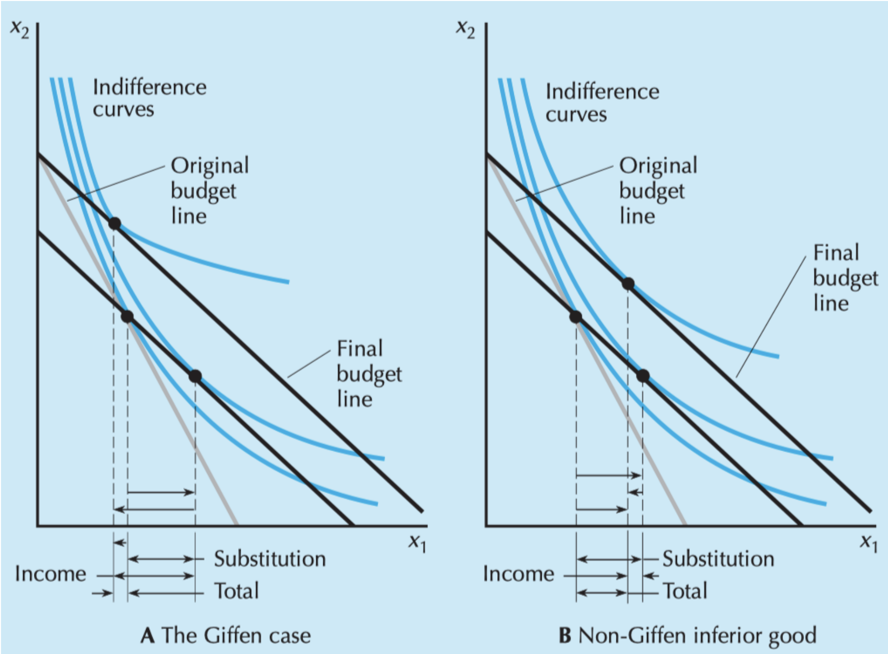

Figure 8.1: Inferior goods

Chapter 9 Buying and Selling

Introduction

❑

Definition 9.1. endowment

Endowment is how much of the two goods the consumer has before he enter the market, which denotes by (ω_1, ω_2) .

Note *Gross demand:* (x_1, x_2) *Net demand:* $(x_1 - \omega_1, x_2 - \omega_2)$

9.1 The Budget Constraint

The first thing we should do is to consider the form of the budget constraint.

$$P_1 x_1 + p_2 x_2 = p_1 \omega_1 + p_2 \omega_2 \tag{9.1}$$

Note *the equation above illustrates that the value of the bundle of goods that she goes home with must be equal to the value of the bundle of goods that she came with.*

Also, we could transfer this formula into other forms:

$$p_1(x_1 - \omega_1) + p_2(x_2 - \omega_2) = 0 \tag{9.2}$$

Note *if* $x_1 - \omega_1$ *is positive, we say the consumer is net buyer or net demander of good 1.*

if $x_1 - \omega_1$ *is negative, we say the consumer is net seller or net supplier.*

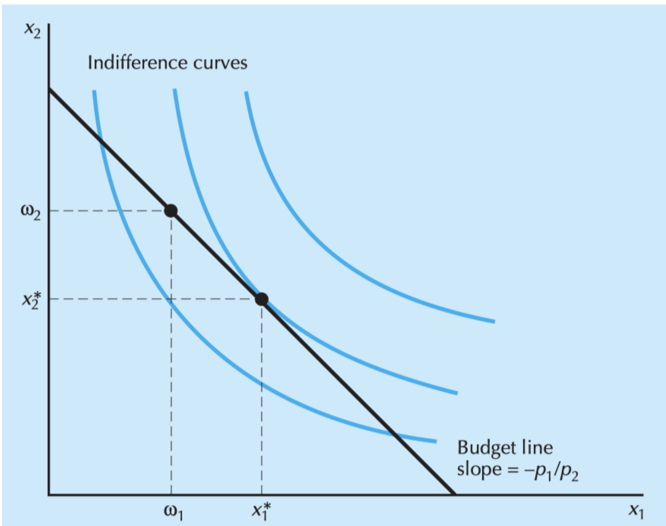

Figure 9.1: The budget line

Note

- *The endowment is always on the budget line.*

- *In the figure 9.1, $x_1^* > \omega_1$, so the consumer is a net buyer of good 1.*

9.2 Price Changes

if the price of good 1 decreases, we know that the budget line becomes flatter. Since the endowment bundle is always affordable, this means that the budget line must pivot around the endowment.

We can therefore conclude that if the price of a good that a consumer is selling goes down, and the consumer decides to remain a seller, then the consumer's welfare must have declined.

However, What if the price of a good that the consumer is selling decreases and the consumer decides to switch to being a buyer of that good? In this case, the consumer may be better off or she may be worse off: there is no way to tell.

Now, let's turn to the case when the person is a net buyer initially!

we can say something for sure: the consumer will continue to be a net buyer of good 1: she will not switch to being a seller.

9.3 The Slutsky Equation Revisited

In this part, the Slutsky Equation will decomposed the change in demand due to a price change into three parts. The first two parts: substitution effect and ordinary income effect were described before. Now, we will turn to the third part: endowment income effect.

Definition 9.2. endowment income effect

When the price of a good changes, it changes the value of your endowment and thus changes your money income. ♣

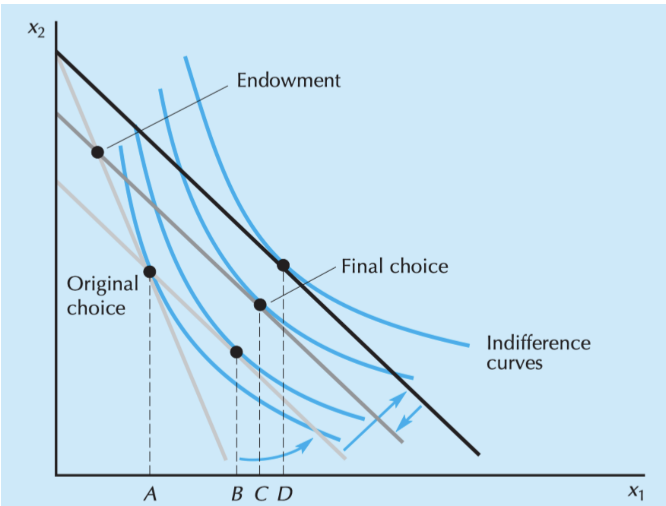

Figure 9.2: The Slutsky equation revisited

Note *For example, if you are a net supplier of a good, then a fall in its price will reduce your* *money income directly since you won't be able to sell your endowment for as much money as you could before.*

Note *Breaking up the effect of the price change into the substitution effect (A to B), the ordinary income effect (B to D), and the endowment income effect (D to C).*