ECON 102 - Macroeconomics

Chapter 6: Macroeconomics - The Big Picture

Keynesian economists claim: macroeconomics is not simply the aggregate of microeconomics, more tools are needed for analysis.

Macro vs. Micro

- Microeconomics: Behavior of *individual* action (consumer, producer, government action in single markets)
- Macroeconomics: Behavior of the total market
    - Unemployment, total # of jobs
    - Growth in economic activities
    - Average price level
    - Currency value

Microeconomics tools lack adequacy

- Multiplier effect: initial action → infinite loop of events
- Paradox of thrift: individuals acting in their best interest may not benefit the society as a whole

Macroeconomics theory and policy

- Classical: Self-regulation
- Keynesian (after the Great Depression): Reduce pain and suffering through government policies
    - Monetary: Central bank adjusting key interest rate
    - Fiscal: Government adopting new tax policy
    - By comparing 1929 and 2008, the length of recession is reduced, this suggests that Keynesian theory is effective

During the Great Depression (1929), the highest unemployment rate is about **20%**, the worst deflation rate is about **-10%**.

The Business Cycle

- Overall economic activities do not change smoothly, expansionary phases are usually larger than recessionary phases, but the temporary nose dive still poses problems

- There is a tendency to alternate between these two phases.
- Both phases can be problems because:
    - Job loss + Unemployment ↑
    - Too rapid or prolonged growth means the economy is in a bubble

Long Run Economic Growth / Capacity Growth (Real GDP)

- This is driven by increasing consumption possibilities.
- We use real GDP (actual quantity of products) to measure growth because nominal GDP includes overestimation with inflation
- Growth accounting
    - The reason for LREG is different from the reason for BC
    - Measures the growth of *potential output* over a long time
    - Per-capita GDP % ↑: indicates an improvement in standard of living in long run
- Calculation
    - $$rGDPpc = \frac{rGDP}{population}$$
    - Potential output is calculated with $A(1+g)^t = B$
        - A: current output
        - g: growth rate
        - t: time
        - B: projected output

Inflation, Disinflation and Deflation

- Inflation: Overall price level ↑

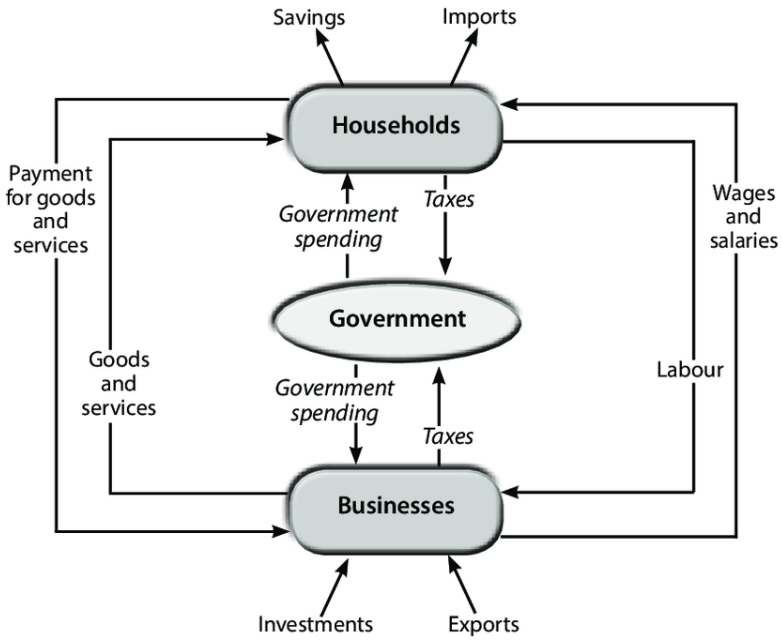
  Deflation: Overall price level ↓
- Disinflation: Average price level rises at a **slower rate** than before
- Use aggregate price level to account for many things in general
- Factors of inflation include:
    - Short run: level of economic activities ↔ potential output
    - Long run: Q_{money} in the economy
- Consequences of inflation
    - Some inflation (2% to 4%) incentivizes growth
    - High inflation disrupts economy and is chaotic, may lead to hyperinflation

International Imbalance

- Trade balance = export - import
    - > 0: surplus
    - < 0: deficit
- It means it is an open economy
- Trade deficit does NOT mean a bad thing, trade surplus does NOT mean a good thing (Greece)

Chapter 7: GDP and CPI

GDP and Circular Flow of Income

- Why measure GDP?
    - Ignorant to economic situations during Great Depression
    - Use precise numeric values to represent total economic activities
    - Reasons
        - Compare standard of living over time
        - Compare difference of standard of living between 2 countries
- Definition of GDP
    - Market value of all **final** goods and services produced within boundary of an economy in a specific period of time
- Report GDP periodically
    - Flow variable (cannot be instantaneous): GDP
    - Stock variable (can be instantaneous): Population, capital
- Circular Flow of Income
    - 

    - There are leakages and injections in the flow, but input = output

Measurement of GDP

- Value added
    - $GDP = \sum value_{added}$
    - This is to avoid double counting, as we want the **final** product
- Expenditure approach
    - $GDP = C + I + G + (X - M)$
    - C: Household consumption - purchases by **domestic** firms
        - Only new product are counted
        - Newly-build home are not counted as consumption (counted as investment)
    - I: investment
        - Plants and equipment
        - (non) residential structures
        - Inventory adjustment
    - G: government spending
        - Government's direct purchase of goods and services
        - Transfer payments are not included
    - $(X - M)$: net export = export - import
- Income approach
    - GDP = income earned by all households + non-factor payments
    - Income earned by all households
        - Wage
        - Interest
        - Rent
        - Dividends
    - Non-factor payments
        - Indirect tax
        - Depreciation
    - By StatsCAN: GDP = compensation of employees + gross operating surplus + gross mixed income + taxes - subsidies

Real vs. Nominal GDP

- Nominal GDP: measured based on current prices
    - Nominal GDP can $\uparrow$ even if $Q_{produced} \rightarrow$, or $\downarrow$ due to ΔP
- Real GDP: adjusted for ΔP
    - Indicates the aggregate output in Q
    - Select a base year to calculate total value of final products and services
    - $rGDP = \sum Q_{new} \times P_{base}$

- Chained Dollar real GDP: used because if we select different base year, we have a small difference in growth rate
    - Consider 2018, 2019 and 2020, to calculate 2020 real GDP, we:
        - Find 2018-2019 growth rate, based on 2018
        - Find 2018-2019 growth rate, based on 2019
        - Take average
        - Find 2019-2020 growth rate, based on 2019
        - Find 2019-2020 growth rate, based on 2020
        - Take average
        - $rGDP_{2020} = GDP_{2018} \times g_{18/19} \times g_{19/20}$

Real GDP per capita

- An increase in real GDP per capita usually indicates an improvement in standard of living, not an increase in real GDP itself
- If %rGDP > %population on average, then the standard of living improves
- $$\%rGDPpc \approx \%rGDP - \%population$$

GDP and meaning of life

- Rich is better: well-being(rich) > well-being(poor)
- Money means less as richer: average gain in utility per extra dollar decreases
- Money isn't everything: Middle-income are happier than rich

Measuring inflation with aggregate price level

- Cost of living
    - $\sum_{i=1}^{n} P_i Q_i$
    - Choose a market basket $\{\bar{Q}_1, \ldots, \bar{Q}_n\}$: this determines how much is spent on a fixed consumption bundle
- Consumer Price Index
    - Used to monitor cost of living
    - Based on consumer expenditure survey every 4 years (StatsCAN decides on the items and quantities to represent an typical average urban household's consumption behaviour)
    - Monthly price survey → collect price data
    - Difference between PI and CPI, PI works with a market basket, but CPI works with a **fixed market basket**
    - $$CPI = \frac{C_{given}}{C_{base}} \times 100$$
- Inflation
    - $$Inflation = \frac{PI_2 - PI_1}{PI_1} \times 100\%$$

- Industry Producer Price Index
    - Monitors prices of goods bought by producers
    - Measures inflation based on commodity prices
    - Usually an early indicator
- GDP deflator
    - $$\frac{nominal}{real} \times 100\%$$
- Usually fluctuation-wise, $IPPI > CPI > Deflator$

Chapter 8: Unemployment and Inflation

Defining Unemployment Rate

- $$\%employment = \frac{employed}{working - age} \times 100\%$$
- Labor force
    - Has part-time/full-time job
    - Not employed, but looked for jobs within the last 4 months
    - Available to work
- %Labor force participation = $\frac{labor-force}{work-age} \times 100\%$
- %Unemployment = $\frac{unemployed}{labor-force} \times 100\%$
- Working age = Labor + Non-Labor = (Employed + Unemployed) + Non-Labor

Labor underutilization

- Possible overestimation: voluntarily unemployed
- Underestimations
    - Discouraged worker (People who stopped looking for work after 4 weeks)
    - Marginally attached worker: Hopeful of being reemployed (laid off, waiting to be recalled)
    - Underemployment
        - Invisibly underemployed: Not happy with current job
        - Visibly underemployed: Have a part-time job, but wants a full-time job

Categories of Unemployment

- Frictional: e.g. due to job search
    - Churning: some people become unemployed constantly
    - Voluntary vs. Involuntary unemployment
    - Job search takes time
    - Detecting the size

        - Period of low unemployment → Short average waiting period → mainly frictional
    - Long run: Unemployed for 27 weeks+
- Structural: e.g. due to structural change in the economy
    - Number of job seekers > Number of positions (surplus in labor): Structural / Cyclic
    - Factors
        - Minimum wages, Unions, Efficiency wages, Government policies
        - Creative destruction
- Cyclical
    - Caused by business cycle downturn
    - The economy has the capacity but not enough demand for output
- The natural rate of unemployment includes: Frictional + Structural
- Change in natural rate of unemployment
    - Δ labor force characteristics
    - Δ labor market institutions (technological innovations)
    - Δ government policies

Cost of Inflation

- Real wage = $\frac{Nominal-wage}{Price-index}$
- Hyperinflation: 50% inflation per month
- Shoe-leather costs
    - Costs of transactions, avoids holding money
    - There may be employments that may not need without hyperinflation (bank hiring more people to process more money)
- Menu costs
    - Cost of changing listed price
- Unit-of-account costs
    - When money is less reliable
    - Calculations (relevant economic indices) are harder when inflation is high

Winners and Losers in Inflation

- Interest rate
    - Return a lender receives after lending out for some time
    - Real interest rate $\leftrightarrow$ Nominal interest rate
- Fisher Equation
    - $r \approx i - \pi$
    - r: real interest rate
    - i: nominal interest rate

    - π: inflation
- When actual inflation > expected inflation, borrowers win (they pay less in purchasing power)

  When actual inflation < expected inflation, lenders win (they receive more in purchasing power)
- Disinflation is hard, as it requires a temporary but large increase in %unemployment

Chapter 9: Long-run Economic Growth

Benefit and Cost of Economic Growth

- Benefit: Improvement in standard of living
- Cost: Environmental pollution
- Kuznet's curve: environment eventually improves
- Measure economic growth by rGDPpc

Rule of 70

- Output doubling time of an economy = $\frac{70}{g}$
    - g: annual growth rate

Sources of Growth

- The most important factor so far: productivity
    - $\frac{T_{output}}{T_{hour}}$
- Average hour per worker
    - $\frac{T_{hour}}{T_{employment}}$
- EPR
    - $\frac{T_{employment}}{Population}$
- Thus, rGDP = Productivity × Average Hour × EPR
- %rGDP = %Productivity + %Average Hour + %EPR
- Factors of economic growth
    - Physical capital ↑
    - Human capital ↑ (better quality, skills)
    - Technological progress ↑

Production Function

- A description/method of turning factors of production into output
- $$Y = A \times F(K, L, H)$$
    - Y: aggregate output
    - L: labor
    - H: human capital
    - K: physical capital
    - A: total factor productivity (determined by technology)
- Marginal Productivity
    - $\frac{\partial Y}{\partial K}, \frac{\partial Y}{\partial L}, \frac{\partial Y}{\partial H}$
- Constant Returns to Scale
    - $2Y = A \times F(2K, 2L, 2H)$
- Assume constant returns to scale (LRAC)
    - $\frac{Y}{L} = A \times F(\frac{K}{L}, \frac{L}{L}, \frac{H}{L})$
    - We then have the Cobb-Douglas production function
    - $$y = A \times f(\frac{K}{L}, \frac{H}{L})$$

Why grow rates differ?

- Different savings and investment spending
- Different education
- Different research and development

Chapter 10: Savings, Investments, and the Financial System

Some constants

- Y_D: disposable income
- $S_{private}$: private savings
    - $Y_D - C$
- S_{public}: public savings
    - $T - TR - G$
- T: tax
- TR: transfer payment
- NFI: net foreign investment
    - Capital outflow - Capital inflow
    - NX
- S^D_{dom}: domestic savings, domestic use; S^D_{for}: domestic savings, foreign use; etc

Closed Economy (Without Government)

- $GDP = C + I = Y_D = C + S_{private} = Y = C + S_{national}$
- $S_{national} = S_{public} = I$

Closed Economy (With Government)

- $GDP = C + I + G = Y$
- $$\begin{aligned} S_{national} &= S_{private} + S_{public} \\ &= (Y - T + TR - C) + (T - TR - G) \\ &= Y - C - G \\ &= I \end{aligned}$$
- $S_{national} = I$

Open Economy (With Government)

- $GDP = C + I + G + NX$
- $S_{national} = S^D_{dom} + S^D_{for}$, $I = S^D_{dom} + S^F_{dom}$
- $S_{national} - I = S^D_{for} - S^F_{dom} = NFI$
- $S_{national} = I + NFI = Y - C - G$
- $NX = NFI$

Loanable Funds Market

- $S_{national} = I$, for closed economy
- Present value calculation
  - $$A = \frac{B}{(1+i)^t}$$
- Bond pricing
  - A bond has three things
    - Face value: A
    - Coupon: r
    - Years of maturity: n
    - Yield
  - A bond's yield (determined by the secondary market) has an inverse relationship with its price, e.g. if the yield increases compared to when it was bought, the bond's price decreases.
  - To calculate the current price, given an interest rate of i
    - $P = \frac{A}{(1+i)^n} + \frac{r}{(1+i)^n} + \frac{r}{(1+i)^{n-1}} + \frac{r}{(1+i)^{n-2}} + \cdots + \frac{r}{(1+i)^2} + \frac{r}{(1+i)}$
- Hypothetical
  - Demand (firms) $\leftrightarrow$ Supply (household/savings)

- Nominal interest rate: opportunity cost; Assumed fixed expected return, higher the interest rate, fewer the projects, less the funds needed → Downward sloping demand

- Nominal interest rate: determine the return of lending/saving; Higher the interest rate, more lucrative to save → Upward sloping supply
- Equilibrium Interest Rate occurs when $D = S$
- Shift in Demand
    - Δ in perceived business profitability and opportunities
    - Δ in government policies that affect investment decisions (tax credit / subsidy)
- Shift in Supply
    - Δ in private savings behaviour
    - Δ in budget balance
- Global market
    - In open economies, flow of funds are driven by
        - Interest differentials
        - Risk status
        - Exchange rate
    - Ceteris paribus, funds flow to market with **higher** interest rate from market with **lower** interest rate
    - The net capital outflow = The net capital inflow
- Change in expected inflation: **Fisher Effect**
    - The equilibrium corresponds to a given expected inflation $\tau_{expected}$
    - A change in expecting inflation would shift demand and supply of loanable funds simultaneously, leading to a new equilibrium rate, but NOT changing equilibrium quantity
    - $r = i - \tau$
    - The real interest rate remains the same

Chapter 11: Income and Expenditure

Assumption

- Producers are willing supply additional output at a fixed price
- Fixed interest rate
- No government spending
- Closed economy

Multiplier Effect

- Multiple rounds of increase in aggregate output will follow the initial change
- Marginal Propensity to Consume (MPC)
    - Limit leading to a fixed amount increase in aggregate income
    - $$MPC = \frac{\Delta spending}{\Delta Y_D}$$
    - $Y_D = expenditure + saving$
- Marginal Propensity to Save (MPS)
    - $1 - MPC$
- Let the autonomous change to be ΔAC, then
    - $$\Delta Y = \frac{1}{1 - MPC} \times \Delta AC$$
    - The multiplier is $\frac{1}{1-MPC} = \frac{1}{MPS}$

Aggregate Consumption Function

- Individual consumption spending is driven by household's disposable income y_d
    - $C = \sum c_{individual}$
- Individual consumption function
    - $c = \alpha + MPC \times y_d$
    - c: a household's consumer spending
    - α: autonomous consumer spending
    - y_d: disposable income
    - $MPC = \frac{\mathrm{d}c}{\mathrm{d}y_d}$
- Aggregating individual consumption function
    - $C = \beta + MPC_{agg} \times Y_D$
    - $\beta = \sum \alpha$
    - Y_D: Since there is no government, this is the real GDP
    - MPC_{agg}: calculated through $\frac{\Delta c_{total}}{\Delta y_{d:total}}$
- Shifts in aggregate consumption function
    - Changes in expected future disposable income
        - Permanent income hypothesis: Consumers spend at a level consistent with their long-term average income
    - Changes in aggregate wealth
        - Life cycle hypothesis: People seek to maintain roughly the same level of consumption throughout their lifetimes by **taking on debt** or **liquidating assets** early and late in life (when income is low), and saving (when income is high)

Investment spending

- $I_{planned}$: the investment spending that business plan or intend to undertake during a given period, depends on
    - i: interest rate
    - expected real GDP
        - %rGDP $\uparrow \rightarrow I_{planned} \uparrow$
    - current level of production capacity
- $I_{unplanned}$: value of change in total inventories due to unexpected swing in sales
    - Inventories: goods held to meet future sales needs
    - Inventory investment: the value of the change in total inventories
    - Positive: unexpected increase in the value of inventory
    - Negative: unexpected decrease in the value of inventory
- $$GDP = C + I$$
  $$Y_D = (\beta + MPC_{agg} \times Y_D) + (I_{planned} + I_{unplanned})$$
- $AE_{planned}$: Planned aggregate expenditure depends on the level of real GDP
    - $$AE_{planned} = C + I_{planned}$$
- Income-Expenditure Equilibrium
    - $GDP = AE_{planned} + I_{unplanned}$
- Consider an Open Economy (Without Government)
    - Assume M(import) to be $M = f(Y_D) = mY_d\{0 \leq m \leq 1\}$
    - $AE_{planned} = Y_D$
        - Ignoring trade for a while:
          $AE_{planned} = C + I_{planned} = (\beta + MPC_{agg} \times Y_D) = Y = Y_D \rightarrow Y = \frac{\beta + I_{planned}}{1 - MPC}$
        - Considering only export:
          $AE_{planned} = C + I_{planned} + X = (\beta + I_{planned} + X) + MPC_{agg} \times Y_D = Y = Y_D \rightarrow Y = \frac{\beta + I_{\text{p}}}{1 -}$
        - Considering both export and import:
          $AE_{planned} = C + I_{planned} + NX = (\beta + I_{planned} + X) + (MPC_{agg} - m) \times Y_D = Y = Y_D \rightarrow$

Chapter 12: Aggregate Demand and Aggregate Supply

Assumptions

- Price are no long fixed
- Nominal interest rate may vary
- Government purchases goods and collect taxes
- The economy is closed

Income-Expenditure Model

- e.g. An increase in GDP deflator (higher price level), ceteris paribus, will shift $AE_{planned}$ downwards in parallel
- Prices we are interested in
    - Goods and services
    - Assets: property, stock, bonds
    - Factor of production: wages (labor), rent (land), interest (capital)
- Why does the above example work that way?
    - Wealth effect: asset value $\downarrow \rightarrow$ purchasing power $\downarrow \rightarrow AE_{planned}$ downward shift
    - Interest rate effect: money holding $\downarrow \rightarrow$ savings $\downarrow \rightarrow$ interest rate $\uparrow \rightarrow$ consumption, investment $\downarrow \rightarrow AE_{planned}$ downward shift
    - Outcome: Price index and real GDP are negatively related, ceteris paribus

Aggregate Demand

- AD curve is not the same as the usual downward sloping demand curve (Y(real GDP) is x-axis)
- Shift in AD
    - Changes in expectation
    - Changes in wealth: price index remained same, but asset value increased
    - Size of existing stock of physical capital
    - Fiscal policy
    - Monetary policy
- Shift from fiscal policy
    - Lump-sum tax: $AE_{planned} = (\beta + I_{planned} + G) + MPC_{agg} \times (Y - T)$
    - Proportional tax: $AE_{planned} = (\beta + I_{planned} + G) + MPC_{agg} \times Y \times (1 - t)$, if we assume $T = tY, \{0 < t < 1\}$
- Shift from monetary policy
    - Change in interest rate, or money supply
    - e.g. G: money supply $\uparrow \rightarrow$ household money $\uparrow \rightarrow$ purchase power $\uparrow \rightarrow$ savings $\uparrow \rightarrow$ loanable funds market (supply right-shift) $\uparrow \rightarrow$ interest rate $\downarrow \rightarrow I_{planned} \uparrow \rightarrow AE_{planned} \uparrow \rightarrow$ AD right-shift

Aggregate Supply

- Shows the relationship between aggregate price index level and quantity of aggregate output producers are willing to supply in the economy
- Short run aggregate supply (SRAS): no change in technology, no change in input price
    - Upward sloping: profit = output price - input price

        - If output price decreases, to maximize profit, costs are cut (labor ↓), this raises marginal productivity while decreasing marginal cost, leading to profit per unit rising at new price index, but a decrease in output.
        - Shift in SRAS
            - Δ commodity price / input price (assuming output price constant), e.g. Δ nominal wage
            - Δ productivity
            - Δ regulation
- Long run aggregate supply (LRAS): change in technology, change in input/output price (adjust to changes in price index)
    - Wages are not sticky in the long-run as contracts are renegotiated, so aggregate price level has no effect on the quantity of aggregate output supplied
    - The long run is the time it takes for all prices (including nominal wages) to adjust
    - LRAS is a vertical line for $Y_{potential}$ (potential output, at full employment)
    - If the economy is at a price and output level away from LRAS (output gap), wages will adjust to shift SRAS toward equilibrium
        - Output gap > 0: inflationary (market overheated)
        - Output gap < 0: recessionary (idle labor present)
    - $$\frac{rGDP_{actual} - rGDP_{potential}}{rGDP_{potential}}$$

Demand shock

- An event that causes AD to shift
    - Positive: Expansionary fiscal policy, right shift
    - Negative: Recession abroad can cause left shift of AD through fall in export

Supply shock

- An event that causes SRAS to shift
    - Positive: Technological improvement increasing profit per unit for a given price level
    - Negative: Oil price increase decreasing profit per unit

Long run equilibriuim

- The economy is in long run macroeconomic equilibrium if SR equilibrium is on LRAS
- Positive demand shock $\rightarrow$ AD right shift $\rightarrow$ Higher P, higher Q in SR $\rightarrow$ SRAS left shift to LRAS (Higher P, same Q) in LR

- Negative demand shock → AD left shift → Lower P, lower Q in SR → SRAS right shift to LRAS (Lower P, same Q) in LR

Chapter 13: Fiscal Policy

Beyond Direct Purchases

- Change in tax rule → change in Y_D → change in C
- Transfer payments (pensions, social assistance)
- Influence to change investments
- They all shift AD

Fiscal Policy

- Keynesian theory
    - Recessionary gap: increase output by $G\uparrow, T\downarrow, TR\uparrow$
    - Inflationary gap: decrease output by $G\downarrow, T\uparrow, TR\downarrow$
        - Usually, when closing an inflationary gap, instead of seeing deflation, we see disinflation
- Criticisms
    - Government spending crowds out private spending
    - Government borrowing crowds out private investment spending
    - Government budget deficit leads to private spending to drop (Ricardian equivalence)

Multiplier Effect

- Government purchase multiplier
    - $$Multiplier = \frac{\Delta Y}{\Delta G}$$
- Consider a closed economy with proportional tax
    - $GDP = C + I + G = (\beta + MPC_{agg} \times Y_D) + I + G = \beta + MPC_{agg} \times Y \times (1 - t) + I + G$
    - So we have a multiplier of $\frac{1}{1-MPC(1-t)}$
- This will shift AD to the right by $\Delta G \times multiplier$
    - However, the new price equilibrium is higher for AD and SRAS
        - Therefore, the ultimate ΔY will be less than what it originally shifted

Tax and Transfer Multiplier

- General transfer payments or tax adjustments will have a smaller effect on AD compared to government's direct purchase
- For the same $\Delta G = \Delta TR$
    - Government multiplier is $\frac{1}{1-MPC(1-t)}$
    - Transfer multiplier is $\frac{MPC(1-t)}{1-MPC(1-t)}$, as the transfer payments will first be saved and taxed before changing the real GDP again in the loop.

Automatic Stabilizers

- Automatic stabilizers are government programs and budgets that automatically offsets fluctuation in the economy

Chapter 14: Money, Banking and the Central Banking System

Quantity of Money and Money's role

- Definition of Money: any asset that facilitates transactions of goods and services
- Money supply = Money in circulation + Chequable deposits
- Money **generates gains from trade** by helping us avoiding **double coincidence of wants** (Item exchanged directly)
- Roles
    - Medium of exchange
    - Store of value
    - Unit of account
- Types
    - Commodity money (gold)
    - Commodity-backed money (US dollar before 1971)
    - Fiat money (central bank's credit and government's declaration)

Measuring Money Supply

- M1+
    - currency in circulation + personal and business chequable deposits (in chartered banks, trust, mortgage and loan companies, credit union & caisses populaires)
- M2
    - Currency in circulation + personal and business deposits in **chartered banks only** (chequable and non-chequable such as savings account and term deposits) - interbank deposits
- M2+

        - M2 + personal and business deposits in other institutions + life insurance company individual annuities + money market mutual funds

Banks

- Liquid asset (money deposited) → Banks (financial intermediary) → Illiquid assets
- Bank Reserve = Cash in vaults + deposit kept in central bank under its account
    - This is to meet withdrawal requirement by its depositors
- If we assume a fixed portion of total deposit is set for bank reserve, then (With T-account model)
    -

ASSETS	LIABILITIES
Reserves	Deposits
Loans	Equity

    - If we denote the reserve ratio to be rr, and a change in deposit to be Δd
        - We eventually would increase chequable deposits by $\frac{\Delta d}{rr}$
- In reality, loans that are made to people will be deposited and held as cash (leakage). This leakage will reduce the **money multiplier**
- Given the amount of **money supply** and **monetary base**
    - Money supply = currency in circulation + chequable deposits
    - Monetary base = currency in circulation + bank reserve
    - $$Multiplier = \frac{Money - supply}{Monetary - base}$$

Central Bank's Tool of Monetary Control

- Reserve requirement (reserve ratio)
- Bank rate (discount rate)
    - Open market operations
- Deposit switching

Chapter 15: Monetary Policy

Money and interest rate

- The **liquidity preference model** of the interest rate asserts that i is determined by the supply and demand for money
- $i = i(M)$, where M refers to the quantity of money
- If the central bank chooses the level of money supply, then money supply is a vertical line

Liquidity Preference Model

- i_E is the equilibrium interest rate
    - If $i > i_E$, there is excess cash, then cash would be used to buy bonds/GIC etc.
        - Buying bonds/GIC, leads to demand $\uparrow$
        - For bond issuers, they will be issuing bonds at $i \downarrow$
    - If $i < i_E$, there is shortage of cash, then people would want to hold on to cash by selling off assets
        - This leads to demand $\downarrow$
        - For bond issuers, they will be issuing bonds at $i \uparrow$

Central Bank and Money Supply

- If central bank increases money supply, shifting supply to the right, $i_E \downarrow$
- If central bank decreases money supply, shifting supply to the left, $i_E \uparrow$