Student's Handbook Guide to ECON 281
Intermediate Microeconomic Theory I

A student's guide to the complex theory of consumer behavior, production, and market structures

The theory of consumer behavior; theory of production and cost; price and output determination under competition, monopoly and other market structures.

Disclaimer: The following information does not contain any knowledge on how a Red Dragon grows and maintain its horde. One can consider their tactics of slavery, tyrannical governance, elimination of rivals, terrorism, or anything a dick would do to be a valid guess. However, in order to avoid being roasted by Bahamut this information will not be discussed any further.

Contents

Chapter 1: Introduction

We get it you like money.

Chapter 2: Demand and Supply Analysis

In this chapter we will review demand and supply, market equilibrium shifts in D and S, and elasticities.

Demand

The demand curve is a function like so:

$$Q{\cdot}d_x = f(P_x, P_y, I, tastes, \#buyers, taxes, subsidiaries)$$

Where:

Variable	Represent	Relation to $Q \cdot d_x$
P_x	Price of x	Negative
P_y	Price of related goods	Negative if complement, Positive if substitute
I	Income	Positive if Normal, Negative if Inferior
$tastes$	Buyers taste	Positive
$\#buyers$	Numbers of buyers in the market	Positive
$taxes$	Government taxes	Negative
$subsidiaries$	Government Subsidiaries	Positive

Only P_x will movement along the $! \cdot d_x$ curve, all other inputs will shift the curve left or right if the relation is negative or positive respectively.

To study the effect of one particular factor on $Q \cdot d$ we need to keep other factors constant "ceterius paribus" to isolate their effect.

Definition 2.0.1. Choke Price

Is the price where the quantity demanded is 0. Basically it is the y-intercept of the demand curve.

Law of Demand

There is a **negative** relation between P and $Q{\cdot}d$, assuming that all other factors are kept constant.

A change in $Q \cdot d$ is a movement from one point to another point on the same demand curve. This is only caused by the change in the product's own price. A change in demand is the shift of the whole demand curve either by shifting left or right for a decrease or increase of the demand respectively. This is caused by the change in other factors other than the product's own price.

Demand can be used for two different sources

1. **Direct** - We demand the good to use it directly.
2. **Derived** - We demand the good to use it to produce something else as an intermediate product like we buy paper to make a book.

Market Demand

This is the demand for all consumers the formula can be written like so

$$Q_m(P) = \sum_{i \in C} Q_i(P)$$

Where

Variable	What they mean
Q_m	Quantity demand for the market
P	Price
C	Set of all consumers

Supply

The Supply curve is a function like so:

$$Q{\cdot}S_x = f(P_x, P_{inputs}, Technology, Taxes, Subsidiaries, \#sellers, W$$

Where

Variable	Represent	Relation
P_x	Price of x	Positive
P_{inputs}	The price for input to create x	Negative
$Technology$	The technology used to produce x	Positive
$Taxes$	Taxes on x	Negative
$Subsidiaries$	Subsidiaries on x	Positive
$\#sellers$	The number of sellers	Positive
$Weather$	The weather to produce the product if affected	Positive
P_e	The expected future price of x	Negative

Only P_x will causes a movement along the supply curve or the quality supplied. All the other factors will shift the supply curve left or right for a decrease or increase in supply respectively.

Equilibrium

In a free market with no government intervention the equilibrium price will be the intersection where the supply and demand curves meet. If $q \cdot d < Q \cdot s$ then there is an excess of supply. If $Q \cdot d > Q \cdot s$ then there is a shortage of supply. The equilibrium of Price and Quantity are caused by endogenous factors while factors that shift the curves are caused by exogenous factors.

Comparative Static analysis

What happens to P and Q "endogenous factors" when there is a shift in D or S due to exogenous factors.

Shifts in P and Q

Any shift in D or S will affect both **P** and **Q**. You can do it yourself to check. However, if both P and Q shift then any one of three things can happen to one of the output factors (P and Q).

- The affect value increases
- The affect value decreases
- The affect value stays the same

In general a shift in both curve will guarantee a movement of one value but an indeterminate movement in the other.

Elasticity

Elasticity is a measure of sensitivity of the response of quality demanded from a change in price. There are three types of elasticity for a product, they are:

1. Price elasticity of demand
2. Cross elasticity of demand
3. income elasticity of demand

Price elasticity of demand

Price elasticity of demand

It measures how sensitive the response of $q \cdot d$ to the change in the product's own price, other factors kept constant.

$$\varepsilon_{Q \cdot p} = \frac{\%\Delta Q \cdot d}{\%\Delta P} = \frac{\Delta Q}{\Delta P} * \frac{P}{Q}$$

For the point formula or

$$\frac{\Delta Q}{\Delta P} * \frac{P_1 + P_2}{Q_1 + Q_2}$$

For the arc or average formula.

- You use the point formula at a point on the supply or demand curve e.g., equilibrium point.
- You use the arc or average formula if you are using two points and want to find the elasticity between those two points. ΔQ and ΔP are found from the table and not from the equation necessarily.

Income elasticity of demand

Income elasticity of demand

It measures how sensitive the response of $q \cdot d$ to changes in income, other factors kept constant.

$$\varepsilon_I = \frac{\%\Delta Q \cdot d_x}{\%\Delta I} = \frac{\Delta Q}{\Delta I} * \frac{I}{Q}$$

For the point formula or

$$\frac{\Delta Q}{\Delta I} * \frac{I_1 + I_2}{Q_1 + Q_2}$$

For the arc or average formula.

If the sign is **negative** then the good is inferior, and if the sign is **positive** then the good is normal.

Cross elasticity of demand

Cross elasticity of demand

It measures how sensitive the response of $q \cdot d$ to the change in the price of another related good, other factors kept constant.

$$\varepsilon_y = \frac{\%\Delta Q_x}{\%\Delta P_y} = \frac{\Delta Q_x}{\Delta P_y} * \frac{P_y}{Q_x}$$

For the point formula or

$$\frac{\Delta Q_x}{\Delta P_y} * \frac{P_{1y} + P_{2y}}{Q_{1x} + Q_{2x}}$$

For the arch or average formula.

If the sign is **positive** then the related good is a substitute and if the sign is **negative** then the related good is a complement, if the sign is 0 then the good is unrelated.

Constant price elasticity of demand

A demand curve with a constant ε_Q then the demand curve has the following equation:

$$Q = \frac{A}{P^b}$$

Where A and b are constants.

Factors that determines elasticity for demand

There are multiple factors that affects the elasticity for demand.

1. **Time period**: In the short run you have less time to find cheaper alternatives so the elasticity is much lower compared to the long run.

2. **Availability of substitutes**: If the goods have many substitutes then it is more elastic then if a good has less substitutes.

3. **Price of the product (Assume straight demand curve)**: The higher the price of the product the more elastic it is because a larger portion of income is spent on the good.

4. **Fraction of income spent**: If a small fraction of income is spent on the good then it is more inelastic if compared to spending a lot more of the income on the good.

5. **Definition of the product**: Demand for broadly defined products is less elastic than narrowly defined items because of the available substitutes.

Note

The reason why price of the product will affect elasticity is because the second term $\frac{P}{Q}$ will increase while the slope of the demand curve is fixed ($\frac{\Delta Q}{\Delta P}$). Increasing the price will increase the elasticity.

Price elasticity of supply

Price elasticity of supply

It measures how sensitive the response $Q \cdot s$ to the change in the product's own price, other factors kept constant.

$$\varepsilon_s = \frac{\%\Delta Q}{\%\Delta P} = \frac{\Delta Q}{\Delta P} * \frac{P}{Q}$$

For the point formula or

$$\frac{\Delta Q}{\Delta P} * \frac{P_1 + P_2}{Q_1 + Q_2}$$

For the arc or average formula.

The sign for this elasticity is always positive unlike the demand elasticity for price.

The Range of elasticity

The range of elasticity is $\varepsilon \in \mathbb{R}^+$ i.e., $[0, \infty]$. Where

Range	Elasticity
0	Perfectly Inelastic
$0 < \varepsilon 1$	Inelastic
1	Unit Elastic
$1 < \varepsilon \infty$	Elastic
∞	Perfectly Elastic

Relationship between P, Total Revenue and Elasticity of Demand

With regards to total revenue and elasticity there are five possible scenarios of total revenue:

Elasticity	Change in Total Revenue
Perfectly Inelastic	Positive relation between P and TR, the % change in TR is the same as P
Inelastic	Positive relation between P and TR , less of an increase in TR as in the Perfectly Inelastic case but still an increase
Unit Elastic	No change in TR for either case because a change in P causes an equal and opposite change in Q
Elastic	Negative relation between P and TR
Perfectly Elastic	Negative relation between P and TR, any change in P leads TR to 0

In general a smart seller should increase price if the product is inelastic while decreasing the price if the product is elastic.

Chapter 3: Consumer Preferences and Utility

Definition 3.0.1. Utility

Satisfaction that you get from consuming a certain basket or bundle or combinations of goods.

There are multiple ways to measure utility:

- **Cardinal approach** Assume we can measure utility in **utiles**; a unit of measuring utility. We can measure this by using a table of values that contains Q, and T_u.
- **Ordinal approach** If we cannot measure utility but can rank the different bundles from the least to the most preferred. We can show these different ranks of utilities from an indifference curve.

Definition 3.0.2. Preference

Indicates how a consumer rank different bundles.

These preferences have certain properties:

1. *They are complete AKA they must have an order function to rank these bundles, Note the ranking also includes indifference meaning both bundles are equally preferable.*
2. *Transitive or logical ranking i.e., $A > B$ and $B > C \rightarrow A > C$.*
3. *More is better than less, the goods that we study are economic goods not economic bads or regression.*

Indifference curve

Definition 3.0.3. Indifference Curve

Shows the different combinations (bundles) of any two goods that give the consumer the same level of utility.

Along the same indifference curve, the level of utility is constant.

The farther the curve is to the right and up the higher the overall amount of utility.

We use the indifference curve to show ordinal utility of bundles.

Notice that the indifference curve is negatively slope. For consumers with a fixed level of utility there can only be trade-offs between one good or another. When the consumer make a single unit of trade-off between two goods it is called the **Marginal Rate of Substitution** or **MRS** which is the slope of the indifference curve at a given combinations of goods.

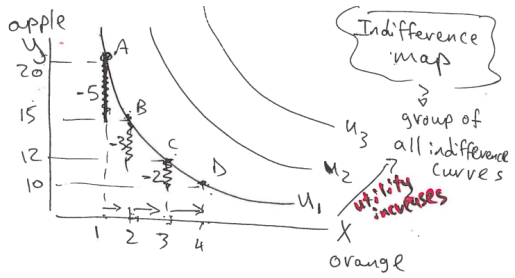


Figure 3.1: Indifference Curve

MRS Equations

$$MRS_{xy} = \frac{-\Delta y}{\Delta x} = -\frac{M_{ux}}{M_{uy}} \tag{3.1}$$

or another way to understand is how much to give up y to gain a single x.

$$MRS_{yx} = \frac{-\Delta x}{\Delta y} = -\frac{M_{uy}}{M_{ux}} \tag{3.2}$$

this is the inverse of the previous equation. How much to give up x to gain a single y.

The best way to understand either form of MRS is to look at the order of the subscripts. The first good is what you want to gain and the second is what you have to give up.

Law of diminishing MRS

The consumer is ready to give up less and less from one of the goods to get an extra unit from the other. That is why the difference curves are convex to the origin.

Note

Indifference curves cannot intersect between each other, if they do they violate the transitivity rule of preferences. Nor can they be thick because you can have a one combination of goods with a higher overall quantity but have the same utility as another combination of goods with a lower overall quantity.

Cobb-Douglas Utility Function

This is a utility function based on the following form

$$u = Ax^{\alpha}y^{\beta} \tag{3.3}$$

where A, α, and β are constant numbers

The Marginal Rate of Substitution using the Cobb-Douglas function is do

$$MRS_{XY} = \frac{M_{ux}}{M_{uy}} = \frac{Y}{x} \tag{3.4}$$

$$MRS_{YX} = \frac{M_{uy}}{M_{ux}} = \frac{X}{Y} \tag{3.5}$$

Shape of different indifference curves

There are many different shapes or classes of indifference curves

Cobb-Douglas

This is based on the convex to origin curve as shown in fig. 3.1. The MRS is diminishing.

Perfect Complements

The indifference curve is L-shaped the two goods must be used together in fixed proportion. The MRS is 0 as the consumer cannot substitute gone good for the other good.

$$u = A \min(ax, by) \tag{3.6}$$

This function is called the Leoutief utility function where a and b are the proportions by which good x and y are used.

Perfect Substitute

Consumers consume any of the two goods or a combinations of both, the MRS constant throughout the entire indifference curve.

$$U = ax + by \tag{3.7}$$

This is called the linear utility function.

Quasilinear Utility Function

This utility function has a linear component for one good and a non-linear component for the other. The MRS is not constant. Example:

$$u = x + \ln y$$

There are many functional forms for this utility function.

Chapter 4: Consumer Choice

Budget Line

Definition 4.0.1. Budget Line

Shows the different bundles from any two goods that the consumer can buy if they use all their income.

*The **Budget Line** has a negative slope. Since your income is fixed, to get more of one good, you must buy less from the other good.*

$$P_X \cdot X + P_Y \cdot Y = I$$

Where I is income, P_X is the price of X, P_Y is the price of Y. Both X and Y are the quantities of X and Y respectively.

Definition 4.0.2. Budget Constraint

Set "group" of all feasible bundles

Definition 4.0.3. Slope of Budget Line

$$\text{Slope of budget line} = -\frac{P_X}{P_Y}$$

Note that the budget line is negative.

Shifts in the B.L

If Income, or the price of X and Y changes by the same percentage then the shift is parallel. A increase in I, or a decrease in both prices by the same % will lead to a rightward shift. While a decrease in I, or a increase in both prices by the same % will lead to a leftward shift.

If both income and both prices increases by the same % then the budget line stays the same.

If the price of one good increases then the budget line's intercept will change along the axis of that good (X or Y). A decrease in price will move the intercept away from the origin while a increase in price will move the intercept towards the origin.

Consumer Equilibrium

The main objective of a consumer is to maximize their utility with their budget.

Definition 4.0.4. Interior Solution

Consumer buys a combination of both X and Y.

The consumer's expenditure minimization problem results in the same optimal basket as the consumer's utility maximization problem if the required level of utility for the expenditure minimizer is the same as the maximized utility for the utility maximizer.

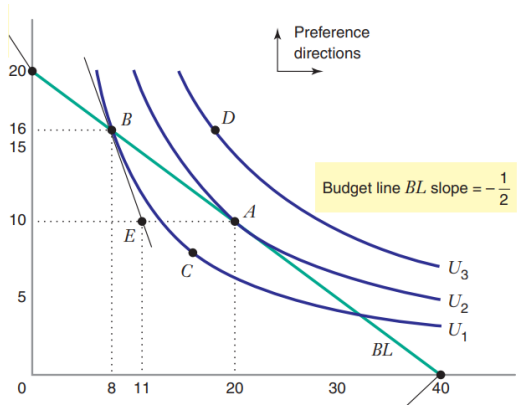


Figure 4.1: Budget line with Indifference Curve

Utility is maximized at the pint where the B.L is tangent to the indifference curve. That means the slope of the budget line is equal to the slope of the indifference curve

$$\frac{P_X}{P_Y} = \frac{MU_X}{MU_Y} \rightarrow \frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

The second equation normalizes the marginal utility with price.

Equilibrium happens when B.L is tangent to the indifference curve not when it intersect it.

In the fig. 4.1 B is feasible but only A is tangent to the highest utility indifference curve.

Moving towards equilibrium

Suppose that:

$$\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$$

this means that you will get more marginal utility of X per dollar or unit of cost than Y. Therefore you would buy or consume more of X and buy or consume less of Y. This continues until

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

Algorithms for Consumer Choice

Cobb-Douglas

1. Find MU_X and MU_Y by doing the derivative
2. Find $MRS_{XY} = \frac{MU_X}{MU_Y}$
3. Find the equilibrium $\frac{P_X}{P_Y} = \frac{MU_X}{MU_Y}$
4. Rearrange so you solve for X or Y
5. Substitute that equation into the B.L
6. Find the best quantity for the other good not used in 4.
7. Find the best quantity for the other good not used in 6.
8. You can find the utility value here as well.

Perfect Complements or Leontief

1. Isolate for X or Y from the function $aX = bY$ from $U = \min(aX, bY)$
2. Substitute that equation into the B.L
3. Find the best quantity for the other good not used in 1.
4. Find the best quantity for the other good not used in 3.
5. You can find the utility value here as well.

Perfect Substitutes or Linear

1. Find MU_X and MU_Y by doing the derivative
2. $\frac{MU_X}{P_X}$ and $\frac{MU_Y}{P_Y}$
3. If $\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$ buy only X $X = \frac{I}{P_X}$
4. If $\frac{MU_X}{P_X} < \frac{MU_Y}{P_Y}$ buy only Y $Y = \frac{I}{P_Y}$
5. If $\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$ buy any
6. From here you can get the maximum utility.

Derivation of Demand Function

The demand function is in the form

$$X = \frac{I}{aP_X}$$

or

$$Y = \frac{I}{aP_Y}$$

Income normal or inferior

To determine if a good is normal or inferior one just needs to find the sign of the derivative of the demand function $\frac{\partial X}{\partial I}$ or $\frac{\partial Y}{\partial I}$. If the sign is **Positive** then the good is normal if **Negative** then the good is inferior.

Substitutes or Complements

To determine if a good is a substitute or a complement of another good you can replace I with P_Y $\frac{\partial X}{\partial P_Y}$ or P_X $\frac{\partial Y}{\partial P_X}$. If the sign is **Positive** then the goods are substitutes if they are **Negative** the goods are complements. If they are 0 then the goods are unrelated.

Demand Curve in Case of Corner Solution

For the corner solution case the demand curves are of a piecewise function.

Let

$$A = \frac{MU_X \cdot P_Y}{MU_Y}$$

and

$$B = \frac{MU_Y \cdot P_X}{MU_X}$$

$$Q \cdot d_X = \begin{cases} 0 & P_X > A \\ \frac{I}{P_X} & P_X < A \end{cases}$$

$$Q \cdot d_Y = \begin{cases} 0 & P_Y > B \\ \frac{I}{P_Y} & P_Y < B \end{cases}$$

Composite Good

So far we assumed we have 2 goods X and Y. Now we will introduce a new type of good which is called **Composite Good** which is the expenditure on all other goods.

Price of Composite Good

The price of a composite good is **always** 1.

Application of Consumer Choice

Joining a Club

Enables the consumer to buy the good or service at a discounted rate after paying for a flat fee membership.

Determining if it's worth it

You find the budget line with and without the membership remembering to take out the cost of the membership from I for the membership B.L. Check the slopes of the two B.L and you can determine if the membership is worth it to the consumer.

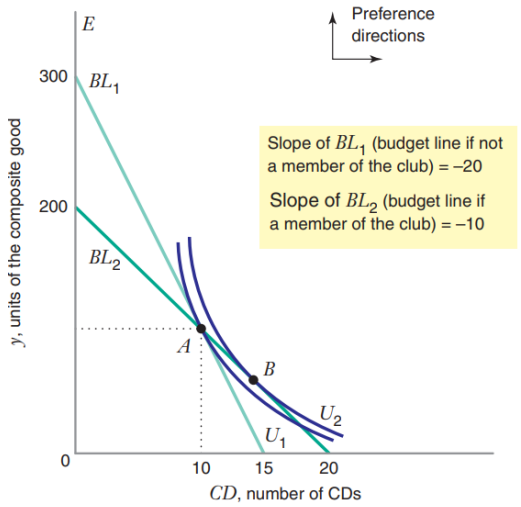


Figure 4.2: BL Joining a Club

Calling Plans

For this you have a fixed free amount of minutes from the plan and each additional minutes after cost a certain amount.

Find the B.L for both and compare and contrast between the two. it may or may not be worth it depending on where the ind. curve is.

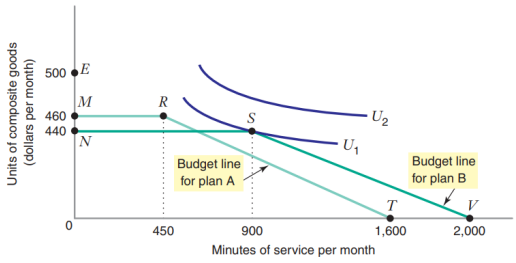


Figure 4.3: ML Cellphone plan

Quantity Discount

This is where the BL has a kink in the middle where after a certain amount the cost of buying more is less per unit.

Find the B.L for both and compare and contrast between the two.

Note

The budget line before the discount kink is the same. It only chances after the quantity that applies the discount.

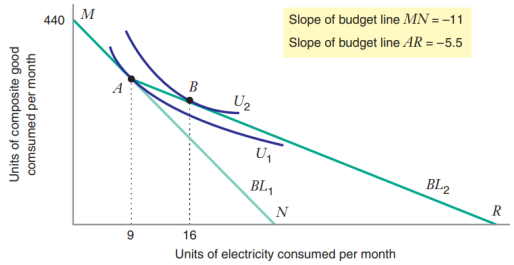


Figure 4.4: BL Quantity Discount

Chapter 5: Theory of Demand

In this chapter you will learn

- Derivation of the demand curve
- price consumption line curve
- Income consumption curve
- Engle curve
- Decomposition of the Price Effect with the substitution and income effect

Optimal Choice of Demand

Price Consumption Line

Definition 5.0.1. Price Consumption Line

Is the set of all utility maximizing points that result from the change in the price of one of the goods while income and the price of the other good are constant.

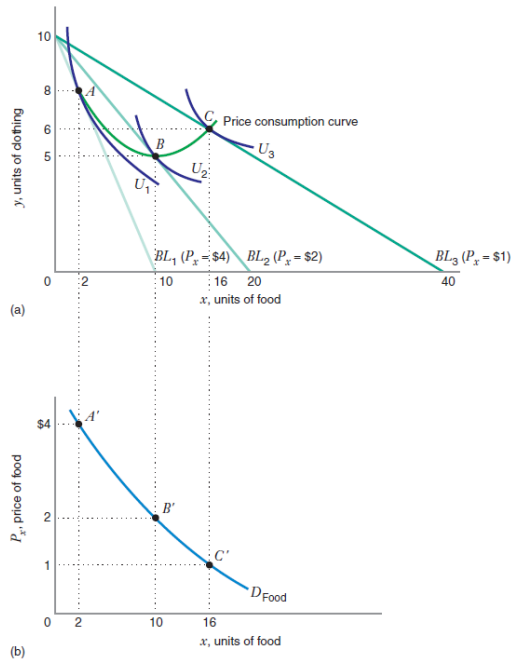


Figure 5.1: Price Consumption Line

As you can see in fig. 5.1 the price consumption line is positively sloped after a certain point while the demand curve is negatively sloped.

You can also have a vertical price consumption line which could lead to a perfectly inelastic demand curve. This will happen if all the optimal bundles are vertically aligned above each other.

The Effect of a Change in Income

Definition 5.0.2. Income Consumption Curve

is the set of utility maximizing points that result from the change in income while the prices of teh two goods are kept constant.

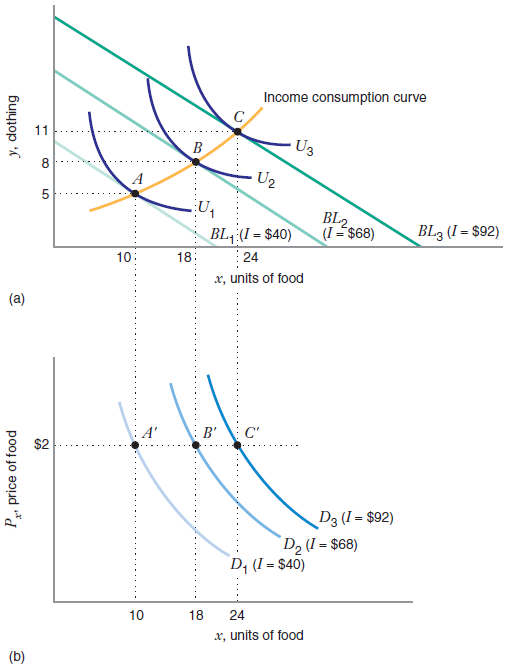


Figure 5.2: Income consumption line

A normal good will have a positively sloped income consumption line while an inferior good will have a negatively sloped income consumption line.

Engel Curve

Definition 5.0.3. Engel Curve

It shows the relation between quantity demanded and income, while other factors kept constant.

A normal good will have a positively sloped Engel curve while an inferior good will have a negatively sloped Engel curve.

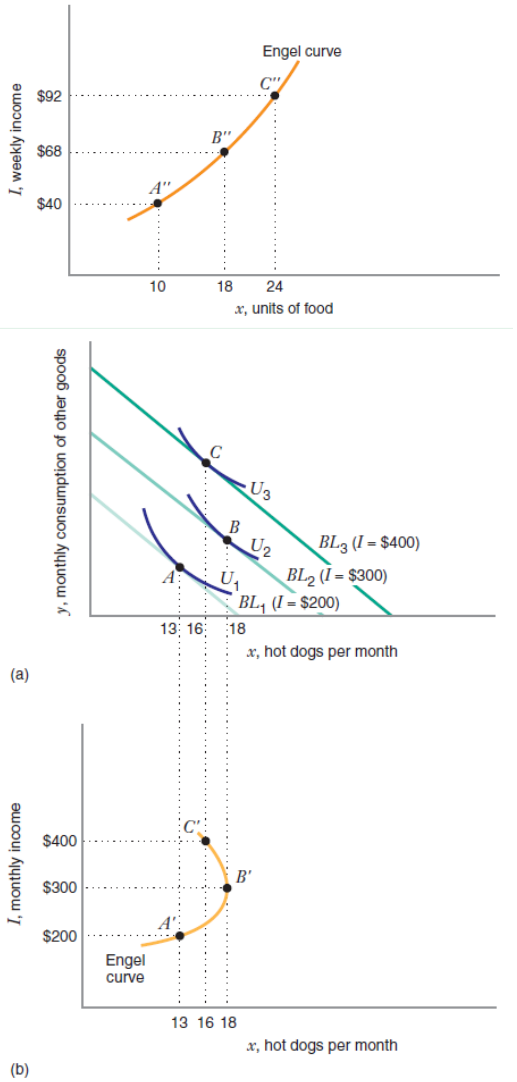


Figure 5.3: Engel Curve

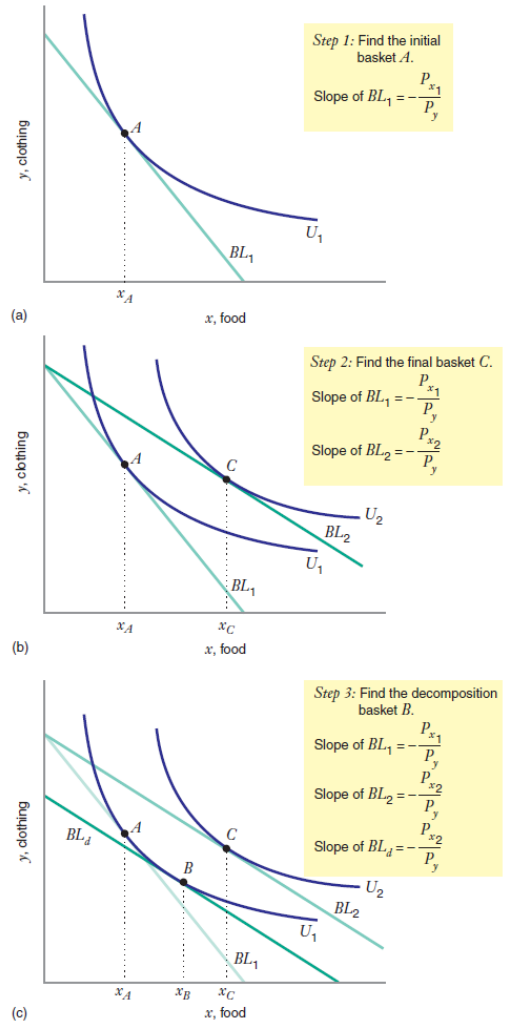


Figure 5.4: Steps to Calculate Price Effect

Effect of a Change in the Price

When there is a change in the price there is a negative correlation with quantity demanded. This effect is called the **Price Effect** and is comprised with two other effects.

- **Substitution Effect**: What is the substitution of the good when your real purchasing power is kept the same but the price of good changes.
- **Income Effect**: What is the purchasing effect of the good when your real purchasing power increases. i.e., is the good normal or inferior.

Steps to calculate Price Effect

In fig. 5.4 subgraph a you have the initial bundle at the original price. Then either the price of good x increases or decreases, in the figure it decrease rotating the new budget line outwards in subgraph b. This will give you the Price Effect of good, to decompose it into it's constitute parts, you make an imaginary budget line that is parallel to the new budget line but it's tangent to the original indifference curve as shown in subgraph c. Point B is the point of tangency that separates the Income Effect and the Substitution Effect. The distance from Point A and B is caused by the substitution effect as your real purchasing power is kept the same, while the distance from point B to C is caused by the Income Effect, the effect caused by the increase in purchasing power.

Figure 5.5 shows the five cases where the new optimal bundle can be located after a change in price.

Definition 5.0.4. Giffen Good

*A **Giffen Good** is a type of inferior good where the demand curve is positively sloped. That is the higher the price, the higher the quantity demanded.*

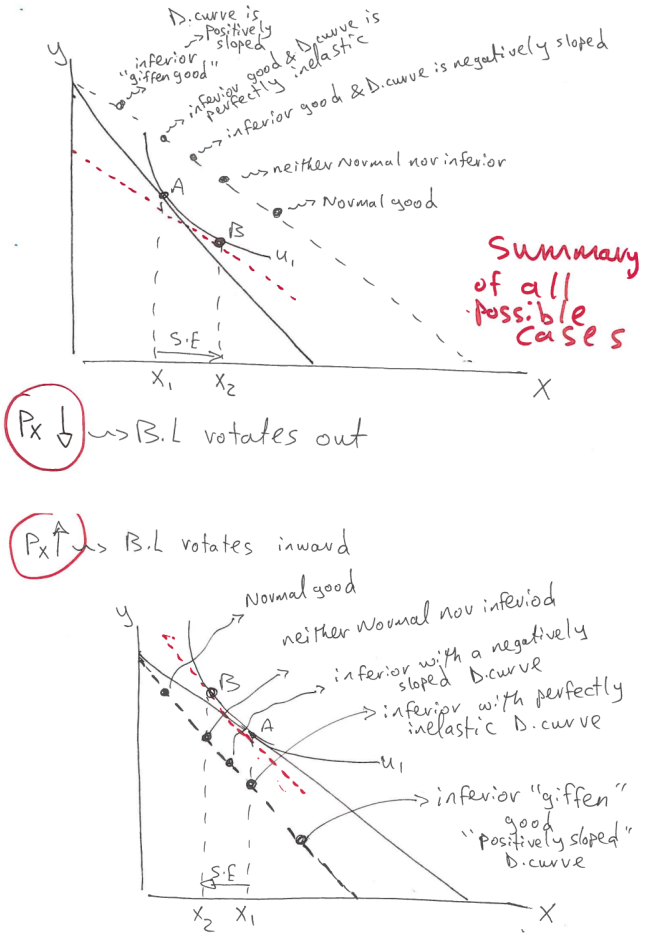


Figure 5.5: All Price Effect Cases in one

Market Demand with Network Externalities

Your demand or consumption is affected by other consumers who buys the same good. There are two effects we will look at

- **Bandwagon Effect**: Your demand increases when more people buys the good
- **Snob Effect**: Your demand decreases when more people buys the good

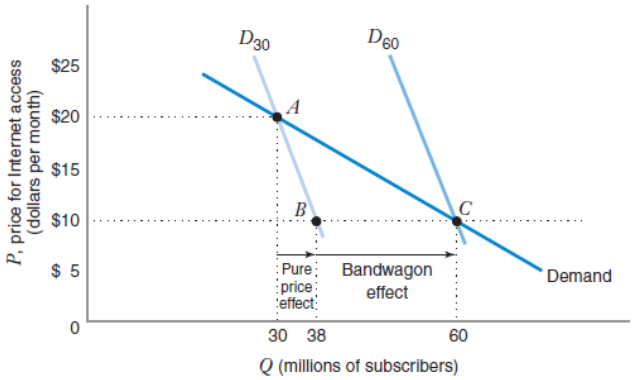


Figure 5.6: Bandwagon Effect

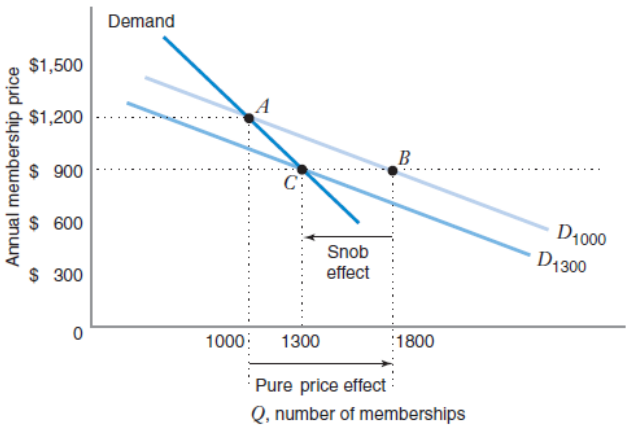


Figure 5.7: Snob Effect

Chapter 6: Input and Production Functions

In this chapter we will look at

- Production in short run
- Production in long run
- Elasticity of substitution
- Returns to scale

We will assume that we only have two inputs

- Labour denoted as L
- Capital denoted as K

Definition 6.0.1. Production Function
The production function for any supply or producer is so:

$$Q = f(L, K) \tag{6.1}$$

Production in Short Run

In the short run capital is fixed because it takes a long time to buy and sell expensive capital assets like land, machines, etc. Only labour is variable because it's relatively easy to hire and fire workers in the short run.

In fig. 6.1 we have two graphs one that shows total output for labour as input and another showing the **Marginal Production of Labour** and the **Average Production of Labour**. Both are calculated as so

$$MP_L = \frac{\Delta Q}{\Delta L} \tag{6.2}$$

MP_L calculates the extra output from one extra unit of labour.

$$AP_L = \frac{Q}{L} \tag{6.3}$$

AP_L calculates the average output per unit of labor.

Theorem 6.0.1. Law of Diminishing Returns
Both MP_L and AP_L will eventually diminish as we have more units of labour beside a fixed amount of capital.

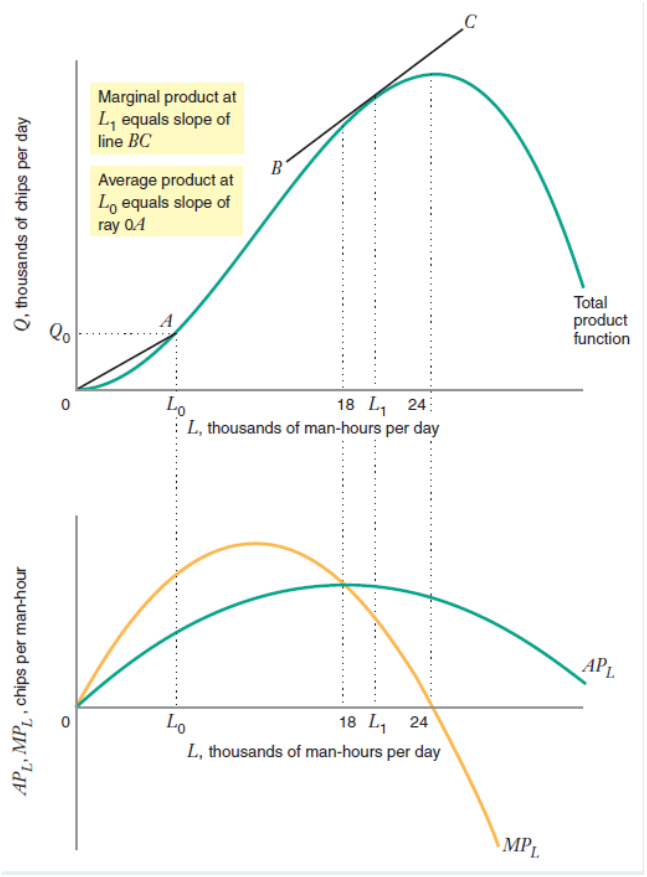


Figure 6.1: Product Graphs

Production in Long Run

In the long run both **Labour** and **Capital** are variable and we have an equivalent indifference curve for production input. It's called **iso-quant**.

Definition 6.0.2. Iso-quant

Shows different bundles of L and K that produce the same level of output. On the same iso-quant curve, the level of output is constant. The higher the iso quant curve the higher the level of output.

Like indifference curves, iso-quant curves do not intersect and are convex to the origin.

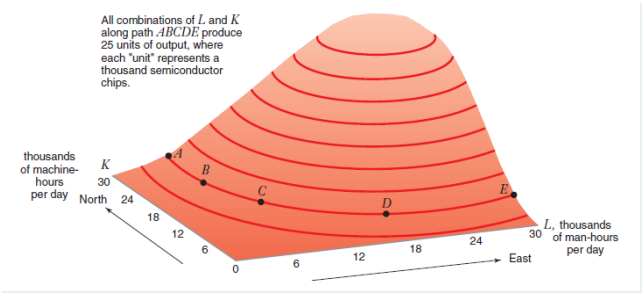


Figure 6.2: A map of Iso-quant

Definition 6.0.3. Marginal Rate of Technical Substitution MRTS

Is the slope of the iso-quant. It tells what we have to give up from one of the inputs to get an extra unit from the other input. Like MRS there are two versions.

$$MRTS_{LK} = \frac{-\Delta K}{\Delta L} = \frac{-MP_L}{MP_K} \tag{6.4}$$

$$MRTS_{KL} = \frac{-\Delta L}{\Delta K} = \frac{-MP_K}{MP_L} \tag{6.5}$$

Where:

$$MP_L = \frac{\partial Q}{\partial L} \tag{6.6}$$

$$MP_K = \frac{\partial Q}{\partial K} \tag{6.7}$$

Theorem 6.0.2. Law of Diminishing MRTS

We give up less and less from one input to get an extra unit from the other input. This means MRTS is diminishing.

Difference cases of Iso-quants

Like indifference curves there are 4 differeent cases

1. Cobb-Douglas Production Function
2. Perfect Complements (Leontief) Production Function
3. Perfect Substitution (Linear) Production Function
4. Quasilinear Production Function

You can review that section of the notes and replace indifference curves with iso-quants and goods X and Y with L and K.

Elasticity of Substitution σ

It measures how easy for the firm to substitute labour for capital. The formula for which is so

$$\sigma = \frac{\%\Delta \frac{K}{L}}{\%\Delta MRTS_{LK}} \tag{6.8}$$

Where the range is between 0 and ∞. The higher the value of σ, the easier it is to substitute one input for another.

Constant Elasticity of Substitution Production Function

Each of the three production functions we have discussed is a special case of a production function called the **constant elasticity of substitution** (CES) production function, which is given by the equation:

$$Q = [aL^{\frac{\sigma-1}{\sigma}} + bK^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{6.9}$$

Where a and b are positive constant numbers and σ is the elasticity of substitution that is constant.

Figure 6.3: Elasticity of Substitution

Production Function	Elasticity of Substitution
Linear Production Function	$\sigma = \infty$
Perfect Complement Production Function	$\sigma = 0$
Cobb-Douglas Production Function	$\sigma = 1$

Return to Scale

Definition 6.0.4. Return to Scale

RTS measures what happens to output Q when all inputs changes by the same %.

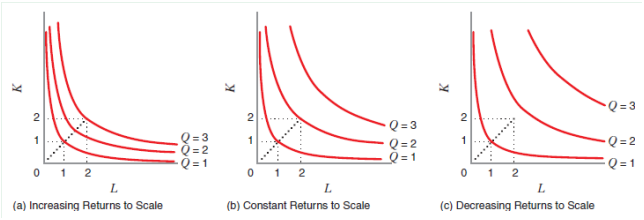


Figure 6.4: Return to Scale

- $\%\Delta Q > \%\Delta inputs$ - Increasing RTS
- $\%\Delta Q = \%\Delta inputs$ - Constant RTS
- $\%\Delta Q < \%\Delta inputs$ - Decreasing RTS

Chapter 7: Cost and Cost Minimization

In this chapter we will talk about

- Explicit and implicit cost and sunk cost
- Difference between economic and accounting profit
- Iso-Cost Line
- Cost minimization problem
- Derivation of the demand curve for labor
- Price elasticity of demand for input

Cost Concepts for Decision Making

Definition 7.0.1. Explicit Costs

Involves monetary payments, i.e., you actually pay for this cost

Definition 7.0.2. Implicit Costs

Does not involve monetary payment. This is also called opportunity cost.

Definition 7.0.3. Accounting Cost

These are explicit cost

Definition 7.0.4. Economic Cost

These are the sum of Implicit and Explicit Costs.

Meaning Economic Costs are greater than Accounting Costs, and economic profit is less than accounting profits.

Definition 7.0.5. Sunk Cost

These are costs that once, happen, it cannot be recovered. Since the it cannot be recovered we should ignore it and don't let it affect your decision.

The Cost-Minimization Problem

Definition 7.0.6. Iso-Cost Line

Shows teh different bundles of L and K that has the same total cost TC.

*The equation of the **Iso-Cost Line** is similar to the budget line*

$$TC = w \cdot L + r \cdot K \tag{7.1}$$

The slope of the Iso-Cost line is determine like so

$$\text{Slope of Iso Cost} = \frac{-w}{r} \tag{7.2}$$

Where: w is the wage rate for the price of labour and r is the interest rate for the price of capital.

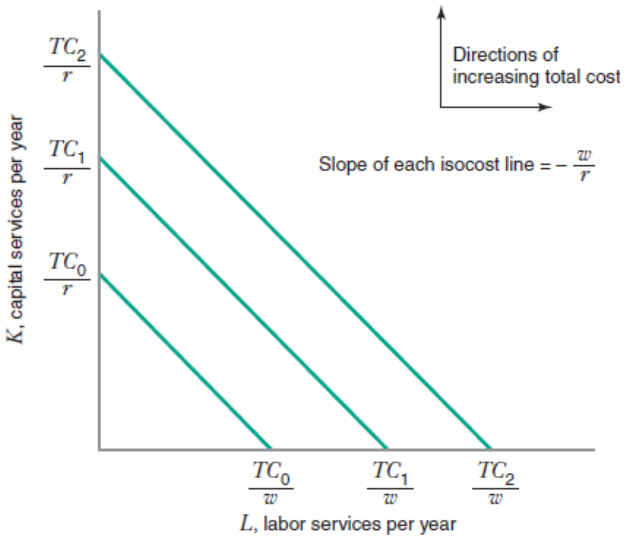


Figure 7.1: Iso-Cost Line

Cost Minization Problem

The objective of the producer is to minimize his total cost which will maximize this profits, the goal of every business owner.

This is done by finding the best bundle of L and K that produces the goods at the lowest cost.

This is similar to the *Utility Maximization Problem* except instead of maximizing a value we are minimizing a value, in this case it's cost.

The cost is minimized when the iso-cost is tangent to the iso-quant.

$$\frac{-w}{r} = MRTS_{LK} = \frac{-MP_L}{MP_K}$$

Rearranging this equation gives us this

$$\frac{MP_L}{w} = \frac{MP_K}{r}$$

This means cost is minimized when the marginal productivity of a dollar spent on labour equals the marginal productivity of a dollar spent on capital.

The method of which is similar to finding the maximum utility of a bundle of two goods.

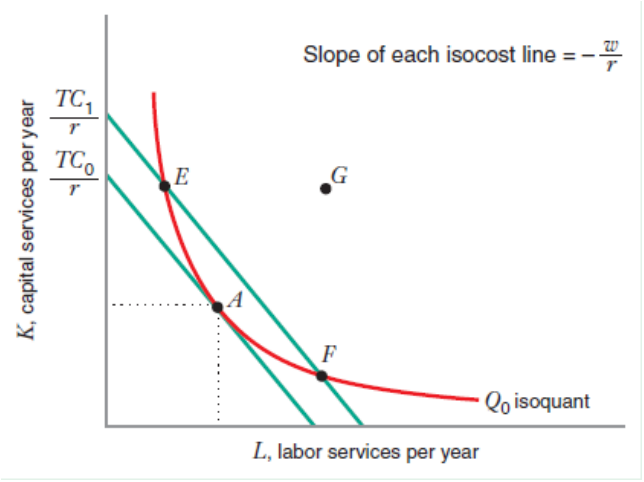


Figure 7.2: Cost-Minimizing Input Combination

In fig. 7.2 Point A is the interior solution for the minimizing the cost.

You can also get a corner solution as well

Comparative Statics Analysis of the Cost-Minimization Problem

The line that connects const minimizing input bundles due to change in quantity while input prices are constant is called the **expansion path**. In fig. 7.4 both inputs are normal therefore an increase in quantity will increase the input for labour and capital.

In fig. 7.5 labour is inferior while capital is normal therefore, an increase in quantity will lead to a decrease in labour and an increase in capital for inputs.

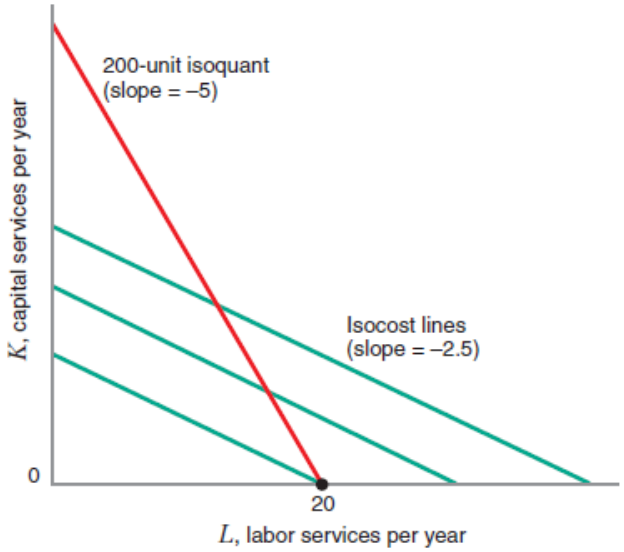


Figure 7.3: Cost-Minimizing Corner Solution

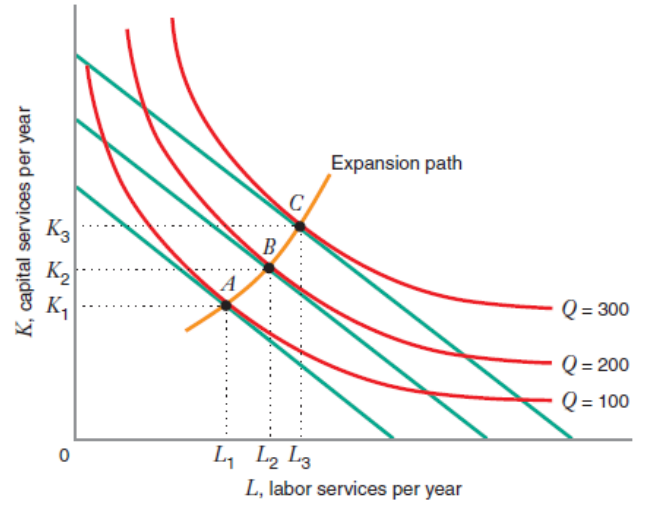


Figure 7.4: Normal Inputs

Labour Demand Curve

There is a negative correlation between the cost of labour and the input of labour in production.

Price Elasticity of Demand for Inputs

Like consumption demand there is an elasticity for the demand of input

- $\varepsilon_{L,w}$ for the price elasticity for labour, or it measures how sensitive Q of L to the change in w, other factors kept constant.
- $\varepsilon_{K,r}$ for the price elasticity for capital, or it

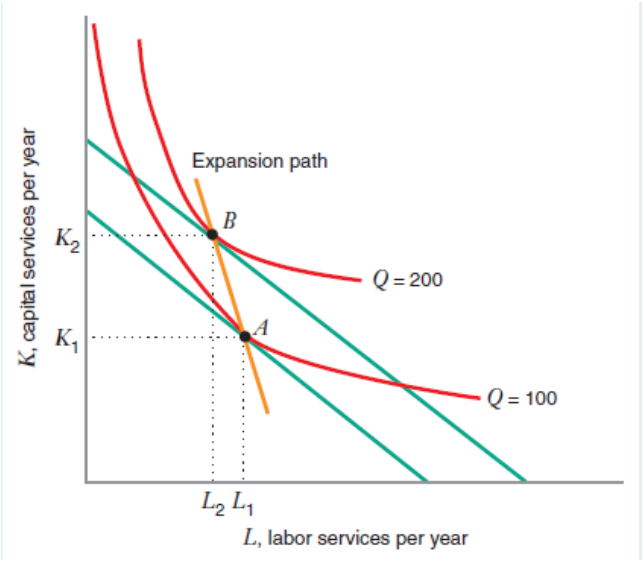


Figure 7.5: Inferior Inputs

measures how sensitive Q of K to the change in r, other factors kept constant.

These elasticity equations follows the same structure as the price elasticity for demand or supply, just replace Quantity Q with L or K, and P with w or r. This rule works with both the point and arc average formulas.

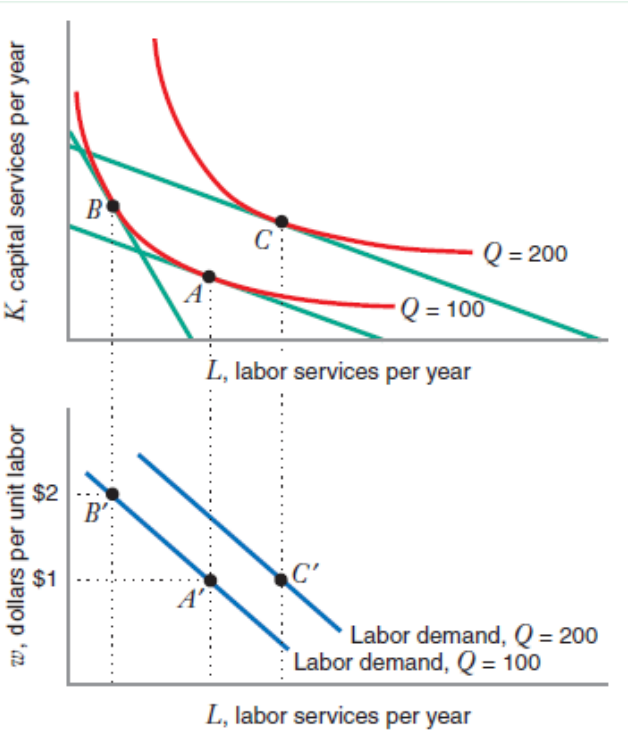


Figure 7.6: Labour Demand Curve

Chapter 8: Cost Curves

We will only talk about Short-Run and Long-Run Cost Curves

Short-Run Cost Curves

In the short run the input variable capital K is fixed while labour L is variable.

Definition 8.0.1. Total Cost

The Total cost is comprised with two terms

1. *Total Fixed Cost - TFC*
2. *Total Variable Cost - TVC*

$$TC = TFC + TVC \tag{8.1}$$

You can get the average by dividing all terms with Q.

SR Iso-Cost

The short run iso-cost is similar to the long-run iso-cost but the capital K is fixed so we denote this with $\overline{K}$.

$$STC = w \times L + r \times \overline{K} \tag{8.2}$$

The first term $w \times L$ is the *Total Variable Cost* and the second term $r \times \overline{K}$ is the *Total Fixed Cost.*

$$MC = \frac{\Delta TC}{\Delta Q} \tag{8.3}$$

Graphing out the different cost measurements shows us fig. 8.1. As quantity increases, average fixed costs decreases to 0, and the distance between Average Variable Cost and Average Total Cost gets smaller and smaller as Q increases.

The **Marginal Cost** will intersect both the Average Total Cost and Average Variable Cost at their global minimum, as shown by point A and B.

The cost curves are opposite images for the production curves. These curves take that shape because of the *law of diminishing return* and *law of diminishing marginal product*. As productivity increases cost decrease, and as productivity decreases cost increases.

In the short-run firms are forced to use a level of capital that may not be optimal. In fig. 8.2 the best bundle to produce Q_2 is bundle B but if K is fixed at K_1 the firm is forced to use bundle C to produce Q_2 which is not the optimal bundle. Due to the short run input inflexibility the firm may not produce with the lowest cost which is not the case in the long run.

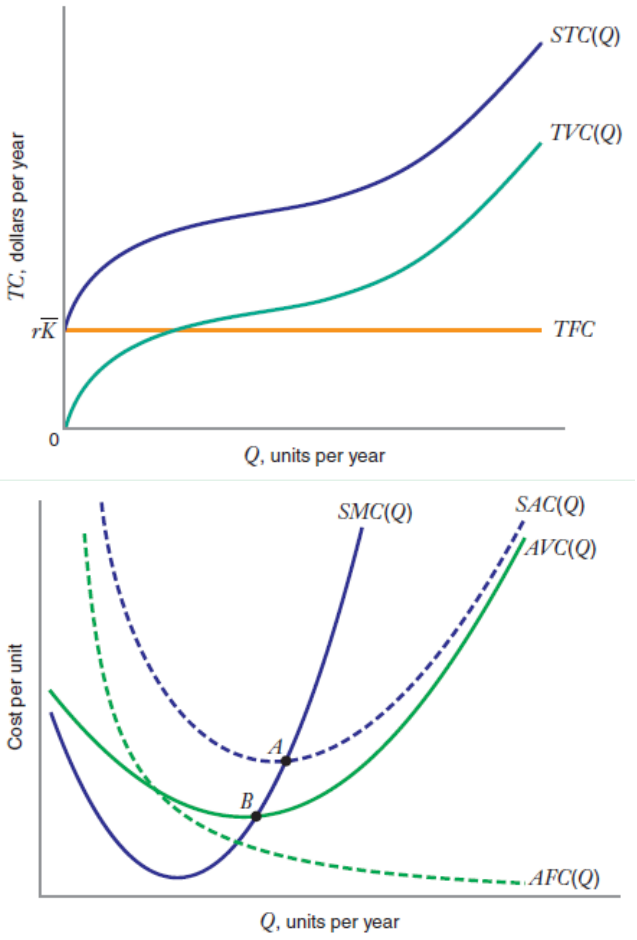


Figure 8.1: Short-Run Costs

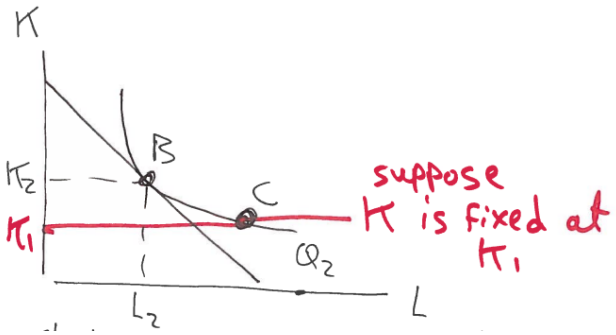


Figure 8.2: Short-Run Inflexibility

Long-Run Cost Curves

In the long run both Labour L and Capital K are variable. Therefore there are no fixed cost and the total cost TC is just the Total Variable Cost TVC.

As shown in fig. 8.3 the Long Run Average Total Cost equals the Long Run Average Variable Cost. The Marginal Cost intersects the Long Run Average Cost at it's global minima.

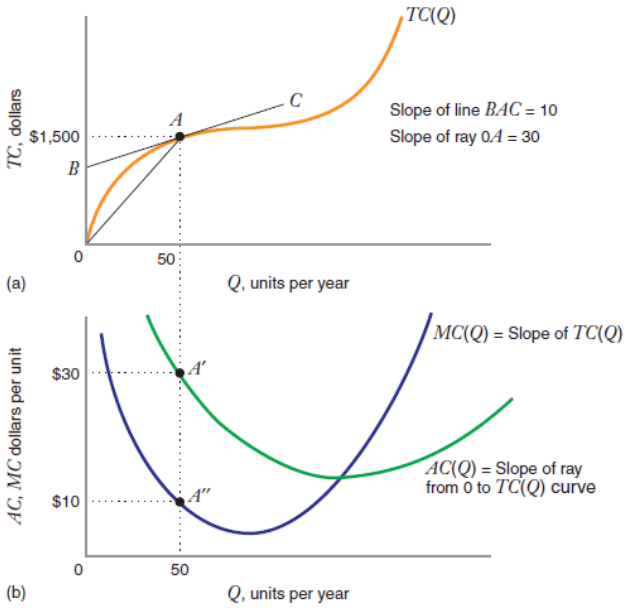


Figure 8.3: Long-Run Total Costs

The Long-Run Average Total Cost fig. 8.4 is the composition of all the lower envelopes of all short-run ATC curves. The LATC shows the lowest cost of producing every quantity because in the long-run the producer could change and adjust all his inputs and pick the input bundle that produces what he wants with the lowest cost.

Economics of Scale

There are three "classes" of Economics of Scales

1. Economics of scales is where as Q increases $LATC$ decreases between the region 0 to Q'.

2. Efficient scale is where LATC reaches its minimum between the region Q' and Q''.

3. Diseconomies of scale is where as Q increases $LATC$ also increases between the region Q'' and beyond.

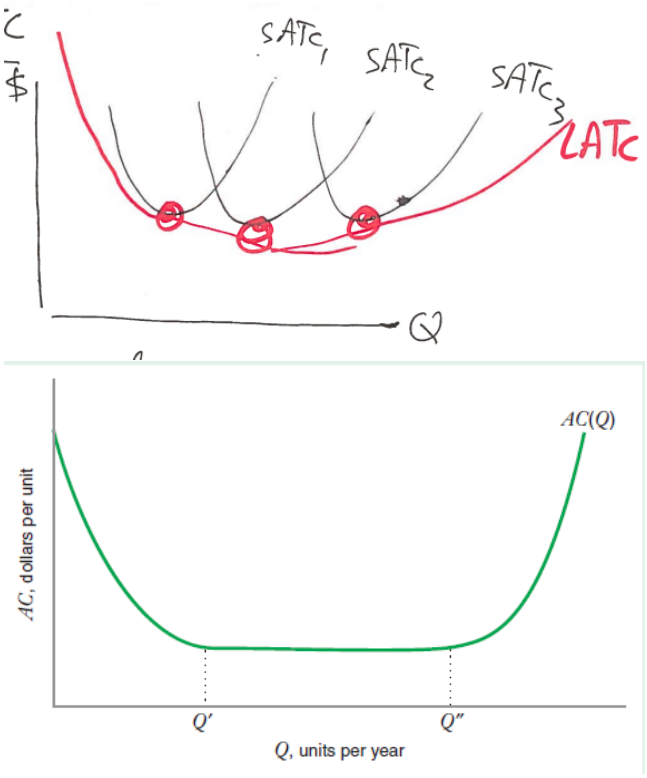


Figure 8.4: Long-Run Average Cost

Output Elasticity of Total Cost $\varepsilon_{TC,Q}$

This measure how responsive TC is to the change in output.

$$\varepsilon_{TC,Q} = \frac{\%\Delta TC}{\%\Delta Q} = \frac{\Delta TC}{\Delta Q} \times \frac{Q}{TC} = \frac{MC}{ATC} \tag{8.4}$$

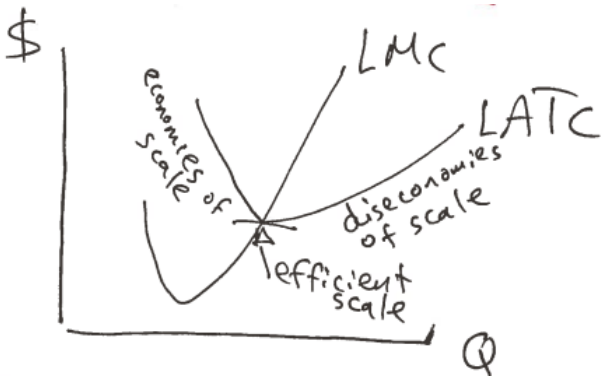


Figure 8.5: LATC vs LMC

- $LATC > LMC$ increasing RTS or economics of scale $\varepsilon_{TC,Q} < 1$
- $LATC = LMC$ constant RTS or efficient scale $\varepsilon_{TC,Q} = 1$
- $LATC < LMC$ decreasing RTS or diseconomies of scale $\varepsilon_{TC,Q} > 1$

Chapter 9: Perfect Competition

In this chapter we will learn about

- What are the characteristics of perfect competition
- Demand curve of a competitive firm
- Profit maximization
  - Marginal Approach
  - Total Revenue minus Total Cost approach

  3 cases
  - profit
  - loss - 3 actions
    - continue
    - indifferent
    - shutdown
  - breakeven
- Short run supply curve of a competitive firm
- Long run equilibrium
- Perfect competition and efficiency

Characteristic of a perfect competition

There are 4 characteristics:

1. Large number of sellers and buyers.
2. Sellers sell identical "homogeneous" products.
3. No single seller controls the price, the market determines the price and the sellers are the price takers.
4. Free entry and exit, i.e., no barrier to entry or exit. In the long run there is no profit nor loss therefore the market of producers in long run will only have breakeven for profits.

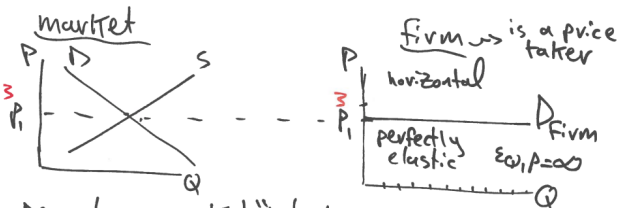


Figure 9.1: Demand Curve for Perfect Competition

The demand curve for the market "industry" is negatively sloped. But the firm curve is horizontal.

The **Marginal Revenue** equals **Market Price** which is constant therefore **Total Revenue** increases at a constant rate.

Profit maximizing for a firm

There are two ways

1. Total Revenue minus Total Cost approach
2. Marginal Approach

Total Revenue and Total Cost

Definition 9.0.1. Profit

$$\Pi = TR - TC \tag{9.1}$$

There are 3 cases

1. $TR > TC$, $P > ATC$ *or a profit*
2. $TR = TC$, $P = ATC$ *or a breakeven*
3. $TR < TC$, $P < ATC$ *or a loss*

The objective of the firm is to maximize profit or Π

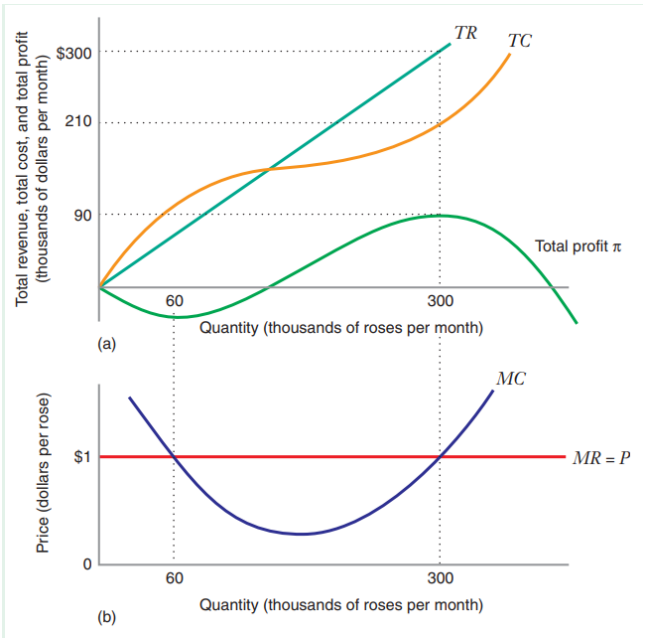


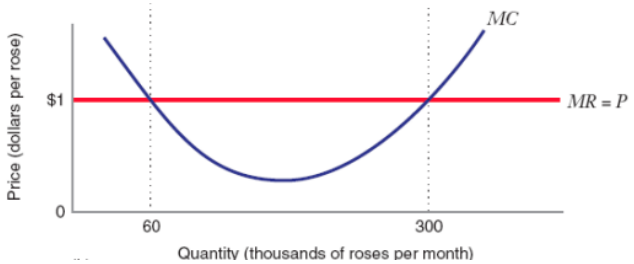
Figure 9.2: TR, TC, MR, MC curves

Marginal Approach

Profit is maximized when:

1. $MR = MC$, this is a necessary condition

2. MC is rising, this is a sufficient condition



In the figure above the optimum quantity is at 300 and not 60 because the first quantity does not have a rising MC. Meaning if the producer keeps producing it will decrease the total cost **gained** for each unit produced increasing their overall profit.

Cases based on Price

There are five cases for profit based on the market price.

1. Abnormal profit
2. Breakeven "Normal Profit"
3. Loss and continue
4. Loss and indifferent
5. Loss and shutdown

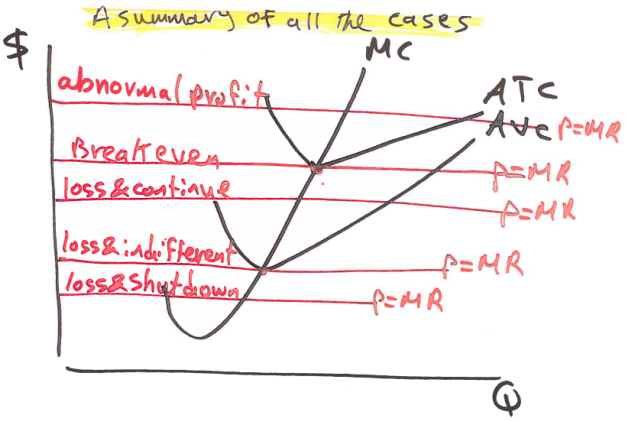


Figure 9.3: The summary of all cases in Short Run

Abnormal profit

Abnormal profit happens when $P > (ATC)$. This is where the firm has a positive accounting and economic profit.

Breakeven or Normal Profit

Breakeven or normal profit occurs when $P = ATC$. At this point there is zero economic profit however there is positive accounting profit. In fact a zero economic profit is in fact a positive accounting profit or a "normal profit".

Loss and Continue

This happens when your $TC > TR > TVC$ or $(ATC) > P > (AVC)$, you can cover all of the variable cost and cover part of the total fixed cost. In this case it is better to continue and pay the uncovered part of TFC out of pocket or from somewhere else like tapping into savings.

Loss and Indifferent

This happens when your $TR = TVC$ or $(ATC) > P = (AVC)$, the loss between continuing and shutting down is the same so it doesn't matter if the firm continue or shutdown, that is why it is called indifferent. The firm pays all of the TFC. The TR only pays the TVC and nothing else.

Loss and Shutdown

This happens when your $TR < TVC$ or $(ATC) > (AVC) > P$, the loss from operating is higher than not operating at all so it would be better to shutdown and only pay the fixed cost TFC. When TR cannot cover TVC the firm will shutdown because they cannot cover the variable cost of operation.

Short Run Supply Curve of a Perfectly Competitive Firm

Supply curve of a perfectly competitive firm is the rising part of the MC curve above the minimum AVC. In Figure 9.4 the bold line is the short run supply curve for the firm. The firm will not produce anything below the minimum of the **Average Variable Cost**.

Long Run Equilibrium of a Competitive Firm

In the long run the perfectly competitive firm will be making breakeven "normal profit" because of the free entry and exit into the market.

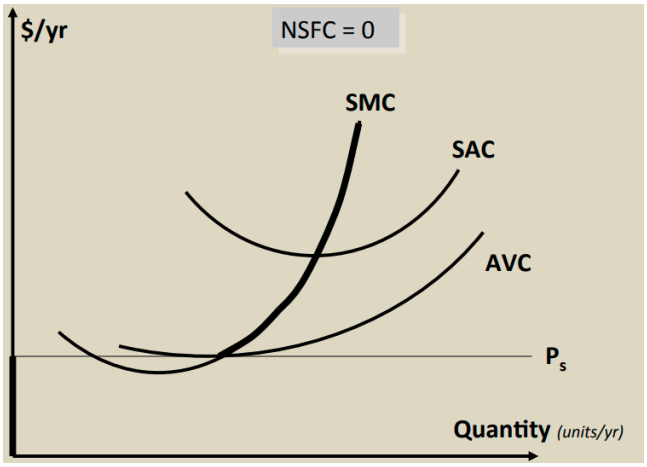
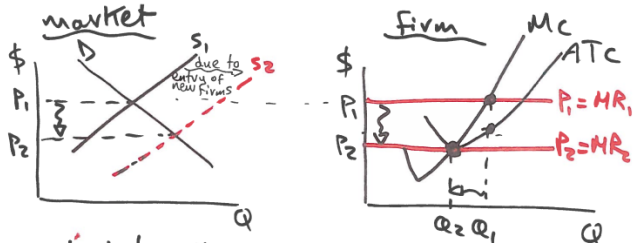
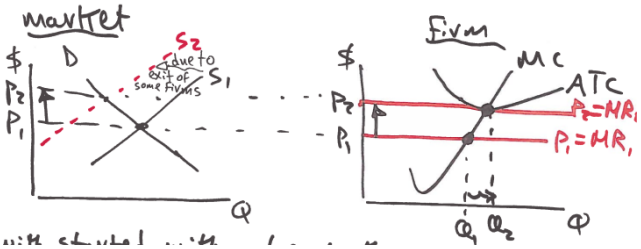


Figure 9.4: Short Run Supply Curve



We started with having profits in the market. This will attracts new firms to enter the market, this will increase supply causing the supply curve to shift to the right so the price will decrease till we reach the breakeven price.



With started with a loss in the market. This loss will push some firms to exit or leave the market. This will decrease the supply and shift the supply curve to the left. This will increase the market price and the exit will continue as long as there is a loss and will stop once the loss disappear and we reach breakeven.

Efficiency

We have 2 types of efficiency:

1. Productive efficiency
2. Allocative efficiency

Productive efficiency

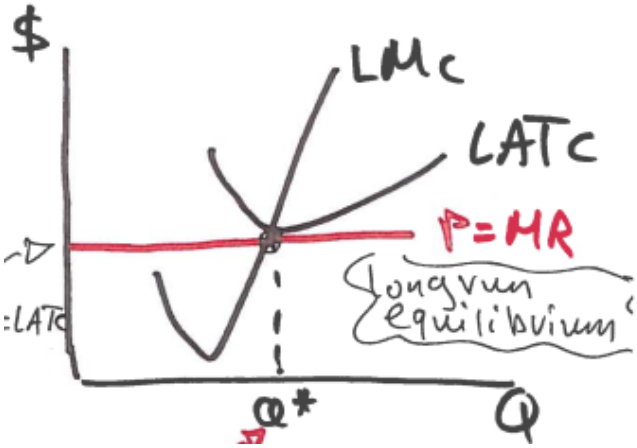
To produce with the lowest ATC.

Note

Notice that the perfectly competitive firm produces with the lowest LATC. So it achieves productive efficiency. Also at Q^* where $P = LMC$ so it also achieves allocative efficiency

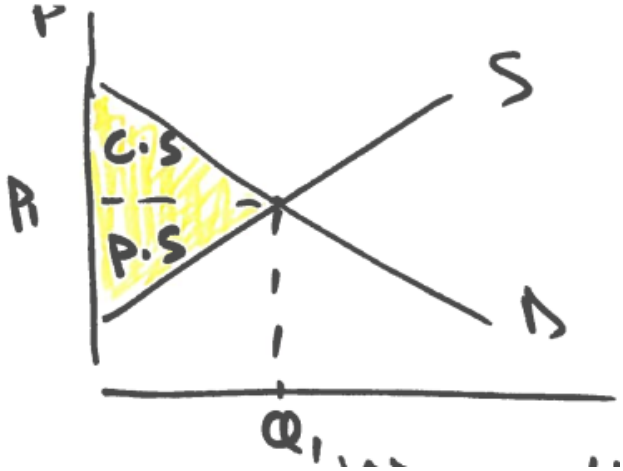
Allocative efficiency

This happens when $P = MC$



Competitive market

In a perfectly competitive market, the competitive equilibrium quantity or **competitive quantity** will maximize total surplus or welfare.



But any other quantity other than the equilibrium will give us less total surplus or a dead weight loss.


DWL
S
D
Q1
Q2
Q

Chapter 10: Competitive Market Application

Definition 10.0.1. Competitive Free Market

No government intervention D and S determines the price.

It is also the maximum total surplus, the sum of the consumer and producer surplus.

Definition 10.0.2. General Equilibrium Analysis

We study what happens not only in the market that is directly affected by the government policy but also what happens to other related markets.

Definition 10.0.3. Partial Equilibrium Analysis

We focus only on the market that is directly affected by the government policy.

In this chapter we will only talk about Partial Equilibrium Analysis.

Surplus

Definition 10.0.4. Consumer Surplus

Is the area above price and below the demand curve.

Definition 10.0.5. Producer Surplus

Is the area below price and above the supply curve.

Definition 10.0.6. Total Surplus

The sum of consumer surplus and producer surplus.

Area of surplus formula

$$\text{Area of a rectangle} = b \cdot h$$

$$\text{Area of a triangle} = \frac{b \cdot h}{2}$$

Price Control

Price control is where the government set the price.

Price Floor

Is the minimum price like a minimum wage, to help the sellers. The price floor is higher than the market price otherwise the price floor is not binding or has no effect.

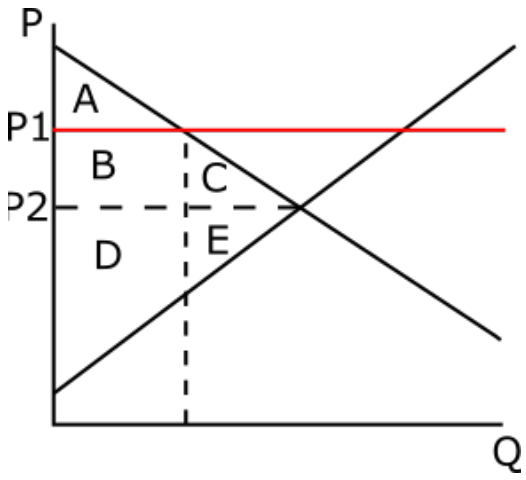


Figure 10.1: Market with Price Floor

The quantity traded is at the quantity where the price floor $P1$ intersects the demand curve.

	Before Price Floor	After Price Floor
C.S	A + B + C	A
P.S	D + E	D + B
D.W.L	None	C + E

- **Consumer** - Worst off he lost area B and C
- **Producer** - Lost E but gained B, could be worst or better off depending on if B or E is bigger.

Price Ceiling

Is the maximum price like rent control, to help the consumers. The price ceiling must be below the market price otherwise the price ceiling is not binding or has no effect.

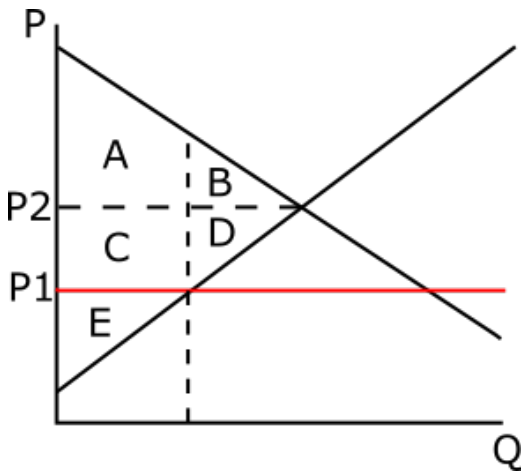


Figure 10.2: Market with Price Ceiling

The quantity traded is at the quantity where the price ceiling $P1$ intersects the supply curve.

	Before Price Ceiling	After Price Ceiling
C.S	A + B	A + C
P.S	C + D + E	E
D.W.L	None	B + D

- **Consumer** - lost B but gained C, could be better off or worst off depending on which part is bigger
- **Producer** - Worst off as they lost C and D.

Production Quota

The government puts a maximum limit on the produced quantity.

The price paid by the consumer before the quota was at $P2$, after the quota the price paid by the consumer is now $P1$. The amount of quantity traded is the quota amount.

However, there is a phantom amount of excess supply as the producer wants to produce at price $P1$ but can't because of the quota. So there is an "excess supply" by the amount of goods produced at $P1$ and the amount bought by the consumer at $P1$.

	Before Quota	After Quota
C.S	A + B + C	A
P.S	D + E	D + B
D.W.L	None	C + E

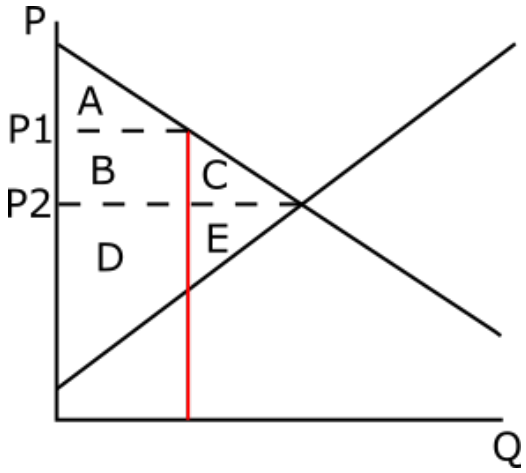


Figure 10.3: Market with Production Quota

- **Consumer** - Worst off he lost area B and C
- **Producer** - Lost E but gained B, could be worst or better off depending on if B or E is bigger.

Taxes

The government can imposes a per unit tax on the producer. This will shift the supply curve to the left by a certain amount.

In Figure 10.4 there is a $6 dollar tax per unit. The consumer pays P^d while the producer only receives P^s or $P^d - Tax$.

To find the new supply curve after tax there are two general forms one for Quantity and the other for Price.

$$P = a + bQ + Tax$$

or

$$Q = a + b(P - Tax)$$

	Before Tax	After Tax	Impact of Tax
C.S	A + B + C + E	A	-B - C - E
P.S	F + G + H	G	-F - G
Gov. revenue	None	B + C + G	B + C + G
D.W.L	None	E + F	E + F

Tax incidence

Definition 10.0.7. Tax incidence
Is how the tax burden is split between the consumer and producer

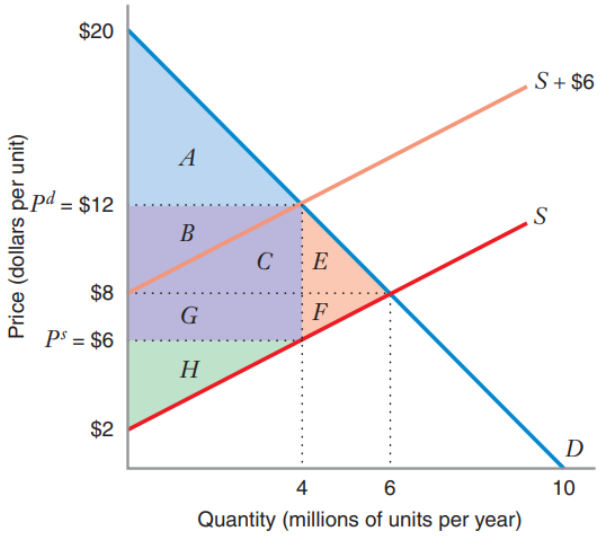


Figure 10.4: Market with Tax

Definition 10.0.8. Inverse Elasticity rule

$$\frac{\text{Consumer Share/Burden}}{\text{Producer Share/Burden}} = \frac{\varepsilon_{Q\cdot s,P}}{\varepsilon_{Q\cdot d,P}}$$

For Figure 10.4 the burdens are:

- Consumer's Burden is B + C
- Producer's Burden is G

When the Inverse Elasticity rule produces a number like 4 it means that the Consumer's Burden is 4 times of the Producer's Burden.

In general how much burden you pay depends on your elasticity. The more elastic you are, the less the tax is a burden on you. Moreover, the bigger the elasticity, the bigger the DWL. If the elasticity is 0 then the DWL is 0.

Subsidies

The government can imposes a per unit subsidy on the producer. This will shift the supply curve to the right by a certain amount.

In Figure 10.5 there is a $3 dollar subsidy per unit. The consumer pays P^d while the producer receives P^s or $P^d + Subsidy$.

To find the new supply curve after the subsidy there are two general forms one for Quantity and the other for Price.

$$P = a + bQ - Subsidy$$

or

$$Q = a + b(P + Subsidy)$$

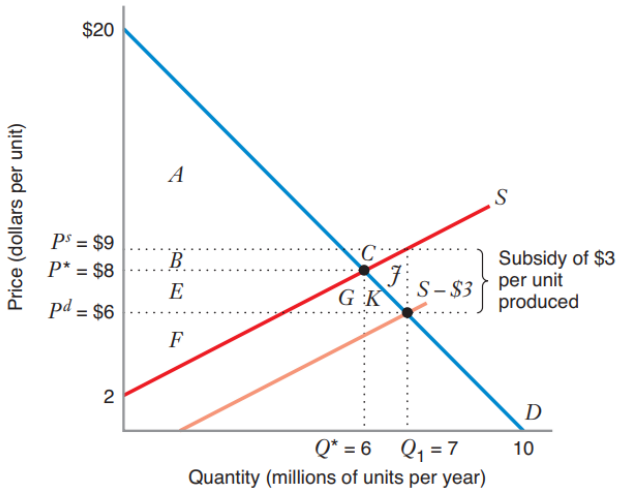


Figure 10.5: Market with a Subsidy

	Before Subsidy	After Subsidy	Impact of Subsidy
C.S	A + B	A + B + E + G + K	E + G + K
P.S	E + F	B + C + E + F	B + C
Gov. budget	None	-B - C - E - G - K - J	-B - C - E - G - K - J
D.W.L	None	J	J

Like with taxes the more elastic you are the less your share in the subsidy.

Note
That when we measure the producer surplus after the tax or the subsidy, we use the old supply curve not the new supply curve.

Tariff

The government could impose an import tariff to

- Increase the domestic price which allows
- Domestic production to increase
- Domestic consumers falls
- imports also falls.

	Before Tariff	After Tariff	Impact of Tariff
C.S	A + B + C + E + F + G + H + J + K	A + B + C + E	-F - G - H - J - K
P.S	L	F + L	F
Gov. revenue	None	H + J	H + J
D.W.L	None	G + K	G + K

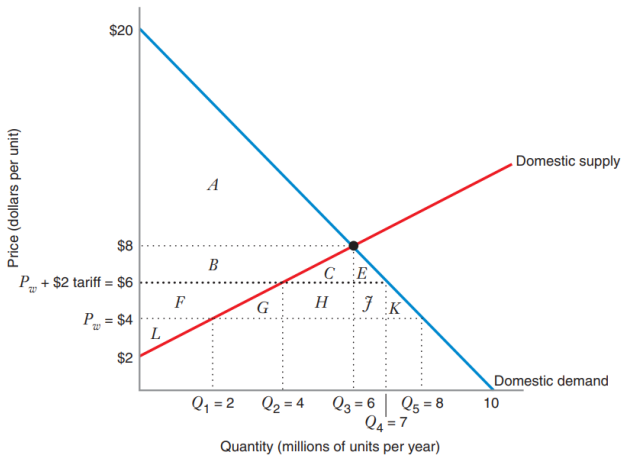


Figure 10.6: Market with Import Tariffs

Note

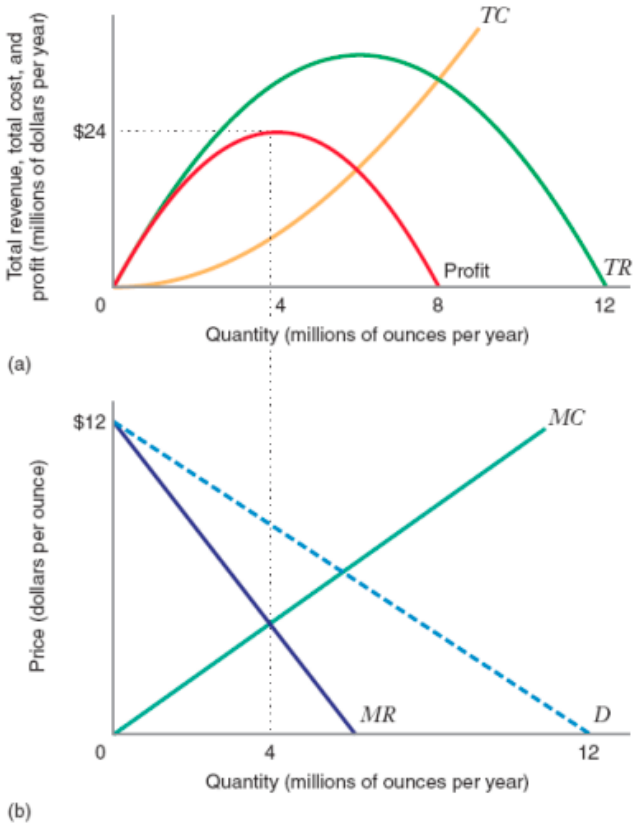
If the tariff causes the import price to equal the domestic price then this is called a prohibitive tariff. Where import falls to 0 and government tariff revenue falls to 0.

Chapter 11: Monopoly

Characteristics of a Monopoly

- A single seller
- High barriers to entry
- Monopolist is the price maker or setter.

Since the monopolist is the only seller his demand is the demand of the whole market which is negatively sloped. To sell more he has to lower the price.

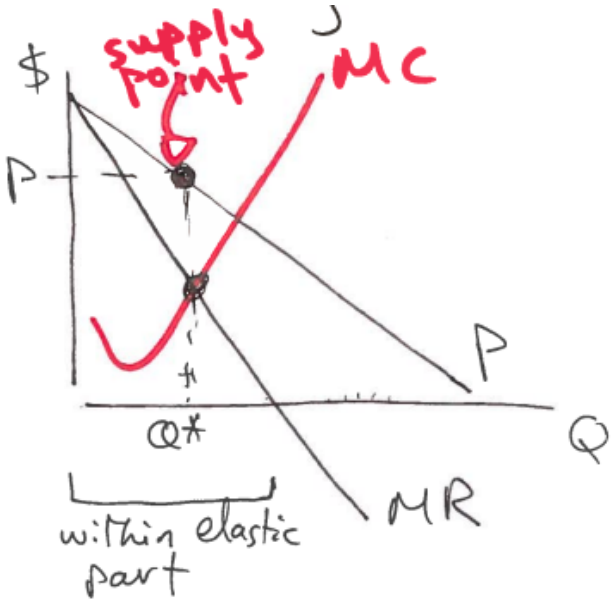


The **Marginal Cost** curve is the supply curve of the monopolist. However, the monopolist will only produce at a single point where $MC = MR$.

Objective

The objective of any producer is to maximize profit. To maximize profit the monopolist must produce the quantity at which

1. $MR = MC$
2. MC is rising.



Monopolist must produce along the elastic part of his demand curve. He will never produce along the inelastic part because MR is negative on that part.

Note

The monopolist has no supply curve. It has a supply point which is the point on his demand curve above the intersection of MR and MC.

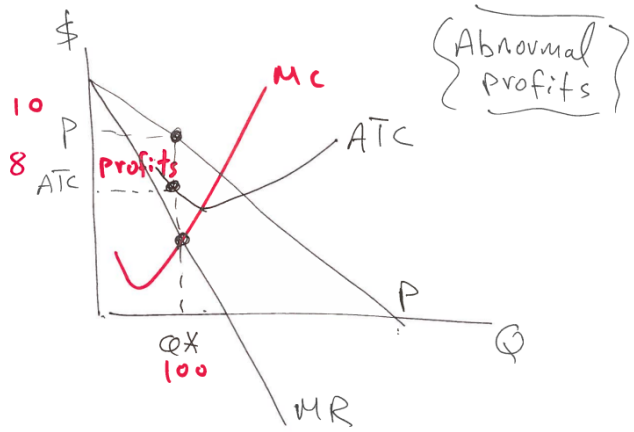
The Q^* is in between 0 and where $MR > 0$, or at least on the elastic part on the demand curve.

Cases for Monopolistic Markets

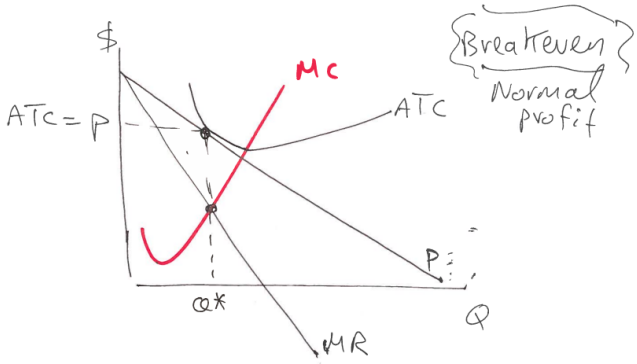
1. Abnormal profit
2. Breakeven
3. Loss

The only difference between the three cases is the location of the ATC.

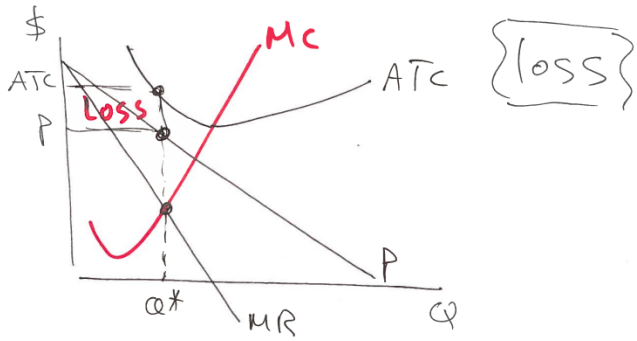
Abnormal profit



Breakeven

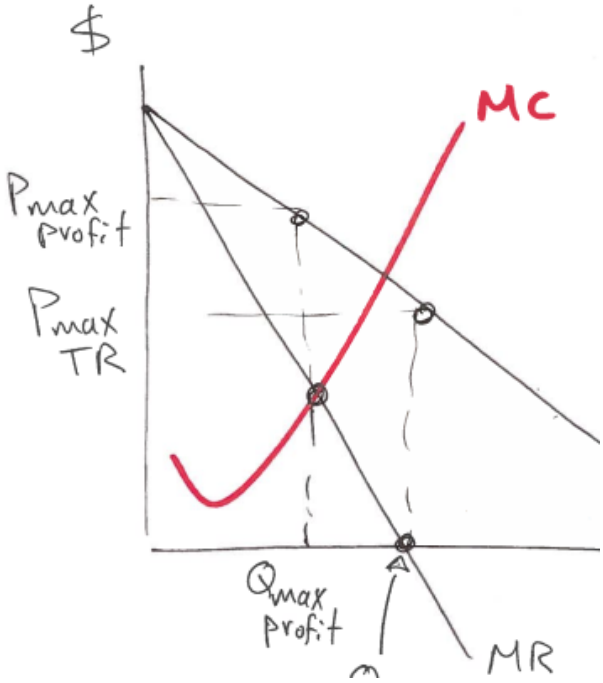


Loss



Maximizing TR vs Maximizing Π

- **Maximizing** Π is where $MR = MC$
- **Maximizing** TR is where $MR = 0$



- For quantity the $Q_{TR} > Q_{\Pi}$
- For price the $P_{\Pi} > P_{TR}$

Monopoly vs Competitive Market

Monopolist is bad because:

- He produces a smaller Q and charges a higher P than perfect competition
- He generate a DWL

The difference between P and MC at the supply point determines the monopoly's power.

Monopoly Power

Assume that:

$$P = f(Q)$$

$$\begin{aligned}
TR &= P \times Q \\
MR &= \frac{\Delta TR}{\Delta Q} = \frac{\partial TR}{\partial Q} \\
MR &= \frac{\Delta P}{\Delta Q} \times Q + P \\
MR &= P \times \frac{\Delta P}{\Delta Q} \times \frac{Q}{P} + P \\
MR &= P[1 + \frac{1}{\varepsilon_{Q.P}}] \\
MR &= MC \\
P + \frac{P}{\varepsilon_{Q.P}} &= MC \\
P - MC &= \frac{-P}{\varepsilon_{Q.P}} \\
\frac{P - MC}{P} &= \frac{-1}{\varepsilon_{Q.P}}
\end{aligned}$$

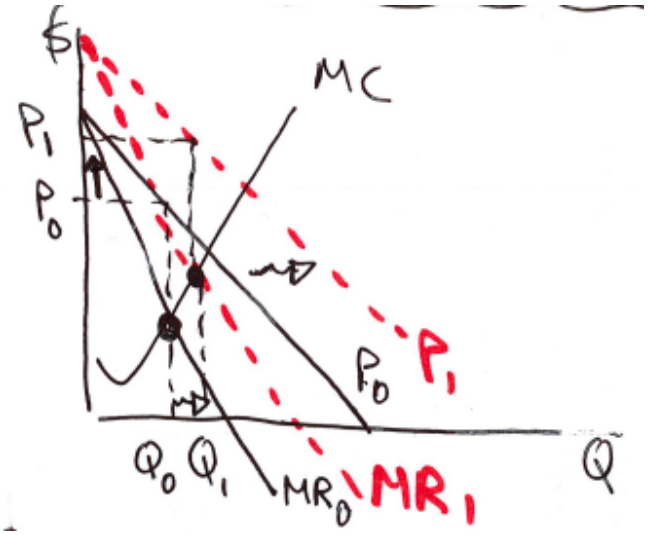
The last term is the Learner's index of monopoly power.

The Learner's index of monopoly power measures the ability to change a price higher than MC. The bigger the $\varepsilon_{Q.P}$ the smaller the monopoly power.

Comparative statics for monopolists

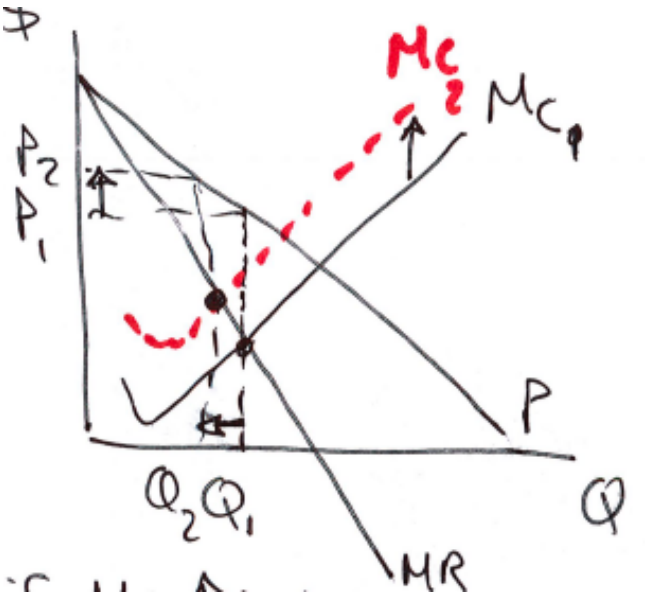
Any shifts in the market demand or MC curves will cause a change int he monopolist equilibrium.

Shifts in market demand



If market demand increases both the price and marginal revenue will shift right and the equilibrium price and quantity will rise. The effect is the same in the opposite directions just everything flipped.

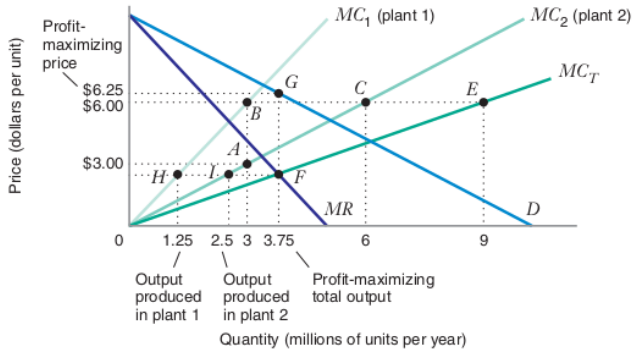
Shifts in MC



If the MC increase of shifts up the equilibrium quantity will decrease and the price will increase and since the monopolist produce in the *elastic part* of his demand curve Total Revenue of the monopolist will decrease since the decrease in Quantity is greater than the increase in price. The effect is the same in the opposite directions just everything flipped.

Monopoly with multiple plants

Consider a monopolist with two plants with marginal cost functions MC_1 and MC_2. How much would the monopolist produce overall and how should it divide that production between its two plants?



The total marginal cost is the horizontal sum of the individual plant's MC curves Mc_1 and MC_2. Overall the monopolist produces Q_T where $MC_T = MR$. To know how much each plant produces, we draw a horizontal line from the point of intersection of MC_T and MR. Each plant will produce the quantity at which this drawn horizontal line cuts its MC curve.

To get the horizontal sum, we must invert the MC equations by expressing Q as a function of MC.

To determine Q^*_{total} we need to get MC_T and set it equal to MR. MC_T is the horizontal summation of MC of both plants.

Note

Be careful that we cannot add the given MC equations as follows $MC_1 + MC_2 = 10 + 20Q_1 + 60 + 5Q_2$ here we are doing a vertical summation. To get the horizontal sum, we must invert the MC equations by expressing Q as a function of MC as follows.

$$Q_1 = \frac{-1}{2} + \frac{1}{20}MC_1$$

$$Q_2 = -12 + \frac{1}{5}MC_2$$

The variable Q is the responding variable, not MC.

The sum of the two Qs will give you Q_T, in this case $Q_T = -12.5 + 0.25MC_T \rightarrow MC_T = 50 + 4Q_T$

To get Q^*_T set $MR = MC_T$ solving the equation will give you the equilibrium quantity and from there you can get the price by substituting it into the market demand equation.

To determine allocation of production between the two plants, we calculate MC_T at the point of intersection of MC_T and MR. This value can be obtained by substituting $Q^*_T = 7$ into MR or MC_T. This value will be 78\$. By substituting

Definition 11.0.1. Cartel

Group of producers that collusively determine P and Q in the market.

The way this works is similar to the monopolist multi-plant production as shown in the previous section.

Chapter 12: Capturing Surplus

In this chapter we will learn how the monopolist can achieve more surplus by *using price discrimination* (charging consumer different prices for the same good) instead of using a uniform price for all consumer.

There are 3 different "degrees" of price discrimination

1. **First Degree Price Discrimination** - The practice of attempting to price each unit at the consumer's maximum willingness to pay for that unit.

2. **Second Degree Price Discrimination** - The practice of offering consumers a quantity discount.

3. **Third Degree Price Discrimination** - Charging different uniform prices to different consumer groups. This type was covered in ECON 101 where monopolist charge a high price to consumers whose demand is less elastic and charge a low price to consumers whose demand is more elastic.

Condition for Price Discrimination

There are certain conditions that must be satisfied for price discrimination to be able to generate more surplus to a firm.

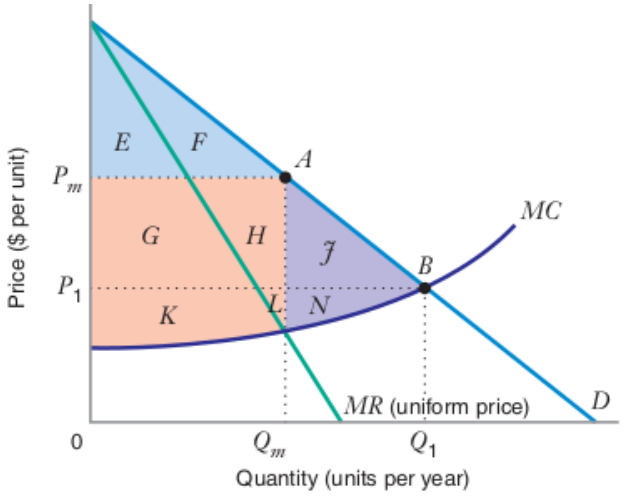
1. Firm must have some market power to price discriminate. This means the demand curve of the firm must be downward sloping. In case of perfect competition where the demand of the firm is horizontal the firm has no power to influence the price and hence cannot practice price discrimination.

2. Firm must have some information about how much consumers are willing to pay and about their elasticities of demand.

3. Firm must be able to prevent resale. The firm cannot prevent the resale of the product or service otherwise the consumer will buy from the low price market and resell the product in a high price market and take the profits for themselves.

First-degree Price Discrimination: Making the most from each consumer

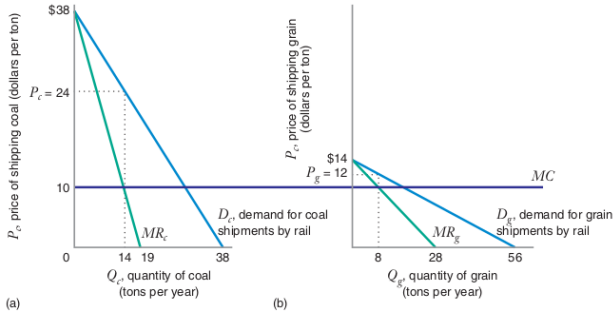
A profit maximizing monopolist who charges a uniform price will produce Q_m and charge P_m and achieves a producer surplus shown below.



	Uniform pricing	First-Degree Price Discrimination
Consumer Surplus	$E+F$	0
Producer Surplus	$G+H+K+L$	$E+F+G+H+J+K+L+N$
Total Surplus	$E+F+G+H+K+L$	$E+F+G+H+J+K+L+N$
DWL	$J+N$	0

If there where uniform pricing there was a DWL but if the producer is charging the consumer the maximum price the consumer is willing to pay for each unit which is reflected by the market demand curve then the DWL is 0. The producer will get all the surplus

Third Degree Price Discrimination: Different Prices for Different Market Segments



The first market (a) demand is steeper meaning less elastic than market b. Here the monopolist charges a higher uniform price in market a than in market b since consumers in market b are more sensitive to the price (more elastic).

Chapter 13: Professor's Villains

Eclass Quiz Minion

Medium Website psychic, neutral evil

Armor Class Collectively 10
Hit Points 10-20
Speed 1 week-ish

STR	DEX	CON	INT	WIS	CHA
29 (+9)	10 (+0)	17 (+3)	12 (+1)	11 (+0)	15 (+2)

Senses —
Languages Algebra, Calculus, Microeconomics
Challenge 1 (200 XP)

Coverage

For quiz

1. Chapter 2 and 3
2. Chapter 4 and 10
3. Chapter 5, 6, 7, and 8
4. Chapter 8, 9, 11, and 12

Composition

Multiple Choice. Variable number of MC questions

Assignment Minion

Medium paper psychic, neutral evil

Armor Class Collectively 10
Hit Points 100
Speed 2-3 week-ish

STR	DEX	CON	INT	WIS	CHA
29 (+9)	10 (+0)	17 (+3)	12 (+1)	11 (+0)	15 (+2)

Senses —
Languages Algebra, Calculus, Microeconomics
Challenge 1 (200 XP)

Coverage

For assignment

1. Chapter 2, 3, 4, and 10
2. Chapter 5, 6, 7, 8, 9, 11, and 12

Composition

Multiple Choice. Variable number of MC questions around 6-8 and 3 long answer questions

First Midterm Champion

Large paper psychic, neutral evil

Armor Class 30
Hit Points 100
Speed 75 minutes

STR	DEX	CON	INT	WIS	CHA
23 (+6)	14 (+2)	21 (+5)	16 (+3)	13 (+1)	20 (+5)

Senses —
Languages Algebra, Calculus, Microeconomics
Challenge 8 (3,900 XP)

Coverage

This will only cover content from Chapters 2, 3, 4, and 10.

Composition

Multiple Choice. Similar to the assignment there are 6 MC and 2-3 long answer questions

Grade Slayer Tiamat

Gargantuan paper psychic, neutral evil

Armor Class 50
Hit Points 100
Speed 120 minutes

STR	DEX	CON	INT	WIS	CHA
30 (+10)	14 (+2)	29 (+9)	18 (+4)	17 (+3)	28 (+9)

Senses —
Languages Algebra, Calculus, Microeconomics
Challenge 23 (50,000 XP)

Coverage

Everything, but more weight on content after the midterm.

Composition

Similar to the midterm, there are around 6-8 MC, and 3 long answer questions

Chapter 14: Credits

General

- Created by u\DnD_Notes, March 2019
- Typesetting engine: LaTeX
- Dungeon and Dragon (5e) LaTeX Template

Art

- The Blue Dragon for the cover art is from D&D Beyond
- Andy the D&D Ampersand is from Dungeon and Dragons
- Cover art formatting: Photoshop CC 2019

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