

1 Introduction to Economic Analysis

1.1 Scarcity

Scarce: Quantity of resources lower than demand, hence insufficient to satisfy needs and wants

Resources: CELL (Capital - physical and human capital, Entrepreneurship, Land, Labour)

What is Economics?: study of choice under scarcity

- How people decide how much to work, what to buy, how much to save, how to invest, etc. given budget and costs
- How firms decide how much to produce, how many workers to hire, etc. given available budget and costs
- How society decides how to allocate its resources among national defense, health care, education, scientific research, social safety nets, etc.

Opportunity cost of any choice: whatever must be given up when we make that choice

Opp. cost = explicit costs + implicit costs
= what you get when you give up the good

- Explicit cost: monetary sacrifice
- Implicit cost: non-monetary e.g. time
- [IMPT]** when the alternatives to a choice are mutually exclusive, the implicit cost of the choice is the value of the next best alternative
 - can try listing all the possible alternatives; if it's infinite then usually opp cost is monetary value

1.2 Five core principles

- Scarcity implies trade-offs**
 - We have unlimited wants and limited resources
 - Hence having more of one good thing usually means having less of another.
- Bargaining strength comes through scarcity**
 - Scarce resources command high prices
- Compare costs and benefits**
 - An action should be taken if, and only if, the benefit is at least as great as the cost.
- People respond to changes in costs and benefits**
 - The likelihood of taking an action rises as the benefit rises, and falls as the cost rises.
- Focus on your comparative advantage**
 - Everyone gains when each individual (or each country) concentrates on the activities in which her opportunity cost is lowest.

1.3 Types of economics

Microeconomics: derived from *Mikros* or *small*

- The study of how households and firms make decisions and how they interact in markets

Microeconomics: derived from *Makros* or *large*

- The study of economy-wide phenomena e.g. inflation, unemployment, and econ growth

Positive Economics: *describe* the world as it is

- Addresses "What is?" question using tools of economics, without any value judgment
- Positive **statements**: can be confirmed or refuted by examining evidence
- Positive **disagreements**: due to differences in scientific judgments

Normative Economics: *prescribe* how the world should be

- Addresses "What should be?" question which require value judgment
- Every normative analysis is based on underlying positive analysis
- Normative **statements**: cannot be confirmed or refuted
- Normative **disagreements**: due to differences in values

1.4 Production Possibility Frontier (PPF)

Model: A simplification of a more complicated reality

- Simplifying* assumptions: do not affect important conclusions
- Critical* assumptions: affect important conclusions

Definition: A graph that shows all combinations of two goods that can be produced given the available resources and technology

- Points on the PPF: possible and efficient
- Points under the PPF: possible but not efficient
- Points above the PPF: not possible

Movements:

- Moving along** a PPF
 - Involves shifting resources from the production of one good to the production of the other good
 - Because resources are limited and hence sacrifice has to be made
 - Slope of PPF = Opportunity cost** of good x in terms of good y
- Shifting** of PPF
 - Due to additional resources or improvement in technology
 - The economy can produce more of good x or good y or any combination in between

Shapes of PPF

- Straight line: opp. cost is constant
- Concave: the opp. cost of a good raises as the economy produces more of the good
 - When different resources are suited for different uses
 - Different resources have different opp. costs of producing one good in terms of the other good (e.g. different workers have different skills)
 - Explanation:
 - Initially, most workers including those who are better at producing good B are producing good A → to get more good B, we can shift workers who are more efficient in producing B from the production of A to B → hence we don't need to give up so many of good A
 - However, producing more of good B would require shifting workers who are more effi-

cient in A than B \rightarrow hence there would be a huge drop in output of A \rightarrow higher opp. cost

1.5 Gains from Trade

Absolute advantage: the ability to produce a good using fewer inputs than another producer

- Producer A can produce the same amount of good x with fewer inputs as compared to producer B
- **[IMPT]** Two countries can gain from trade when each specializes in the good it produces at lowest cost

Comparative advantage: the ability to produce good at a lower opportunity cost than another producer

- Producer A can produce the same amount of good x by giving up fewer of good y as compared to producer B
- **[IMPT]** Absolute advantage is not necessary for comparative advantage
- Gains from trade arise from comparative advantage (differences in opp. costs)
- When each country specializes in the good in which it has a comparative advantage,
 - total production in all countries is higher,
 - the world's economic pie is bigger,
 - and all countries can gain from trade.

Note that there are different possibilities for CA/AA

- AA possibilities
 - A has AA in both goods
 - A has AA in good X but B has AA in good Y
 - Neither has AA in either good
- CA possibilities
 - A has CA in both goods
 - A has CA in good X but B has CA in good Y
 - Neither has CA in either good

1.6 Supply and Demand

Why? How supply and demand determine prices in a market economy which has the function of allocating the economy's scarce resources

Market Economy : allocates resources through the decentralized decisions of households and firms as they interact in markets for goods and services

Market : a group of buyers and sellers of a particular good and service

Perfectly Competitive Market : Identical goods and services, Numerous buyers and sellers, no one can affect market price (price taker)

1.6.1 Demand

Q^D : the amount of the good that buyers are willing and able to purchase

- Q^D in the market is the sum of the Q^D by all buyers at each price

Law of Demand: As the P of good \uparrow , the $Q^D \downarrow$

Demand Schedule: a table that shows the relationship between P and Q^D of a good

Demand Curve: Shows how P affects Q^D , ceteris paribus

(other things kept equal)

Non-price determinants of DD

- Number of buyers
- Y (Income)/type of good (*normal/inferior*); are they positively/negatively related to income?
- P of related goods (substitutes/complement?); **[IMPT]** will cause a shift in DD curve, not Q^D
- Tastes and preferences
- Expectations (of future P or Y)

1.6.2 Supply

Q^S : the amount of the good that sellers are willing and able to sell

- Q^S in the market is the sum of the Q^S by all sellers at each price

Law of Supply: As the P of good \uparrow , the $Q^S \uparrow$

Supply Schedule: a table that shows the relationship between P and Q^S of a good

Supply Curve: Shows how P affects Q^S , ceteris paribus (other things kept equal)

Non-price determinants of SS

- Number of sellers
- Input prices
a \downarrow in input prices will $\uparrow \pi$ at each output P , so firms increase Q^S at each P
- Technology
- Weather/Natural factors
- Expectations (of future events/ P)
- Expectations (of future P or Y)

1.6.3 DD and SS

Equilibrium: a state in which opposing forces are balanced so that one is not greater than the other.

- Eq. P : the price that equates Q^D with Q^S
- Eq. Q : Q^S and Q^D at the eq. P

Surplus/excess supply: $Q^S - Q^D$ when $Q^S > Q^D$

Shortage/excess demand: $Q^D - Q^S$ when $Q^D > Q^S$

One important question to ask: will DD change more than SS when both curves shift?

1.7 Elasticity

1.7.1 PED

PED measures how much Q^D responds to a change in P

$$\begin{aligned} PED &= \frac{\% \Delta Q^D}{\% \Delta P} \\ &= \frac{Q_2^D - Q_1^D}{\frac{Q_2^D + Q_1^D}{2}} \cdot 100\% \bigg/ \frac{P_2 - P_1}{\frac{P_2 + P_1}{2}} \cdot 100\% \\ &= \frac{Q_2^D - Q_1^D}{Q_2^D + Q_1^D} \bigg/ \frac{P_2 - P_1}{P_2 + P_1} \text{ (using midpoint)} \end{aligned}$$

Types of DD curves:

- Perfectly inelastic ($PED = 0$)

- Inelastic ($PED < 1$)
- Unit elastic ($PED = 1$)
- Elastic ($PED > 1$)
- Perfectly elastic ($PED = \infty$)

Factors that affect PED:

- How **broadly** or **narrowly** the good is defined
number of substitutes?? e.g. fruits vs apple
- Is the good a **necessity** or **luxury**?
e.g. water vs orange juice
- The extent to which **close substitutes** are available
e.g. breakfast cereal vs rabies vaccine
- How **expensive/cheap** the good is
Proportion of income?? e.g. Nike vs nonbranded flip-flops
- **Time horizon**
in the SR, when P changes, there's not much we can do (PED is close to 0)
in the LR, more substitutes are available hence PED↑

How does PED affect R ?

- Elastic $\Rightarrow \% \Delta Q^D > \% \Delta P$
 - If $P \downarrow$, $R_{total} \uparrow$ as the $\uparrow R$ from $\uparrow Q$ dominates
 $\downarrow R$ from $\downarrow P$
 - If $P \uparrow$, $R_{total} \downarrow$ as the $\downarrow R$ from $\downarrow Q$ dominates
 $\uparrow R$ from $\uparrow P$
 - Inelastic $\Rightarrow \% \Delta Q^D < \% \Delta P$
 - If $P \downarrow$, $R_{total} \downarrow$ as the $\downarrow R$ from $\downarrow P$ dominates
 $\uparrow R$ from $\uparrow Q$
 - If $P \uparrow$, $R_{total} \uparrow$ as the $\uparrow R$ from $\uparrow P$ dominates
 $\downarrow R$ from $\downarrow Q$
- e.g.** Pharmacies increase the price of insulin by 10%

1.7.2 CED

CED measures how much Q^D responds to a change in the price of another good

$$CED = \frac{\% \Delta Q_1^D}{\% \Delta P_2}$$

- Substitutes $\Rightarrow CED > 0$
- Complements $\Rightarrow CED < 0$

1.7.3 YED

YED measures how much Q^D responds to a change in the Y

$$YED = \frac{\% \Delta Q^D}{\% \Delta Y}$$

- Normal goods $\Rightarrow YED > 0$
- Inferior goods $\Rightarrow YED < 0$

1.7.4 PES

PES measures how Q^S responds to a change in P

$$PES = \frac{\% \Delta Q^S}{\% \Delta P}$$

Factors that affect PES:

- How **easily** sellers can change the quantity they produce
The more easily, the greater the PES and vice versa
- **Time horizon**
In the SR, PES is low. In the LR, PES is high because firms build new factories and new firms enter the market

[IMPT] If DD shift, consider PES

1.8 The Efficiency of Markets

Welfare economics: how the allocation of resources affects *economic well-being*

- *how much* of each good and service is produced
- *which producers* produce them
- *which consumers* consume them

Willingness to Pay (WTP): *maximum amount* the buyer will pay for that good

- measures how much the buyer values the good
- Buyer will buy the good if $WTP \geq P$

$$WTP_{\text{market}} = \sum WTP_{\text{buyer}}$$

- **Marginal buyer:** the buyer who would leave the market if P were any higher
[IMPT] height of DD curve is the WTP of the marginal buyer
- **Consumer Surplus (CS):** the amount a buyer is willing to pay - the amount he actually pays

$$CS = WTP - P$$

(area below DD but above P from 0 to Q)

- If $P \uparrow$, CS will fall
 - $\downarrow CS$ due to less buyers and they leave market
 - $\downarrow CS$ due to remaining buyers paying higher P

Cost/Willingness to Sell (WTS): value of everything a seller must give up to produce a good (opportunity cost) = input costs + value of the seller's time

- Seller will produce only if $P \geq C$
- **Marginal seller:** the seller who would leave if the P were any lower
[IMPT] the height of the SS curve is the WTS of the marginal seller
- **Producer Surplus (PS):** the amount the seller receives for a good - his cost

$$PS = P - \text{Cost}$$

(area above SS but below P from 0 to Q)

- If $P \downarrow$, PS will fall
 - $\downarrow PS$ due to less sellers and they leave market
 - $\downarrow PS$ due to remaining sellers receiving less

1.8.1 Efficiency

$$\begin{aligned} \text{Total Surplus} &= \text{Value to Buyers} - \text{Cost to Sellers} \\ &= CS - PS \end{aligned}$$

*CS = buyers' gains from participating in the market
 *PS = sellers' gains from participating in the market
 *Total Surplus = total gains from trade (a measure of *society's well-being*)

- An allocation of resources is efficient if Total Surplus is maximized
 - goods are consumed by buyers who value them most highly
 - goods are produced by sellers with the lowest cost

(Harford Chapter 3): A set of interconnected **perfectly competitive markets** results in:

1. Companies making things the right way (\downarrow Costs)
2. Companies making the right things (no externalities)
3. Things being made in the right proportions (no under/over allocation)
4. Things going to the right people (those with the highest valuation get to consume the goods)

the Invisible Hand

- Interaction between buyers and sellers determine P
- Each P reflects sellers' costs and buyers' valuation of the good
- Self-interested sellers and buyers use P to guide and make decisions which will allocate resources

First Fundamental Theorem of Welfare Economics, Assume that:

1. **Markets** and **market prices** exist for all goods
2. All buyers and sellers are **competitive price takers**
3. Each person's utility depends only on his own consumption

then any market equilibrium is efficient

1.9 Government Intervention in Markets

Price Ceiling

- Unintended consequences: rental control law in Cambridge, MA led to subpar maintenance of rent-controlled properties (because PB for property owner decreases and hence need to keep costs down)
- Unintended consequences: **black market** (goods are sold illegally at prices above the legal ceiling and above the original P_{eq}), e.g. primary market and secondary market for NBA tickets
 - **[IMPT]** [Active Learning 4.2] Black market price would be the height of DD curve at $Q = Q^S$ (marginal buyer's willingness to pay)

Price Floor

- Unintended Consequences: surplus

Tax

- Payment by buyers/sellers to the government on each unit bought or sold
- Per-unit tax: DD/SS shifts down/up by the amount of tax imposed
 - if Tax on buyers, WTP decreases by the amount of the tax

- if Tax on sellers, WTS
- The **Incidence** of a Tax: how the burden of a tax is shared between buyers and sellers
 - buyers' incidence: buyers pay $(P_{final} + \text{tax} - P_{init}) * Q$ more
 - sellers' incidence: sellers receive $(P_{init} - P_{final}) * Q$ less
 - tax revenue: $\text{Tax} * Q$
- **[IMPT]** Effects of PED and PES on Tax Incidence
 - If SS more elastic than DD: it is easier for sellers than for buyers to leave the market when P increases, so buyers bear most of the burden of the tax
 - If DD is more elastic than SS: sellers bear most of the burden
- DWL: some units between Q_T and Q_E are not sold
 The **value** of these units to buyers is greater than the **cost** of producing them
 Hence the tax prevents some mutually beneficial trades
 - The **more elastic** the PES/PED, the easier it is for sellers/buyers to leave the market and thus Q will drop by a significant amount \Rightarrow the greater the DWL

Subsidy

- Payment by the government to buyers/sellers on each unit bought or sold
- shifts the D/S curve up/down by the amount of the subsidy
- The **Incidence** of a subsidy:
 - buyers' incidence: buyers pay $(P_{init} + \text{subsidy} - P_{final}) * Q$ less
 - sellers' incidence: sellers receive $(P_{final} - P_{init}) * Q$ more
 - government expenditure: $\text{Subsidy} * Q$
- DWL: The value of these units to buyers is less than the cost of producing them; the subsidy induces some wasteful trades

2 Market Failure

If one or more assumptions in the First Fundamental Theorem of Welfare Economics does not hold, then we have Market Failure.

Externalities a byproduct of consumption or production that affects someone other than the buyer or seller

$$\text{Social Cost} = \text{Private Cost} + \text{External Cost}$$

Private Marginal Costs (PMC) the costs directly incurred by sellers

Private Marginal Benefits (PMB) the value to buyers (the price they are willing to pay)

External Marginal Costs (EMC) value of the negative impact on bystanders

2.1 Negative Externality

- Market equilibrium is greater than the socially optimal equilibrium
- To internalize the externality,
 - introduce a tax with amount = EMC

2.2 Positive Externality

- Market equilibrium is less than the socially optimal equilibrium

$$\text{Social Marginal Benefits (SMB)} = \text{PMB} + \text{EMB}$$

- To internalize the externality,
 - introduce a subsidy with amount = EMB

2.3 Public Policies on Externality

Command-and-control policies regulate behaviour directly

- Limit the amount of pollution permitted
- Require firms to adopt a particular technology to reduce emissions

Market-based policies provide incentives so that decision makers will take into account externalities when making decisions

- Corrective taxes/subsidies
 - Pigouvian taxes will correct market failure if Amount = Amount of externalities
 - Align private incentives with society's interests
 - Move towards a more efficient market allocation
- Cap and trade (Tradable pollution permit)

Coase Theorem: If private parties can *costlessly* bargain over the allocation of resources, they can solve the externalities problem on their own

- The private market achieves the efficient outcome regardless of the initial distribution of rights
- Property rights determine the direction in which compensation payments are made (pay to the person with property rights)

Why private solution does not always work:

- Transaction costs:** if costly to reach an agreement (e.g. legal fees etc.)
- Stubbornness:** each party will wait for the other to concede so that they can get the better end of the stick
- Coordination problems:** multiple parties are involved

2.4 Public Goods and Common Resources

excludable if a person can be prevented from using it

rival in consumption if a person's use of it diminishes another person's use of it

When goods have no **prices**, the market forces that normally allocate resources are absent; the private market fails to provide the **socially optimal** quantity of the good

	Rival	Not Rival
Excludable	Private Good	Natural Monopoly
Not Excludable	Common Resource	Public Good

Public Good

- Tends to be **underproduced**
 - The market fails to allocate resources efficiently because property rights are not well-established
 - Nobody can charge people who benefit from public resources → less than optimal quantity provided
- Not excludable ⇒ free riders (people get benefits without paying for it)
- Firms do not produce the good even if Collective Benefits > Cost of providing it
- If the Total Benefits > Total Costs, the government should provide the good and use taxpayers (people who benefit from it) money to finance it

Common Resource

- Tends to be **overused**
 - The market fails to allocate resources efficiently because property rights are not well-established
 - Nobody can charge people who benefit from public resources → more than optimal quantity consumed
- Not excludable
 - Free riders who enjoy without paying ⇒ Firms will not provide
 - Hence role of government is to ensure that they are provided
- Rival in consumption
 - Each person's use reduces another person's use
 - Role of government: ensuring they are not overused
- [IMPT] The Tragedy of the Commons:** Each individual is motivated to maximize their own benefit through over-consumption and this will end up badly for everyone due to limited resources (e.g. overfishing, air-con usage, antibiotic usage)
 - However we also have social contracts and government laws which mitigates this
- [IMPT] Policies to prevent overconsumption of common resource**
 - Privatize** resources (convert common resource to private good)
 - however this means that only some people will have access to it
 - Regulate** use of resources (e.g. Beijing car license plate where only cars with odd/even numbered plates can drive on certain days)
 - Impose a **corrective** tax: hunting and fishing licenses which requires money to register
 - Auction off **permits** allowing use of resources

3 Market Structure

$$\text{Profit} = \text{TR} - \text{TC}$$

$$\text{TR} = P \times Q$$

$$\text{AR} = \frac{\text{TR}}{Q} = P$$

$$\text{MR} = \frac{\Delta \text{TR}}{\Delta Q}$$

$$\text{ATC} = \frac{\text{TC}}{Q}$$

$$\text{MC} = \frac{\Delta \text{TC}}{\Delta Q}$$

Why MC crosses through ATC at the ATC minimum?

- When $\text{MC} < \text{ATC}$, ATC will ↓
- When $\text{MC} > \text{ATC}$, ATC will ↑

What Q maximizes the firm's profit?

- If $\text{MR} > \text{MC}$, then ↑ Q to raise profit
- If $\text{MR} < \text{MC}$, then ↓ Q to raise profit
- Hence profit is maximized at Q when $\text{MR} = \text{MC}$

3.1 Perfect Competition

- There are many buyers and sellers
- Sellers offer a standardized product
- Sellers can freely enter/exit market
- Buyers and sellers are well-informed
- Each buyer and seller is a price-taker

MR=P only for perfectly competitive firm

- A firm can keep increasing output without affecting market prices

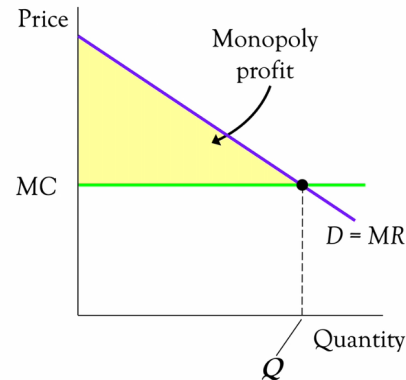
3.2 Monopoly

- Only one firm sells a product with **no close substitutes**
- Has **market power** - ability to influence the market P of the product it sells due to
 - Selling unique product
 - Having large market share and few significant competitors
- **Barriers to Entry**
 - Single firm owns a key resource (De Beers)
 - Natural monopoly → high fixed costs → one firm can produce for all at significantly lower TC as compared to multiple firms
 - The government gives a single firm the exclusive right to produce the good (patents, copyright)
- It faces the market demand curve: To ↑ Q , it must ↓ P
 - Output effect: ↑ $Q \Rightarrow R \uparrow$
 - Price effect: ↓ $P \Rightarrow R \downarrow$
- $P > \text{MC} \Rightarrow$ buyers' valuation of the unit is more than the MC of producing that unit \Rightarrow DWL

3.2.1 Price Discrimination

- Selling the same good at different prices to different buyers

- Increase profit by charging a higher price to buyers with higher WTP
- **Perfect discrimination:**
 - * But no firm knows every buyer's WTP
 - * Buyers do not announce their WTP to sellers
 - * Solution: divide customers into group based on some traits that are likely related to WTP



- Harford The Undercover Economist Chapter 2: *What Supermarkets Don't Want You to Know*
 - * Unique target (first-degree)
 - * Group target (third-degree)
 - * Self-incrimination

3.3 Monopolistic Competition

- **Many** buyers and sellers
- Offer **differentiated** products
- Sellers are **free** to enter and exit the market
 - LR Economic profit = 0 due to entry and exit
 - New firms enter the market due to existing firms making profits
- **[IMPT] Externalities due to entry of new firms**
 - **Product-variety externality:** consumers benefit from intro of new products
 - **Business-stealing externality:** existing firms lose revenues when new firms enter the market

3.4 Oligopoly

- **N-firm Concentration Ratio:** percentage of the market's total output supplied by the N largest firms
- Only **a few** sellers offer similar or identical products
- A firm's decision about P or Q can affect other firms
 - The firm will consider the reactions from other firms when making decisions
- **Game theory:** study of how people behave in strategic situations
- **Types of oligopoly**
 - Collusion: an agreement among firms in a market about quantities to produce or prices to charge
 - Cartel: A group of firms acting in unison (e.g. price fixing)
 - * Cartel = Monopoly
 - * Collective firms acting as a single unit, hence graph is equal to monopoly

3.4.1 Game Theory

Collusion vs self-interest

- Both firms would be better off if they both stick to the cartel agreement
- But each firm has an incentive to cheat

Nash Equilibrium

- A situation in which players interacting with one another each chooses his best strategy given the strategies that all the others have chosen

Dominant Strategy

- A strategy that is best for a player in a game regardless of the strategies chosen by the other players

Prisoners' Dilemma

- Cooperation is difficult even when it is mutually beneficial
- Both players have dominant strategies that result in inefficient outcomes

		P2	
		A	B
P1	A	P1: Good P2: Good	P1: Worst P2: Best
	B	P1: Best P2: Worst	P1: Bad P2: Bad

- Non-cooperative oligopoly equilibrium will be
 - Bad for oligopoly firms: prevented from achieving **monopoly** profits
 - Good for society: Q is closer to the socially efficient output, P is closer to MC
- Strategies that lead to cooperation:
 - Grim:**
Initially, a player using grim trigger will cooperate, but as soon as the opponent defects (thus satisfying the trigger condition), the player using grim trigger will defect for the remainder of the iterated game. Since a single defect by the opponent triggers defection forever, grim trigger is the most strictly unforgiving of strategies in an iterated game.
 - Tit for Tat**
For example, two competing economies can use a tit-for-tat strategy so that both participants benefit. One economy **starts with cooperation** by not imposing import tariffs on the other economy's goods and services to induce good behavior. The idea is that the second economy responds by also choosing not to impose import tariffs. If the second economy reacts by implementing tariffs, the first economy retaliates by implementing tariffs of its own to discourage the behavior.