ECON*1100 - Introductory Macroeconomics (Adomait)
Midterm: Chapter 35, 19-26

Chapter 35: Exchange Rates and the Balance of Payments

- Chapter 35.2: The Foreign-Exchange Market
  - Canadian- dollar price of 1 U.S. Dollar (CAD/USD)
  - US-dollar price of 1 CAD dollar (USD/CAD)
  - Appreciation of the CAD = more valuable
    - A fall in the exchange rate (less money to buy USD)
  - Depreciation of the CAD = less valuable
    - A rise in the exchange rate (more money to buy USD)

  Supply of foreign exchange (demand for CAD)

  - Canadian exports (lumber, engineering services)
  - Asset sales: capital inflows (government bonds, real estate)
  - Reserve currency (accumulate & hold CAD; ex. Poland buys more CAD because they think it will be worth more)
  - CAD depreciating:

    - Euro prices of Canadian goods falling
      - Europeans want to buy more

    CAD appreciating:

    - Euro prices of Canadian goods rising
      - Europeans want to buy less

- CAD depreciates (higher exchange rate)
  = Canadian securities & assets = attractive

  Demand for foreign exchange (demand for foreign currency)
  - CAD depreciating against the euro
    - CAD prices of euro goods rising
      - Canadians will buy less imported European goods
  - CAD appreciating against the euro:
    - CAD prices of euro goods falling
      - Canadians will buy more imported European goods

- Chapter 35.3: The Determination of Exchange Rates

1. Purely floating or flexible exchange rate: central bank makes no transactions in the FX market

2. Fixed or pegged exchange rate: central bank intervenes in the FX market to "fix" or "peg" the exchange rate at a particular value

3. Adjustable peg: banks fix specific values but recognize that circumstances may arise where they need to change that value

4. Managed float: some stabilizing influence on the exchange rate but no publicly announced value

➔ Most countries are mostly flexible exchange rate
- Fixed at e1 (excess supply of FX)
  - Purchase foreign exchange, sell CAD (to maintain excess supply of FX)

- Fixed at e2 (excess demand for FX)
  - Sell foreign exchange, buy CAD (to maintain excess demand for FX)

Appreciation of CAD:
- Bad for Europeans buying CAD goods
- Good for Canadians buying European goods

Depreciation of CAD:
- Bad for Canadians buying Euro goods
- Good for Europeans buying CAD goods

- Bretton-Woods System (adjustable peg system)
- IMF: International Monetary Fund
- European Exchange Rate Mechanism (ERM)
  - Fixed to one another but floated as a block against USD

Demand and supply cause exchange rates to vary
Demand curve right or supply curve left = depreciation (exchange rate goes up)
Demand curve left or supply curve right = appreciation (exchange rate goes down)

-> Causes of shifts of supply and demand

- A rise in the world price of exports
  - CAD exports increase in response to higher world price, supply of FX increases further

  = Increase in supply of FX = appreciation of CAD

- A rise in the foreign price of imports
  - CAD consumers have elastic demand for Euro cars; spend fewer dollars on Euro cars

  = Decrease in demand for FX = appreciation of CAD

Many products have a relatively inelastic demand in the short run; short run effects of a rise in foreign prices = depreciation of CAD

- Rise in world price of CAD exports = CAD appreciates
- Rise in price of CAD imports = CAD depreciates

- Changes in overall price levels

1. Equal inflation in both countries

- No change in demand for imports
- No change in equilibrium exchange rate

2. Inflation in only one country

- Inflation in CAD, stable in Europe
  = CAD goods increase, more expensive in Europe
  = Euro goods in CAD unchanged, CAD goods expensive

➔ Therefore Euro goods are cheaper, equilibrium exchange rate must rise

3. Inflation at unequal rates

- Country A has higher inflation than B =
  - A's exports are expensive in B market
  - A's imports from B are cheaper in A market
  - A's currency depreciates

- Capital Movements

- Ex. Canadians buy more Euro assets, capital outflow (more demand for FX, CAD depreciates)
- Ex. Europeans buy more CAD assets, capital inflow (more supply of FX, CAD appreciates)

1) Short-term capital movements

- One country's short term interest rate rises above the rates in another country (contractionary monetary policy)
  - Large inflow of short term capital, take advantage of the high rate

➔ Carry trade: holders of transaction balances lend in markets with high interest rates
➔ Contractionary monetary policy: slow down the economy by country's central bank/finance ministry by:
  - Increasing interest rates
  - Increasing reserve requirements
  - Reducing the money supply, directly/indirectly

- One country's short term interest rate falls below the rates in another country (expansionary monetary policy)
    - Shift of financial capital away from country
    - Decreased demand for domestic currency, depreciates

➔ Expansionary monetary policy: expand money supply by country's central bank/finance ministry by:

- Tax cuts
- Rebates
- Increased government spending

2) Long term capital movements

- Speculation of future values of a country's exchange rate
- Predict appreciation: buy assets (stocks and bonds)
- Predict depreciation: do not buy assets

- Structural Changes:
    - Change in cost structure, inventions of new products, changes in preferences
    - One country = adopting technological innovations = gradual depreciation in non-technological country
    - One country = rich in resources/discovery = appreciation
- The Volatility of Exchange Rates: Exchange rates constantly changing

Chapter 19: What Macroeconomics is All About

- <u>Chapter 19.1: Key Macroeconomic Variables</u>

- National product: measure of total production of goods & services (aka output)
    - Production of goods and services generates income

- National income: value of total output and value of income claims generated by the production of output

➔ Nominal national income: sum of (number of units at each good produced by units of each good sold) across all different goods produced by the economy

- Quantity of total output/national income

➔ Real national income: measuring income by value of individual outputs at a set of prices that prevailed in some base period

- Recessions: periods where GDP falls
- Business cycle: ebb and flow of business activity that occurs around the long-term trend
- Potential output: level of output the economy would produce if all resources (land, labour, capital) were fully employed

Y = actual output Y* = potential output

Output gap = difference between potential output and actual output (Y - Y*)

Actual < Potential (Y< Y*) = Recessionary Gap
Actual > Potential (Y>Y*) = Inflationary Gap

- Employment: number of adult workers (aged 15+) who have jobs
- Unemployment: number of adult workers who are not employed but who are actively searching for a job
- Labour force: total number of people employed or unemployed

- Frictional unemployment: new people enter workforce, quit jobs, turnover of labour
- Structural unemployment: mismatch between characteristics of labour force & available jobs (structure of supplies of labour & structure of the demands for labour)
- Cyclical unemployment: rises & falls with business cycle and seasonal fluctuations

- Labour productivity: amount of real GDP produced per unit of labour employed
- Inflation: rate at which the price level is rising
- Price level: average level of all prices in the economy, symbolized as P
- Consumer Price Index (CPI): measures the average price of goods and services bought by a typical Canadian household
- Purchasing power of money: amount of goods & services that can be purchased with a given amount of money
- Interest rate: price paid to borrow money for a slated period of time
    - Prime interest rate: rate that banks charge to best business customers
    - Bank rate: rate that Bank of Canada charges on short term loans to commercial banks
- Nominal Interest Rate: the price paid per dollar borrowed per period of time
- Real Interest Rate: nominal rate of interest adjusted for the change in the purchasing power of money

Real Interest Rate = Nominal Interest Rate – Rate of Inflation

- Exchange rate: number of units of domestic currency needed to purchase one unit of foreign currency
- Foreign exchange: foreign currencies are traded
- Foreign exchange market: market in which different currencies are traded
    - More CAD to purchase foreign = depreciation
    - Less CAD to purchase foreign = appreciation

Chapter 20: The Measurement of National Income

- Chapter 20.1: National Output and Value Added
    - Intermediate goods: outputs of some firms that are used as inputs by other firms
    - Final goods: products not used as inputs by other firms
    - Value added: amount of value that firms and workers add to their products over and above the costs of intermediate goods

Value added = Sales Revenue – Cost of Intermediate Goods

- Chapter 20.2: National Income Accounting: The Basics
    - Gross Domestic Product (GDP): total value of goods & services produced in the economy during a given period
    - GDP: Expenditure side

1. Consumption expenditure: services & goods sold
2. Investment expenditure: inventories of goods made, capital goods (factories, computers, etc.)
    - Inventories: stocks of inputs & own outputs
    - Capital stock: economy's o=total quantity of capital goods
    - Fixed investment: creation of new planet & equipment

Net Investment = Gross Investment – Depreciation

3. Government purchases: (gov't = income; actual purchases of gov't goods & services = G_a
4. Net exports:
    - Imports: domestic expenditure on foreign-produced goods & services
    - Exports: foreign expenditure on domestically produced goods and services

(X_a-IM_a)

Total Expenditures:

$$GDP = C_a + I_a + G_a + (X_a - IM_a)$$

- GDP: Income side
  1. Factor Incomes

- Wages & salaries
- Interest
- Business profits
- Net Domestic Income

  2. Non-factor payments

- Indirect taxes & subsidies
- Depreciation

Total income:

GDP = Factor incomes + indirect taxes + depreciation

- Chapter 20.3: National Income Accounting: Further Issues

  - Gross National Product: value of total incomes earned by domestic residents

    - GDP: total output produced in Canada (used to measure domestic economic activity)

    - GNP: total amount of income in Canada (used to measure income of domestic residents)

  - Disposable personal income: part of national income that is available to households to spend or to save

  - Total GDP at current prices = Nominal GDP
  - GDP valued at base-period prices = Real GDP
  - CPI = measures changes in average price of consumer goods
  - GDP deflator = measures changes in average price of goods produced in Canada

    Omissions from GDP:

- Illegal activities
- Underground economy
- "Home production" & other non-market activities
- Economic "bads"

Chapter 21: The Simplest Short-Run Macro Model

- Chapter 21.1: Desired Aggregate Expenditure

$$\mathbf{AE = C + I + G + (X - IM)}$$

  - Autonomous expenditures: aggregate expenditure that does not depend on national income
  - Induced expenditure: aggregate expenditure that changes in response to changes in national income
  - Closed economy = no trade with other countries
    - No gov't (no taxes)
    - Constant price level

  - Consumption function: total desired consumption expenditures of all households to several factors:
    - Disposable income
    - Wealth
    - Interest Rates
    - Expectations about the future

$$C = 30 + 0.8Y_D$$

- Slope of consumption function (MPC)

- 45º line shows where $C = Y_D$

➔ Where consumption function cuts through 45 degree line = breakeven

APS + APC = 1, MPS + MPC = 1

-> Shift of the consumption function:

- Change in household wealth (increase = consumption function will shift up, saving function down; cut @ same number on real disposable income axis)
- Change in interest rates (fall in interest rates = increased desired consumption, shift up)
- Change in expectations (fearful about economy = less desire of consumption, shift down, more saving)

- Movement ALONG consumption function = changes in consumption INDUCED by changes in disposable income

- Shift of consumption function = autonomous changes in consumption

- Desired Investment:
    - Inventory accumulation
    - Residential construction
    - New plant & equipment

➔ Determinants of aggregate investment expenditure:
- Real interest rate
- Changes in the level of sales
- Business confidence

➔ High real interest rate: higher opportunity cost of investment, lower amount of desired investment

➔ Future expectations; optimism = invest more; pessimism = invest less
➔ Desired Investment = autonomous = horizontal line

- Aggregate expenditure (AE) function: relates desired aggregate expenditure to actual national income

$$AE = C + I$$

- <u>Chapter 21.2: Equilibrium National Income</u>

- If desired AE exceeds national income, pressure for national income to rise
- If desired AE is less than national income, pressure for national income to fall

$$Equilibrium = AE = Y$$

- <u>Chapter 21.3: Changes in Equilibrium National Income</u>
  - AE upward shifts:
    - Shifts parallel if same addition to expenditure occurs at all levels of income (ex. government expenditure and investment go up by 100)
    - Slope change if change in marginal propensity to spend (%)
  - AE downward shifts:
    - Shifts parallel if equal reduction to expenditures at all levels of income
    - Slope change if fall in marginal propensity to spend out of national income

1. Rise in desired AE = Increase equilibrium national income
   Fall in desired AE = decease equilibrium national income

   * Increase in MPS (z) steepens AE curve
   * Decrease in MPS (z) flattens AE curve

- Simple multiplier: change in equilibrium national income that occurs in response to change in AE when price level is constant
    - Large MPS = steep AE = larger simple multiplier

- Small MPS = flat AE = smaller simple multiplier

Chapter 22

- Chapter 22.1: Government and Trade

  - Fiscal policy: use of government's tax and spending policies to achieve government objectives

  - Net tax revenue: total tax revenue received by the government minus total transfer payments made by the government (T)

  - National income rises = more revenue (net of transfers)
  - Income rises = less transfers to households

$$T = tY$$

  - Budget balance: difference between total government revenue and total government expenditure

$$T - G$$

  - Budget surplus: any excess of current revenue over current expenditure
  - Budget deficit: any shortage of current revenue before current expenditure

➔ Balanced budget: revenue and expenditure are equal

➔ Budget deficit: borrow the excess of spending via government bonds/treasury bills

All levels of government added to desired AE

- Chapter 22.2: Foreign Trade

  - As consumption rises, imports and desired imports rise

$$IM = mY$$

Net Exports: $$NX = X - mY$$

  - Net export function = negative

➔ Anything affecting Canadian exports (shift up if exports increase, shift down if exports decrease)

➔ Anything affecting proportion of income changes the slope of the NX function

Foreign income (foreigners earn more money): Increases = more CAD exports
Decreases = less CAD exports

Changes in international relative prices:
Examples:
- If CAD $ goes up, less exports demanded (X shifts down)
- CAD imports more, marginal propensity to import increases, IM curve rotates up

- Chapter 22.3: Equilibrium National Income

Disposable Income = National Income – Net Taxes

$$Y_D = Y - T$$

1. Assume net tax rate; t is 10% of national income (Y)

$$T = tY$$

$$T = (0.1)Y$$

2. Therefore disposable income would be 90% of national income (Y)

$$Y_D = Y - T$$
$$= Y - (0.1)\,Y$$
$$= (0.9)\,Y$$

3. Consumption function used last chapter

$$C = 30 + (0.8)Y_D$$

➔ MPC out of disposable income is 0.8

4. Substitute (0.9) for Y_D in the consumption function

$$C = 30 + (0.8)(0.9)Y$$
$$C = 30 + (0.72)Y$$

- The AE function:

$C = C + MPC \times Y_D$	Consumption
I	Autonomous Investment
G	Autonomous government purchases

T = tY	Net Tax Revenues
X	Autonomous exports
IM = mY	Imports

Desired consumption in terms of national income

$$C = C + MPC\,(1 - t)Y$$

$$AE = C + MPC\,(1 - t)Y + I + G + (X - mY)$$

$$AE = [C + I + G + X] + [MPC\,(1 - t) - m]Y$$

Autonomous expenditure Induced Expenditure

Z = Marginal Propensity to Spend

$$Z = MPC\,(1 - t) - m$$
$$= (0.8)\,(1 - 0.1) - 0.1$$
$$= 0.72 - 0.1$$
$$= 0.62$$

- Chapter 22.4: Changes in Equilibrium National Income

Multiplier (without gov't & foreign trade)

$$Z = MPC$$
$$= \triangle Y / \triangle A$$
$$= 1 / 1 - Z$$
$$= \frac{1}{1 - MPC}$$

Multiplier (with gov't & foreign trade)

$$Z = MPC$$
$$= \triangle Y / \triangle A$$
$$= 1 / 1 - Z$$
$$= \frac{1}{1 - [\,MPC\,(1 - t) - m\,]}$$

* The higher m (marginal propensity to import), the lower the simple multiplier

* The lower m (marginal propensity to import), the higher the simple multiplier

- Stabilization policy: using gov't policy to stabilize the level of Real GDP to Y*

* Gov't purchases change AE; shift up or down

* Tax rates change MPS (z); rotate up or down

- Chapter 22.5: Demand-determined output

Important aspects:

1. Equilibrium national income => AE = Y

2. The simple multiplier:
   - Closed economy- z = MPC
   - Open economy- z = MPC (1 – t) –m

3. Demand-determined output:

   - Unemployed resources & firms have excess capacity

   - When firms are price setters (after production & sales, and after, prices)

$$\triangle Y_e = \text{Multiplier X } \triangle A$$

$$(= \frac{1}{1 - MPC})$$

   - > Output gap = Actual GDP – Potential GDP

   Autonomous Portion of Consumption:

$$\text{Total AE} - C_a + I_a + G_a + X_a$$

(Total AE minus consumption, investment, government purchases, net exports)

- Chapter 23.1: Demand Side of the Economy

- A rise in price level lowers the real value of money (in private sector)

- A fall in price level raises the real value of money (in private sector)

  - Rise in domestic price level = net exports decrease, AE curve decrease
  - Rise in domestic price level = net exports increase, AE curve increase

- Aggregate demand curve (AD): relationship between price level and equilibrium level of real GDP
    - Make AE = actual national income

➔ AD curve shows level of real GDP where desired AE = actual GDP

Negatively sloped because

1. Rise in price level causes AE to shift down
=> AD curve moves upward and to the left (fall in equilibrium level of GDP)

2. Fall in price level causes AE to shift down
=> AD curve moves downward & to the right (rise in the equilibrium level of GDP

- AD curve can shift because of any event that changes equilibrium GDP

➔ any change (other than price) can shift AD curve = aggregate demand shock

- Increase in AE = AD curve right
- Decrease in AE = AD curve left

=> Simple multiplier measures horizontal shift in AD

- <u>Chapter 23.2: Supply Side of Economy</u>

- Aggregate Supply (AS) Curve: price level to the quantity of output
    1. State of technology is constant
    2. Prices of all factors of production are constant

- Unit cost: cost per unit of output
    - ⇨ Unit costs rise with output; firms generally increase their production only if they are able to receive higher prices
    - ⇨ AS curve; positively sloped
- low output = low unit costs; higher output (above capacity) = higher costs

Shifts in AS curve:
- Changes in input prices [endogenous change] (rise in production = increased demand for labour = shift AS curve up, left)
- Changes in outside factors [exogenous change] (rise in world price of oil = raise input prices of virtually all firms = shift AS curve up, left)
- Changes in technology (improvements in technology reduce unit costs = lower prices = same output sold at lower prices, AS curve shifts downward to the right)

- Chapter 23.3: Macroeconomic Equilibrium

AD & AS curves meet = macroeconomic equilibrium = real GDP & price level

- Higher level of real GDP = positive shock (rightward AD shift)
- Lower level of real GDP = negative shock (leftward AD shift)
- Increase in AE/aggregate supply = more real GDP = positive shock (right AS shift)
- Decrease in AE/aggregate supply = less real GDP = negative shock (left AS shift)

* The steeper the supply curve, the less GDP changes; price changes a lot

- Increase in supply = price level falls, GDP rises

- Decrease in supply = price level rises, GDP falls

- Chapter 24.1: The Adjustment Process

Output above potential, Y > Y* = inflationary output gap
- Increase in factor prices
- Unit costs increase
    - AS curve shifts up (less supply, excess demand for labour)
      -> Reducing equilibrium real GDP, raising price level

Output below potential, Y < Y* = recessionary output gap

- Decrease in factor prices
- Unit costs decrease
    - AS curve shifts down (more supply, excess supply of labour)
      -> Increasing equilibrium real GDP, lowering price level

* Upward pressures rise quicker than downward pressures; wages fall more slowly than they would rise = sticky wages*

Philips Curve: wages fall in periods of high unemployment; wages rise in periods of low unemployment

- Any output gap is assumed to cause wages and other factor prices ot adjust
  -> Eventually equilibrium GDP = potential GDP (Y*)

Potential GDP acts like an "anchor" for the economy

- Chapter 24.2: Aggregate Demand & Supply Shocks

-> Adjustment of wages & factor prices eventually eliminates any boom caused by a demand shock; real GDP -> potential level

-> Flexible wages that fall rapidly in the presence of a recessionary gap = automatic adjustment process, pushes economy toward potential output

=> Sticky wages = adjustment is sluggish, will not eliminate recessionary gap quickly

- Exogenous changes in input prices cause the AS curve to shift -> creates an output gap

  * Adjustment of factor prices continues until real GDP returns to Y* = <u>long-run equilibrium</u>*

- Y* is also known as <u>long-run aggregate supply curve</u>

- Shift in AD curve = change in price level in the long run

- Shift in potential output (level of Y*) = change in real GDP

- <u>Chapter 24.3: Fiscal Stabilization Policy</u>

  - Closing a recessionary gap:
    1. Excess supply of factors = cause wages & factor prices to fall (takes a long time)

    2. Use expansionary fiscal policy to shift AD curve right (reducing tax rates, increasing transfers, more gov't purchases)

  - Closing an inflationary gap:
    1. Excess demand for factors = cause wages & factor prices to rise

    2. Use contractionary policy to shift AD curve left (increasing tax rates, reducing transfers, reducing gov't purchases)

  - Paradox of Thrift: what may be good for one individual is undesirable for the economy as a whole
    - Increase in savings = reduces level of real GDP (only true in the long run)

  - Long run = real GDP determined by potential output

  - Automatic stabilizer: tax-and-transfer system that reduces the responsiveness of real GDP

  <u>Canada's statistics:</u>

  Marginal Propensity to Consume = 0.8

Net Tax Rate = 0.25

Marginal Propensity to Import = 0.35

Marginal Propensity to Save = 0.25

Simple Multiplier = 1.33

- Decision lag: delay between recognition of recessionary/inflationary gap
- Execution lag: delay between enactment of legislation and implementation of policy action
- Fine tuning: use of fiscal and monetary policy to offset all fluctuations in private sector spending to keep real GDP at/near potential level
- Gross tuning: use of fiscal and monetary policy to remove large & persistent output gaps
- Increase in gov't purchases leaves current level of output unchanged; crowding out of private = reduces future growth rate of potential output
- Increase in gov't purchases leads to increase in potential output or growth rate; negative effects from crowding out of private investment will be reduced
    - Reductions in tax rates = short run demand, long run increase in level & growth rate of potential output

- Chapter 25.1: Difference Between Short Run and Long Run Macroeconomics

    - Long-run trends in GDP, economists focus on change in potential output
    - Short-run trends in GDP, economists focus on change in output gap

1. $GDP = F$

$$\overline{GDP/F}$$

2. $$GDP = F \times \frac{F_E}{F_E} \times \frac{GDP}{F_E}$$

F = factor supply
F_E = factor utilization rate
GDP/F_E = productivity (output per unit of input employed)

⇨ Changes in factor supply and productivity growth = useful for long run (not useful for short-run)

⇨ Factor Utilization = useful for short run (not for long run)

$$GDP = L \times \frac{E}{L} \times \frac{GDP}{E}$$

L = labour
E/L = employment rate
GDP/E = labour productivity

- Chapter 25.2: Policy Implications

  - Short run = study actual output from potential
  - Long run = study changes in potential

- Chapter 26.1 The Nature of Economic Growth

Benefits of economic growth:
- Increases in average living standards (rich countries can devote resources to environmental conservation)
- Addressing poverty & income inequality

Costs of economic growth:
- Forgone consumption (buy less now so we can produce more in the future)
- Social costs: machines become obsolete, skills of workers obsolete

4 determinants of growth:
1. Growth in labour force (more people working)
2. Growth in human capital (skills)
3. Growth in physical capital (more machines)
4. Technological improvement (better machines, increased knowledge)

- Chapter 26.2 Established Theories of Economic Growth

Long-run analysis =

$Y - C = I$ $S = I$

Saving = Desired Investment

Short run macro model = real GDP varies to determine equilibrium (S=I)

Long run macro model = real GDP equals Y* interest rate varies to determine equilibrium

Private saving: Y* – T – C

Public saving: T – G

National saving: NS = Y* – C – G

⇨ Increase in supply of national saving

- Excess supply of financial capital -> decline in real interest rate
- More investment projects; higher rate of investment = higher future growth rate of potential output

⇨ Increase in investment demand

- Excess demand for financial capital -> rise in real interest rate
- Reduce current consumption, higher investment = higher future growth rate of potential output
- Can be caused by technological improvements or gov't tax incentive

1. Y = Y* long run = economy's investment & saving

2. Increase in supply of national saving = real interest rate falls
=> Increase investment = shift NS, movement along I curve

3. Increase in demand for investment = real interest rate falls
=> Increase in national saving = shift I, movement along NS curve

Neoclassical:

$$GDP = F_T (L, K, H)$$

GDP = nation's total level of output
F_T = technology
L = labour
K = physical capital
H = human capital

Characteristics of Neoclassical Growth Theory:

1) Law of Diminishing Marginal Returns
- Increasing quantities of a variable factor are applied to a given quantity of fixed factors; marginal productivity of variable factors will decrease

2) Constant returns to scale:
- Output increases in proportion to the change in all inputs as the scale of production is increased

Four Forces of Economic Growth in the Neoclassical Theory

1. Labour:
- Increases in population lead to increases in GDP
- But eventual decline in material living standards

2. Physical & human accumulation:
- Improvements in material living standard
- But because of Law of Diminishing Marginal Returns, improvements are smaller with each additional increment of capital

3. Balanced Growth Rate and Technology
- Capital & labour both increase by X %, GDP also increases by X %
- GDP/L remains constant

=> Growth in total GDP but not in per capita GDP/material living standards

- Neoclassical view = technological change is exogenous
  - Increase in productive capacity created by installing new & better capital goods = embodied technical change (physical or human capital)
  - Robert Solow won Nobel Prize; 'Solow Residual' = amount of growth in GDP that cannot be accounted for by growth in the labour force or by growth in capital stock

-> ' Solow Residual' also known as rate of growth of total factor productivity

- Chapter 26.3: Newer Growth Theories

  - Technology = endogenous (responsive to economic signals such as prices & profits)
    -> Development of new technology in response to relative prices

New implications of understanding growth through costly, risky, innovative activity:

1. Learning by doing: information not finalized, sent back to main designers (learn as you go; ex. Japanese firms involved design, production and manufacturers in all stages of design process)

2. Knowledge transfer: diffusion of knowledge from those who have it & those who do not (firms need research capacity just to adopt the technologies developed by others)

3. Market structure and innovation: competition creates innovation (through reduced trade barriers, increasing globalization of market, etc.)

4. Shocks & innovation: price shocks influence fuel-efficient jets

Market development costs:

1. Investment in early stages of development create new skills –> then available to all firms whose costs are lower than those encountered by initial firms

2. Each new firm finds environment more favourable because of newly created physical infrastructure

3. First investment in new production = countless production problems, once overcome, fewer problems to subsequent investors

- Knowledge: economics referred to as “economic science”

-> New growth in technology = unlimited potential by knowledge-driven technological change

-> Neoclassical Theory focuses on diminishing marginal returns

-> Limits to growth:

- Resource exhaustion (not really any absolute limits to economic growth)
- Environmental degradation (management is imperative)