1 Introduction to Economic Analysis

1.1 Scarcity

Scarce: Quantity of resources lower than demand, hence insufficient to satisfv 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

$$\begin{aligned}\text{Opp. cost} &= \text{explicit costs} + \text{implicit costs} \\ &= \text{what you get when you give up the good}\end{aligned}$$

- 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

1. **Scarcity implies trade-offs**
   - We have unlimited wants and limited resources
   - Hence having more of one good thing usually means having less of another.
2. **Bargaining strength comes through scarcity**
   - Scarce resources command high prices
3. **Compare costs and benefits**
   - An action should be taken if, and only if, the benefit is at least as great as the cost.
4. **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.
5. **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 rises 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 $\rightarrow$ to get more good B, we can shift workers who are more efficient in producing B from the production of A to B $\rightarrow$ 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 → hence there would be a huge drop in output of A → 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 ⇑, the Q^D ⇓
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 ⇑, the Q^S ⇑
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 ⇓ in input prices will ⇑ π 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

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

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$\Uparrow$

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 seler receives for a good - his cost

$$PS = P - Cost$$

  (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 (↓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 bough 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 $(P_{\text{final}} + \text{tax} - P_{\text{init}}) * Q$ more
  - sellers' incidence: sellers receive $(P_{\text{init}} - P_{\text{final}}) * Q$ less
  - tax revenue: 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 $(P_{\text{init}} + \text{subsidy} - P_{\text{final}}) * Q$ less
  - sellers' incidence: sellers receive $(P_{\text{final}} - P_{\text{init}}) * Q$ more
  - government expenditure: 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 MC $<$ ATC, ATC will $\downarrow$
- When MC $>$ ATC, ATC will $\uparrow$

What Q maximizes the firm's profit?
- If MR $>$ MC, then $\uparrow Q$ to raise profit
- If MR $<$ MC, then $\downarrow Q$ to raise profit
- Hence profit is minimized at Q when MR $=$ MC
- **[IMPT]** Also note that $P > MR$ for a monopolistically competitive firm

Long run equilibrium?
- Only happens when $P = ATC$ so that profits $= 0$

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

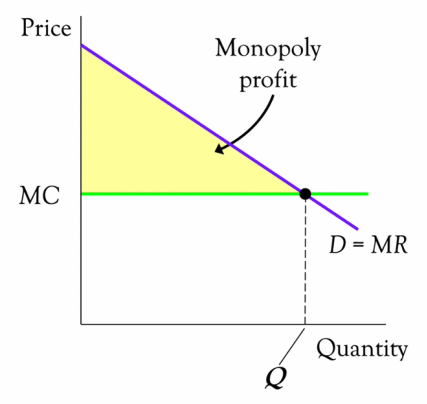
MR=P only for perfectly competitive firm
- A firm can keep increasing output without affecting market prices

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 $\rightarrow$ high fixed costs $\rightarrow$ 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 $\uparrow Q$, it must $\downarrow P$
  - Output effect: $\uparrow Q \Rightarrow R \uparrow$
  - Price effect: $\downarrow P \Rightarrow R \downarrow$
- $P > MC \Rightarrow$ 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)
      - Producer can easily determine consumers' WTP
      - Producer can prevent arbitrage
    - 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.

4 Measurements in Macroeconomics

Origins of Macroeconomics

- Classical economy did not work during the Great Depression
- 3 branches:
  - *Theory*: John Maynard Keynes
  - *Policy*: Franklin D Roosevelt
  - *Measurement*: Simon Kuznets

Goals in Macro

- High and sustained economic growth: Real GDP/GDP Per Capita
- Stable Prices: CPI
- Low Unemployment: Employment Rate

4.1 Economic Growth

Making goods and services (g&s) that satisfy needs and wants

- Goods: tangbible goods
- Services: Enjoyed while produced, inseparable from their production
- **[IMPT]** Loan/deposit/cash/shares are not part of g&s

So, **Economic growth** = rise in an economy's economic production per period

Why is economic growth desired?

- Required for improvements in living standards and well-being
- Provides society with a sense of progress
- Helps society avoid conflicts over distribution

4.1.1 GDP

Definition: Total monetary value of final goods and services in a country during a given time period

- "Total Monetary value": use current **market prices**
  Indirect measurement of monetary value:
  - Financial services: use **spread**: difference between interest earned on loans and interest paid on deposits
  - Housing services:
    * for tenants, value is measured by **rent paid**
    * For occupiers, value is measured by rent for similar houses

  [IMPT] When there are no market prices: e.g. g&s produced by government for its own use / specialized eqpmt by firms for their own use: **estimated by cost of production**
- "Final": **avoid double-counting** goods and services
  e.g. Tire used on Ferrari sold to customer is not counted as it is part of a final good (Ferrari)
  - Final good: sold to final user
  - Intermediate good: used up to produce some other good
- "In a country": inside geographical boundaries (except embassies)

- "In a given period": Stock vs flow variables, in this case GDP is a flow

4.1.2 Three approaches to measuring GDP

1. **Expenditure**

$$Y = C + I + G + NX$$

   - Private consumption: g&s purchased by households as final users
     [IMPT] C excludes the purchase of new homes, but includes value of housing services enjoyed by both tenants and owner-occupiers
     Why?? Might be because of accrual accounting? purchasing 1 big house can be done anytime but
   - Private Investment: g&s purchased by firms as final users
     Include **capital goods**: goods made to produce other g&s
     Also include **change in inventories**: goods stored by firms for future use
     Also include **subsidies**
   - Government Expenditure: Expenditure on g&s by government as final users
     - **Government consumption**: inventory for railroad workers
     - **Government investment**: highways, bridges, railroads,
     - **[IMPT]** Does not include **government transfers** to households
   - Net Exports: Exports - Imports

2. **Value-added (Production)**

   A firm's value added = Value of g&s it produces − Value of intermediate g&s it uses up
   $= \text{Final} - \text{Initial value}$

$$Y = \sum \text{Value-added}$$

   This reveals the contribution of various industrial sectors to GDP

3. **Income (Income)**

$$\sum \text{Value-added} = \sum \text{Factor incomes}$$

   - A firm's value added is **paid out** to owners of FOP
   - Wages = Payments to workers
   - Interest = Payments to financiers
   - Rent = Payment to Landlords
   - Profit = income accruing to firms' owners

   [IMPT] : Can tell us distribution of incomes across different factors

Comparing GDP across time

- Nominal GDP: GDP at current prices
- Real GDP: To make better comparisons of GDP over time
- **Fixed-base approach**
  - Choose a base year (arbitrary?!)
  - Use base year prices to value production for all years
- **[IMPT] Annual Chain-linking approach**
  - Definition: Goods and services produced in each year are revalued using the prices of the previous year
  - Youtube Video
  - Instead of taking an arbitrary year as the base year, we set the last year as the base year
    * Find growth rate first for each year based on previous year
    * To get Real GDP in a given year, chain multiply growth rates from reference year until given year

$$RGDP_i = RGDP_k \times g_{k+1} \times \cdots \times g_i$$

  - Limitation: can only compute year-on-year changes of GDP
  - Benefits:
    * Takes into consideration changes in the relative prices of g&s that occur from one year to the next
    * Reflects any recent changes in economic conditions

The GDP Deflator: measure of price level of g&s included in GDP

$$\text{GDP Deflator} = 100 \times \frac{\text{nominal GDP}}{\text{real GDP}}$$

4.1.3 Problems with GDP

Quality changes

- Quality should account for more production, but this is subjective

Free goods and services

- *e.g.* Facebook, Youtube, TikTok
- There are associated payments for these but these likely underestimates the value of these products

Shadow Economy/Underground Economy

- informal, illegal, unreported market activities
- hard to obtain measurements
- Hard to compare GDP across countries if one country has greater importance of the shadow economy

GDP $\neq$ indicator of well-being: many important things that matter to well-being are not captured by GDP

4.2 Price Levels and Inflation

Note that GDP Deflator is not suitable for measuring changes in households' cost of living (COL) since it includes everything

Consumer Price Index

- Fix the market basket of g&s that the average household consumes in a year
- Collect prices of items in the market basket for each year
- Using the prices, compute the market basket's cost
- Choose a base year and compute the CPI and Inflation Rate (year-on-year)

$$\text{CPI}_{\text{current}} = 100 \times \frac{\text{CPI}_{\text{current}}}{\text{CPI}_{\text{base}}}$$

- Real value vs Nominal value

$$\text{Real Value} = \text{Nominal Value} \times \frac{100}{\text{CPI}}$$

$$\text{Real i/r} = \text{Nominal i/r} - \text{Inflation Rate}$$

The Economist Intelligence Unit's Cost of Living Index

- Basket of g&s = 160 items consumed by expatriate households
- Comparison is across cities rather than across time (New York is chosen as base city with index value = 100)
- Cost is converted to US Dollars at prevailing exchange rate

4.2.1 Problems with CPI

Upward bias: overstates the amount of inflation the households are experiencing

- **Substitution bias**: when one good increases its price, households tend to switch to cheaper goods but it is not reflected in market basket
- **Outlet bias**: as prices increase, consumers shift purchase from more expensive mainstream stores to cheaper discount outlets and retailers but this may be less represented in statistical authorities' data collection
- **Quality bias**: inflation does not take into account paying for higher quality
- **New goods bias**:
  - New products tend to fall in price and improve in quality during the during the early years of the product's life cycle
  - However they are only added to the market basket only much later
  - So CPI fails to capture the fall in price during early years

4.2.2 Stable Prices

[IMPT] The goal of keeping inflation **predictable, low, and positive** (2% per year as a guideline)

- Expected inflation can be incorporated into agreements ahead of time, thereby preventing unwanted redistribution of purchasing power
  - *e.g.* if inflation rate is higher than predicted, then lender will be worse off and borrower will be better off
  - **How to guarantee real inflation rate?**
    - Indexation to correct for inflation: loan agreement where

$$\text{Nominal i/r} = \text{Read i/r} + \text{Inflation rate}$$

whatever the latter turns out to be

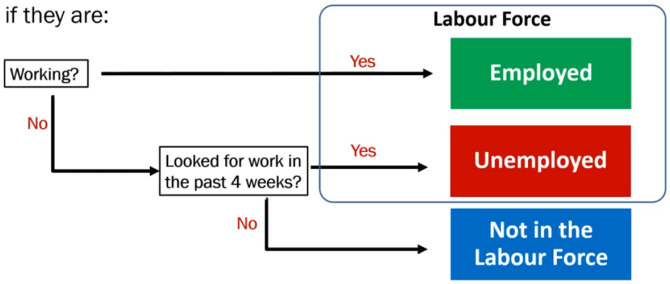
- *High inflation* is costly to society
  - **Distort relative price signals** → causing misallocation of resources
  - Prompts people to use up valuable resources and time to cope with it
  - **Menu costs**: Sellers change price more often
  - **Shoe leather costs**: costs due to efforts in minimizing money holdings as people go to bank more
- *Deflation* is also costly to society
  - **Definition**: a prolonged spell of negative inflation
  - Can make downturns and recessions worse as incomes ↓
    - Households and firms postpone purchases to anticipate for lower future prices
    - Borrowers incomes fall but their debt and interest may not; **loan defaults** and **bankruptcy declarations** increase

4.3 Low Unemployment

Social costs of having large numbers of unemployed people:

- Labour resources are underutilized
- Skills of workers erode with non-use
- Health, social, and political problems

Ask those *able to work*:

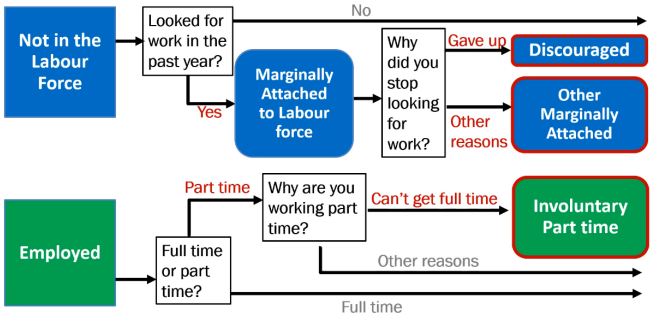


$$\text{Unemployment Rate} = 100\% \times \frac{\text{Unemployed}}{\text{Labour Force}}$$

$$\text{Labour Force Participation Rate} = 100\% \times \frac{\text{Labour Force}}{\text{Able to work}}$$

$$\text{Employment Rate} = 100\% \times \frac{\text{Employed}}{\text{Able to work}}$$

Ask more questions in the survey (II)



Modified U-rates

A	Employed	155.5m
B	Unemployed	6.3m
C	Discouraged	0.4m
D	Other marginally attached	1.0m
E	Involuntary part time	4.4m

$$\text{U-Rate (U-3)} = \frac{B}{A+B} = 3.9\%$$

$$\text{U-4} = \frac{B+C}{A+B+C} = 4.1\%$$

$$\text{U-5} = \frac{B+C+D}{A+B+C+D} = 4.7\%$$

$$\text{U-6} = \frac{B+C+D+E}{A+B+C+D} = 7.4\%$$

4.3.1 Seasonality in Unemployment

- Short term
- Entirely predictable
- Seasonally adjusted → modified to remove the seasonal variation to facilitate comparisons

4.3.2 Types of Unemployment

Frictional Unemployment: those in between jobs or just entering labour market

- Characteristics:
  - Looking for good matches
  - Short term
  - Generally painless
- Government provided unemployment insurance will extend job search time

Structural Unemployment:

- Skill mismatch: mismatch between skills and employers' requirements
- Geographic mismatch: workers' and employers' locations
- Labour market impediments: high minimum wage, discrimination, unionization

Cyclical Unemployment: fluctuations in unemployment that arises from changes in production over the **business cycle**

- Rise during recessions and fall in between recessions
- Note that **Full employment** refers to **zero cyclical unemployment** and other types of unemployment are present
- At full employment, the output the economy produces is called its **Potential output**

5 Long-run Macroeconomics

5.1 Growth Rate approximation

Rule of 70 approximation:

$$\text{Time to double} \approx \frac{70}{\text{growth rate percentage point}}$$

Approximation for growth rates products and quotients: let g_A be growth rate of variable A

- If $C = A \times B$, then $g_C \approx g_A + g_B$
- If $C = A/B$, then $g_C \approx g_A - g_B$

$$\text{RGDP per capita} = \text{Productivity} \times \text{Avg Hours} \times \text{EPR}$$

$$g_{\text{RGDP per capita}} = g_{\text{Productivity}} + g_{\text{Avg Hours}} + g_{\text{EPR}}$$

5.2 Divergence

Given sufficient time, even a **small difference** in annual growth rate of RGDP creates a **big difference** in RGDP
Why some countries have big growth and others don't?

- Institutions needed for markets to thrive must be developed for growth
- *e.g. Rule of law, market orientation, openness, stability*

5.2.1 Rule of Law

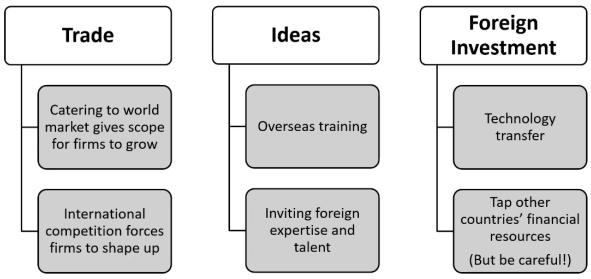
- **Private property rights**: investment must be secure against criminal and/or government appropriation
- **Enforcement of contracts**: Private enforcement is expensive, inefficient and uncertain, much better to rely on a trustable legal system

5.2.2 Market Orientation

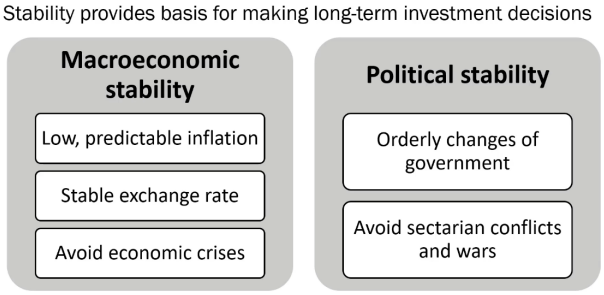
Central planning can mobilize resources on massive scale but is prone to **resource misallocation and mal-investment**

- In contrast **market-based economies** are faster in generating and processing information about needs and constraints
- So they are far more adaptive to changes in the economic environment
- **Industrial policy** (govt-directed attempts to grow specific targeted industries) has a mixed record
  - They are based on protectionism and will continue to be supported by government without much exposure to the real market, hence inefficient

5.2.3 Openness



5.2.4 Stability



5.3 Aggregate Production

$$Y = f(L, K, \text{Land}, A)$$

- Y is Output
- L is Labour
- K is Capital
- $Land$ is Natural Resources
- A is technology

5.3.1 Labour

For a given K and A, if L is doubled, Y would increase by a smaller extent due to **diminishing returns to labour**

$$g_{\text{RGDP per capita}} = g_{\text{Productivity}} + g_{\text{Avg Hours}} + g_{\text{EPR}}$$

Problems with increasing EPR/Avg. hours:
- More labourers will increase Labour Supply (LS) resulting in falling wages and falling household incomes
- Encourage **homemakers** to work: sacrifice child care
- Import **foreign workers**: inability to integrate, loneliness
- Encourage **elderly** to work: not efficient and desirable
- **Lengthen** work hours: Karoshi (death by overwork)

So the only effective alternative is to increase productivity (output per unit labour)

$$\frac{Y}{L} = f\left(\frac{K}{L}, A\right)$$

5.3.2 Capital Deepening

Definition: raising K/L. Assume that L is fixed so raising K/L means raising K

$$K_t - K_{t-1} = I_t + G_t - \delta K_t$$

- K_t and K_{t-1} are capital stock at time t and $t-1$ respectively, so $K_t - K_{t-1}$(Net Investment) is the change in capital stock (flow variable)
- I_t is private investment
- G_t is govt investment
- δK_t is **Depreciation** (loss due to wear and tear, obsolescence), assumed to be a constant fraction of existing capital stock

Policies for Capital Deepening
1. Change incentives to promote investment
   - Reduce corporate tax (on firm's profits) but this effectiveness is mixed
   - Grant Investment Tax Credit: tax reduction for firms that invest in new capital
2. Change inventives to promote saving
   - Shift from taxing income to taxing consumption
   - Reduce transfers to elderly, unemployed
   - Mandatory saving (*e.g.* Singapore's CPF)

Human Capital: workers' knowledge, skills, discipline, and health
- Increases productivity (H/L) but is not included under investment
- H/L: human capital per unit of labour

$$\frac{Y}{L} = f\left(\frac{K}{L}, \frac{H}{L}, A\right)$$

Catch-up growth: poor countries with solid institutional conditions can grow rapidly and catch up with other countries
- *e.g.* Post WWII Japan and Germany, Four Asian Tigers
- Elements of catch-up growth:
  - Reduce C, to boost I
  - Invest in health and education to improve H
  - Adopt and adapt technology from rest of the world (H and K)

Limitations of capital deepening
- More K, Less C goods (PPF), but PPF will shift more in the future due to more K goods (legitimate trade-off)
- **Diminishing returns to capital**: productivity growth from capital deepening eventually slows as we increase K (For a given amount of $\bar{L}$ and $\bar{A}$, Y will only increase marginally)
- **Rising depreciation**: as K increases, δK will increase and thus *more gross investment is needed to replace depreciated capita;, leaving less for net investment*

5.3.3 Technological Growth

Productivity growth can come from tech change: *Invention and application of new inputs, new products, or new production methods*
- **Discovery-based growth**: growth based on pushing the technological frontier by creating and using new ideas!

Some policies:
- **Intellectual property rights**:
  - needed to incentivize commercial R&D, otherwise copycats can reap gains without paying for R&D costs (non-rival)
  - But should not be too strong,otherwise people would be discouraged from using the discovery
  - Examples:
    - Patent: right to exclude others from, or charge others for the use of one's invention, valid for a set period
    - Copyright: right to exclude others from, or charge others for, reproducing one's work, valid for a set period
- **Promoting entrepreneurship**: startup culture, seed financing for fledgling entrepreneurship to obtain funding

- **Government funding for R&D**: Subsidies for private R&D, government direct funding of R&D

5.4 Loanable Funds Market

$$S = I^P + G - T$$

$$Y = C + I^P + G$$

$$\text{Output} = \text{Planned Spending}$$

5.4.1 Households

$$S = Y - T - C$$

- S is supply of savings, a portion of Y minus T (net taxes which is Taxes-Subsidies) minus C
- **Determinants of S**
  - Real i/r $\Rightarrow$ if rates increase, it's more lucrative to save
  - Future expectations of income: if Future Y is expected to increase, there will be less S now
  - Households wealth:

5.4.2 Firms

$$I = I^P + \Delta\text{Inventories}$$

- Borrow loanable funds market to finance spending on planned private investment I^P
- Let all changes in inventories be unplanned
- **Determinants of I^P**
  - Real i/r
  - Expected future profits from new capital (optimism)

5.4.3 Government

- Govt purchases $= G$, Govt collects net taxes T
- If $G > T$, govt has budget deficit of size $G - T$ and will demand funds
- If $T > G$, govt has budget surplus of size $T - G$
- **[IMPT]** Assumption: $G > T$ and always running on budget deficit, and is insensitive to change in real i/r

5.5 The Classical Model

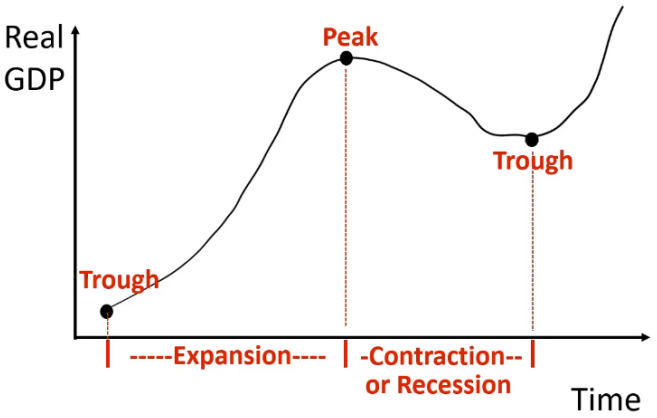
Focuses on **resource markets and technology** as **determinants** of an economy's potential output

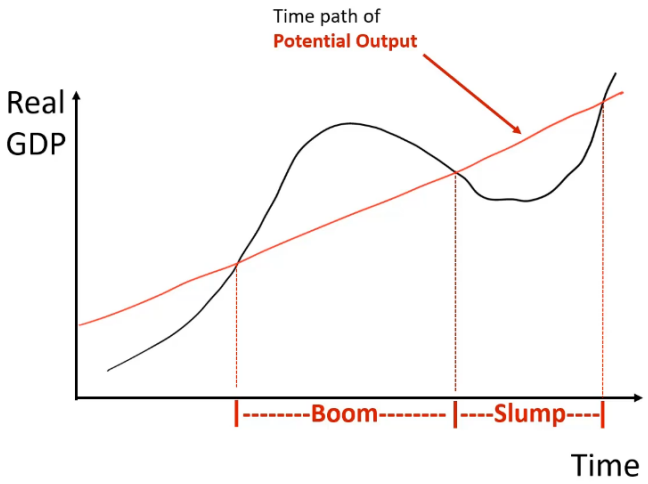
Assumption: markets clear:
- Labour market reaches equilibrium
- Loanable funds market reaches equilibrium
- Open vs closed economy?

Say's Law: "Spending adjusts to equal output (and not the other way around)"
- Supply creates its own demand
- **100% crowding out**: If one spending component increases/falls, output does not change, instead the other spending components fall/increase by the same extent
  - Use $Y = C + I^P + G$ at equilibrium and other assumptions (loanable markets, labour market at equilibrium)

6 Short-run Macroeconomics

Singapore's Covid-19 Resilience Package (Fiscal Policy)
- G elements
  - Spending on public health and safe reopening
  - Spending on investments in hardest-hit sectors
- T elements
  - Job Support Scheme: paying a portion of workers' salaries
  - Recovery Grant: Financial support for workers who lost jobs or were forced to take no-pay leave
  - Grants for workers in hardest hit sectors





Some terms: (refer to diagrams)
- **Business Cycles**: another name for econ fluctuations
- **Technical Recession**: two consecutive quarters of contraction (might be abit arbitrary so that's why it's called technical)
- **Boom/Slump**: depends on the position with regards to the economy's Potential output (not directly measured and so is estimated)

What is Short Run Macro?
- LR Macro refers to the time when all markets clear, so the Classical Model is a useful guide because the assumptions hold
- SR Macro refers to the time period where some markets do not clear (Classical Model is not suitable) and economic fluctuations during the period
  - **Labour markets do not clear**: Sticky Wages assumption h

  - Wage rates tend to fall slowly, if at all due to inertia, long-term contracts, worries about morale
  - During recessions, Labour Demand do not usually fall as this will entail a decrease in wages which is not what is observed
  - Instead, the Sticky Wages assumption holds and so there is a surplus of workers (unemployment) and markets do not clear
- **Loanable funds markets do not clear**:
  - Other forces affect i/r, lending and borrowing, especially within relatively shorter time periods
- **Spending depends on output = income**
  - The more output produced $\Rightarrow$ more income households receive $\Rightarrow$ more goods and services they purchase
- **Output depends on spending**
  - If spending $>$ output, firms will increase output in response
  - If spending $<$ output, firms will reduce output in response

6.1 Keynesian Model

6.1.1 Spending Depends on Output

Spending is due to Households (C), Firms (I^P), Government (G), and the External Sector (NX) and they are assumed to be **autonomous** (meaning they do not change when the output Y changes)

$$C = a + b(Y - T), 0 < b < 1$$

- a is the part of consumption independent on disposable income (**autonomous consumption**)
- $b(Y - T)$ is part of consumption that depends on disposable income
- **Marginal Propensity to Consume (MPC)**

$$MPC = \frac{\Delta C}{\Delta Y} = b$$

- **Aggregate Expenditure (AE)**

$$AE = C + I^P + G + NX$$

- **Demand Shocks**: When AE shifts due to factors that affect a, I^P, G, T, and NX
  - a: expected future income, wealth, real i/r
  - I^P: business optimism, real i/r
  - G: fiscal policy decisions
  - NX: exchange rate, other countries' spending

6.1.2 Output Depends on Spending

$$I = I^P + \Delta\text{Inventories}$$

- I is total investment, I^P is planned investment, change in inventories is assumed to be always unplanned
- If $Y > AE$, Inventories will increase as there are unsold goods in the warehouse, $I > I^P$ and Firms will $\downarrow Y$ to $\downarrow$ inventories
- If $Y < AE$, Inventories will decrease as firms are producing insufficient g&s to satisfy spending from parties, $I < I^P$ and Firms will $\uparrow Y$ to $\uparrow$ inventories
- Note that firms respond by changing output, not prices as the economy's price level is assumed to be fixed (short run stickiness in wages and prices)

6.1.3 Goods Market Equilibrium

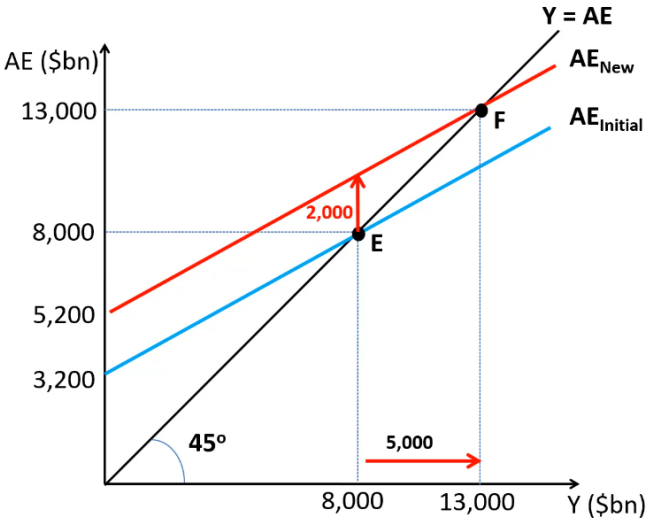
Equilibrium is achieved when $Y = AE$ and

$$AE = (a - bT + I^P + G + NX) + bY$$

which is achieved at Y^*, the equilibrium level of Y

$$Y^* = \frac{1}{1-b}(a - bT + I^P + G + NX)$$

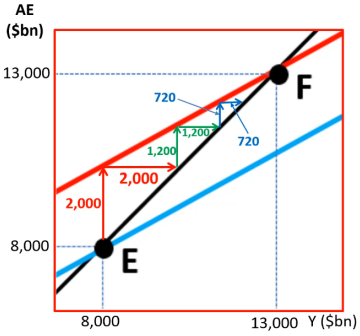
Note that T = Net Taxes = Taxes - Transfers **[IMPT]**



When there is a change in components (a, I^P, G, or NX) due to demand shock, the new equilibrium will increase through **multiplier process** by

$$\Delta Y^* = \frac{1}{1-b}\Delta I^P \text{ or } G \text{ or } NX$$

The equilibrating process



Initially at E
- AE↑ by $2 tr
- Firms respond: Y↑ by $2tr
- Households respond: AE↑ by 0.6 x$2tr = $1.2tr
- Firms respond: Y↑ by $1.2tr
- Households respond: AE↑ by 0.6 x $1.2tr = $720bn
- Firms respond: Y↑ by $720bn...

and $\frac{\Delta Y^*}{\Delta I^P}$, $\frac{\Delta Y^*}{\Delta a}$, $\frac{\Delta Y^*}{\Delta G}$, $\frac{\Delta Y^*}{\Delta NX}$ are called **expenditure multipliers** and are most of the time given by $\frac{1}{1-b}$

6.1.4 Explaining Economic Fluctuations

- Fluctuations are mostly due to **demand shocks**, which are amplified by the multiplier process
- Main sources of demand shocks
  - I^P is the most volatile because it depends on business optimism and expectations which are volatile (animal spirits)
  - For small open economies, NX can be highly volatile
- There is no relationship between equilibrium output (Y^*) and potential output (Y_{FE}), as the economy can be in a slump or a boom for a protracted period of time
  - Output gap $= Y^* - Y_{FE}$
  - Percentage output gap $= 100\% \times \frac{Y^* - Y_{FE}}{Y_{FE}}$

6.1.5 Automatic Stabilizers and Destabilizers

- **Automatic stabilizers**: features of the economy that automatically dampen the spending resposne during the multiplier process
  - makes the multiplier smaller
  - makes the economy more stable in the short run
- **Automatic destabilizers**: features of the economy that automatically strengthen the spending resposne during the multiplier process
  - makes the multiplier bigger
  - makes the economy less stable in the short run

Suppose there is a positive demand shock and $Y \uparrow$

- Relax the assumption that T is autonomous
  - When $Y \uparrow$, there will be increase in income tax revenue, sales tax revenue, and decrease in trasnfers to unemployed & poor (overall increase in T)
  - $T \uparrow$ means $C \downarrow$ and this partially **counteracts** the initial $Y \uparrow$
- Relax the assumption that M (imports) are autonomous
  - When $Y \uparrow$, $C \uparrow$ and more of this is spent on purchasing imports
  - Hence the multiplier becomes smaller
- Household wealth may rise with income
  - Stock prices, prices of homes rise rapidly during booms
  - When $Y \uparrow$, $a \uparrow$ which means a is not autonomous
- Planned investment (I^P) may rise with income as firms become more optimistic as economy booms

6.2 Countercyclical Fiscal Policy

Definition: fiscal policy aiming to dampen economic fluctuations

- If $Y^* < Y_{FE}$, countercyclical FP should be **expansionary** (Aim to $\uparrow AE$ by $\uparrow G$ or $\downarrow T$)
- If $Y^* > Y_{FE}$, countercyclical FP should be **contractionary** (Aim to $\downarrow AE$ by $\downarrow G$ or $\uparrow T$)
- By contrast, **fiscal austerity** during a slump is **procyclical**

To counter a slump, G only needs to be a fraction of the output gap to close the gap and reach Y_{FE}, in contrast, we need bigger change in T as a change in T only affects a portion of Y

$$\text{G-Multiplier} = \frac{\Delta Y^*}{\Delta G} = \frac{1}{1 - MPC}$$

$$\text{T-Multiplier} = \frac{\Delta Y^*}{\Delta T} = -MPC \times \frac{1}{1 - MPC}$$

6.2.1 Problems with FP

Timeliness Problem: discretionary FP prone to lags since time is used to

- Collect and interpret macroeconomic data
- Formulate the fiscal plan
- Get legislative approval for the spending plan

Irreversibility Problem

- Ideally counter-cyclical policy should be reversible (should be able to withdraw stimulus after recovery)
- But it is difficult to reverse
  - Voters hate $T \uparrow$ again and $G_{\text{transfers}} \downarrow$
  - Businesses that benefit from G will lobby the govt to keep spending

Monetary Policy is available

- Central Bank may already have used monetary policy to stabilize the economy which is fast and easy to reverse
- Central banks are usually independent from govt, to insulate monetary policy from political considerations

Theory vs Practice

- Size of output gap: cannot be estimated accurately
- Size of multiplier: uncertainty about size
- Size of stimulus: political considerations dominate (govt wants to appease as many people as possible, big stimulus would anger some people)
- Mix of G&T: similar to above (political considerations)
- Timing of stimulus: ideally applied ASAP, but there is always time lag

6.2.2 Singapore's Countercyclical FP in 2020

- Jobs Support Scheme: \$20 billion wage subsidy
  - Able to support businesses wage expenses and prevent retrenchment
- Covid-19 Support Grant: discretionary unemployment benefit
- Care and Support Package:
  - Vouchers for groceries, utilities, and conservancy
  - Poorer families get more
- Solidarity payment: cash transfers to citizens and PR
- Government-sponsored traineeships: to reduce unemployment spell for those entering job market
- Industry-specific help: \$100 credit per household to use on local tourism