

# Economics 100B: Macroeconomics

Macroeconomics is the study of economic activity + prices in the national economy

- structure, dynamic performance/adjustment, + performance of national economies
- government policies that affect national performance, e.g. fiscal + monetary policies

Macroeconomics focuses on 4 major issues:

1. Long-term economic growth (GDP): reasons economic activity stagnates or expands over long periods of time
2. Short-term business fluctuations: reasons for recurrent fluctuations in economic activity over relatively short business times (e.g. business cycles, expansions, recessions)
3. Employment + Unemployment: how changes in the economy affect the labor market
4. Inflation: how rapidly overall price level is rising; average prices of goods + services; disinflation, deflation, hyperinflation

Data Series:

1. Real GDP: output of actual goods + services in an economy over a fixed period of time
  - business cycles: fluctuations in GDP
  - recessions: decline in GDP
  - depression: severe decline of GDP
2. Unemployment
3. Inflation

Main Economic Goals:

1. Rapid + stable economic growth
2. Low + stable unemployment
3. Low + stable inflation

\* may not all be compatible

Major Features of Macroeconomics:

1. Model-based: explain economy with economic theory (a set of ideas about how the economy works, organized in a logical framework - relationship between variables) + economic models (simplified representations of a particular economic phenomenon)
  - identify an interesting economic question
  - specify + measure endogenous + exogenous variables (controversial)
  - look for patterns in data + formulate a theory to explain them
  - Develop / Test the model against real world experiences + make further predictions
2. Aggregation: summing up of individual economic activity/variables to obtain economy-wide totals.
3. General equilibrium analysis: four agents - consumers or households, businesses or producers, governments, + foreigners

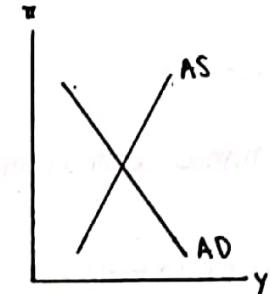
Stabilization Policies:

1. Fiscal policies: gov't decisions concerning gov't spending + tax rates
2. Monetary policies: decisions by the central bank (gov't agencies that oversee banking systems) concerning money supply, short-term interest rates, +/or size of central bank's balance sheet
3. International policies
4. Regulatory policies

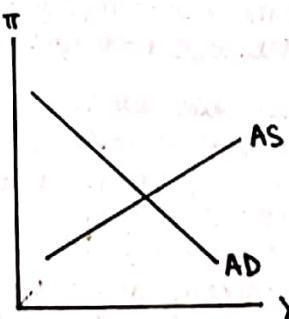
} activists vs. nonactivists;  
positive vs. normative;  
discretionary manner vs.  
conducted by the rules

Why is macroeconomics so controversial?

1. The macroeconomy is exceedingly complex (economics + human behaviors evolve/are different)
2. There are theoretical differences about the (1) structure of the economy, (2) sensitivity of the economy to changes in exogenous variables, + (3) "Classical" vs. "Keynesian" economists
3. There are important policy implications (issues of goals, benchmarking, values, definitions)
  - positive analysis (consequence of policy) vs. normative analysis (what should be done)
4. Data is not very robust, - reported since 1948; is it still relevant?
5. Absence of controlled experiments
6. Time horizon differences (short-run vs. long-run differences)



**Classical**  
→ wages + prices are "flexible" in the LR + SR  
→ economy moves to LR equilibrium rapidly  
→ Gov't policy has a minimal effect on real economic activity



**Keynesian**  
→ wages + prices are flexible in LR + sticky in SR  
→ economy moves to LR equilibrium slowly  
→ Gov't policies can have a significant effect

Gross Domestic Product (GDP) is the total value of goods produced / total income of everyone in the economy;  
It is the broadest measure of economic activity; wealth per capita, production, + econ. growth  
→ National Income + product accounts: accounting framework to measure economic activity  
→ Fundamental identity of national income accounting: Total Production = Total Expenditure = Total Income

1. Product Approach: GDP is the current market value of all final goods + services newly produced in the domestic economy during a specified period of time
    - market value + imputed values of goods not used up in the production processes
    - capital good: used to produce other goods + are not completely used up in the production process
    - inventories: firms' holdings of raw materials, unfinished goods, + unsold finished goods
    - inventory: change in inventory over a given period of time
    - not included: intermediate goods (completely used up in production), underground economy (not gov't reported), non-market goods, household goods
  2. Expenditure Approach: GDP is the total spending on currently produced final goods + services in the economy;  $Y = C + I + G + NX$  (national income identity, or income-expenditure identity)
    - (Personal) Consumption Expenditure (C): total spending for currently produced goods; it is the largest component of GDP (2/3 of all spending)
      - ↳ Consumer durable goods spending: goods purchased by consumers that last more than 3 years (ex: automobiles, electronics, appliances, etc.); 12-15% of consumption
      - ↳ Non-durable goods spending: spending by households on goods that last less than 3 years (ex: food, clothing, beverages, gas)
      - ↳ Services spending: spending by households to be consumed immediately (ex: entertainment, medical, education, rent, electricity); more than 1/2 of consumer spending
    - Investment, or Gross Private Domestic Investment (I): spending by domestic businesses for new capital goods + inventories to produce goods over an extended period of time (not financial investment)
      - ↳ Business fixed investment: current spending by businesses on (1) new equipment, (2) new structures, + (3) new intellectual property products
      - ↳ Residential fixed investment: current spending by households on new housing + apartment units; house + apt are capital goods because they are a service over an extended period of time
      - ↳ Inventory investment: current spending on additional holdings of raw materials, parts, + finished goods; Δ in inventories held by firms
    - Government Purchases (G): spending by gov't on units of final goods currently produced (ex: tanks, airplanes, buildings, employees, military); more spending by state / local than federal gov't
      - ↳ Gov't consumption: gov't purchases for short-lived goods like healthcare + police
      - ↳ Gov't investment: spending for capital goods like buildings + computers
      - ↳ not included: gov't transfer payments - payments for which no goods or uses of factors of production are exchanged in a specific time; negative tax + gov't check not used right away; transfer from one segment to another (ss, medicare, unemployment)
    - Net Exports, or Trade Balance (NX): value of currently produced goods exported or sold to other countries minus value of goods imported from abroad; exports - imports
    - Trends in spending of GDP over time:
      - ↳ consumption expenditure grew steadily
      - ↳ investment is more volatile than other components of GDP
      - ↳ Gov't purchases have remained quite stable over the past 60 years
      - ↳ Usually, net exports have been negative + US has been running a trade deficit
3. Income Approach: GDP is the total income earned from newly produced final goods in domestic economy during a specific time; income from households + firms including profits + tax revenues; categories:
    - compensation of employees: wages + salaries + employee benefits
    - other income: income of self-employed, renting properties (royalties from arts), net interest earned by individual from businesses + foreign sources, + indirect business taxes
    - corporate profits
    - depreciation: loss of value due to wear/tear or b/c capital has become obsolete
      - ↳ net domestic product: GDP - depreciation
    - net factor income: wage, profits, + rent paid to US residents by foreigners minus factor income paid by US residents to foreigners
    - Five different income measures:
      - ↳ GDP + factor income from rest of world - factor payments from rest of world = GNP
      - ↳ GNP - depreciation - statistical discrepancy = national income
      - ↳ National Income = compensation of employees + corporate + non-corp profits + other income
      - ↳ Private Disposable Income = GDP + net factor income + transfer payments from gov't +

interest payments on govt debt + - taxes

- PDI: amount of income that private sector has available to spend

↳ Net govt income (net tax receipts) = (Gross) tax receipts - govt transfer payments - interest payments on govt debt

- NGI: government's disposable income available to spend

- Thus PDI + NGI = GDP + net factor payments from foreigners (GNP)

\* GDP is a flow (an amount per given time) not a stock (a quantity at a given point in time)

Nominal variables are measured in current dollar terms. Real variables are adjusted for changes in price to reflect only quantity terms.

A price index measures the weighted average level of prices for some specified set of goods, relative to those prices in a specified base year; weighted by how much income is used to buy a g.

Nominal GDP: the dollar value of an economy's final output measured at current market prices; nominal grows faster than real because of inflation + price; Nominal GDP = Price level \* Real GDP

Real GDP: estimate of the value of an economy's final output, adjusted for changes in the overall price level; Real GDP =  $\frac{\text{nominal GDP}}{\text{Price level}}$ ; use constant prices rather than current prices

→ seasonally adjusted so that seasonal fluctuations are subtracted

→ chain-weighted measures: fix for prices of different goods changing more/less relative to other goods; base year allowed to change continuously by averaging out a timespan

Price indexes are different measures of price level. It measures the average level of prices in the economy

→ Price level = nominal GDP / real GDP

→ Three major price indexes:

1. GDP Deflator, or Implicit Price Deflator: deflates nominal GDP to obtain real GDP; broadest measure; GDP Deflator = nominal GDP / real GDP; disadvantage: only recorded quarterly
2. Personal Consumption Expenditure (PCE) Deflator: PCE component of GDP; closer to measuring what the consumer price index measures; PCE Deflator = nominal PCE / real PCE (70%)
3. Consumer Price Index (CPI): measure of average prices of consumer goods; cost of living
  - BLS creates a "basket of goods" that the average urban consumer buys
  - can overstate the cost of living

Inflation rate is calculated as

$$\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}} = \frac{\Delta P_t}{P_{t-1}}$$

where  $\pi_t$  = inflation rate in period t

$P_t$  = price level at time t

$P_{t-1}$  = price level at time t - 1

$$\% \Delta \ln(x \cdot y) = \% \Delta \ln x + \% \Delta \ln y$$

$$\% \Delta \text{ in nominal GDP} = \% \Delta \text{ in price level} + \% \Delta \text{ in real GDP}$$

Growth rate of nominal GDP = Inflation rate + growth rate in real GDP

Inflation = growth rate of nominal GDP - growth rate of GDP

\* does not refer to one good but a basket

Different types of inflation:

1. Headline (or overall) inflation: includes all items in a specified basket of goods that is being priced
  - measures the cost of living
2. Core inflation: exclude items w/ volatile prices; generally food + energy g.
  - measures inflation ~~inertia~~ underlying movements taking place on inflation
  - volatile g. prices are usually mean-reverting
    - ↳ affected by supply rather than demand
  - central banks use this to set interest rates because it is a better indication/forecast
    - ↳ the Fed is like this
    - ↳ European Bank uses headline inflation

\* Fed's target = 2%

Employment is the number of people working

1. Payroll employment: measures the number of employees on company payrolls
  - from a survey of 220k firms a month
  - less volatile than below because uses more people - used more often

2. Household employment: measures number of people who self-report that they are working, including the self-employed
3. Working during past week or on temporary leave

Unemployment rate is the % of the civilian force who are

1. willing + able to work
2. actively looking for work
3. who do not have jobs
  - does not include discouraged workers who would like to work but have given up b/c they believe there are no jobs avail

- \* indicate what is happening in the labor market
- \* how well the economy is utilizing its resources for labor

Adult population composes of: (16 yrs or older)

1. Employed
2. unemployed ] Labor force
3. Not in the labor force: did not work during the past week + has not looked for a job in the past month (discouraged workers)

Three Basic Sources of Unemployment:

1. **Frictional unemployment**: related to job search in a dynamic labor market where, in a given month, many workers change their labor market status; labor markets have informational friction
  - related to imperfect information between job seekers + employers w/ job openings
  - generally short-term
2. **Structural unemployment**: related to mismatch between the work skills job seekers have + the work skills that employers are looking for; having skills which there is no demand
  - usually long + sometimes training or pay cut is required
  - often occurs when there are sectoral shifts in the economy
3. **Cyclical unemployment**: related to the changes in demand for labor caused by short-term fluctuations in economic activity (concerning)
  - generally due to wage rigidities; real wages cannot adjust quickly enough to equate the supply + demand for labor

**Natural rate of unemployment** is the unemployment rate that remains even when wages have fully adjusted to bring the labor market into equilibrium

- **full-employment level of unemployment**: natural unemployment that exists when there is full employment; no everyone has a job
- frictional + structural employment or when cyclical unemployment = 0
- cannot actually be surveyed

**Interest rates** are the cost of borrowing (price paid for rental funds) + the return to saving + lending

1. **Loan**: postponement of lender's spending; charge interest to compensate the opportunity cost of borrow/ waiting to spend their money, inflation, + default risk

2. **Bonds**: a type of debt securities which make payments on a regular basis for a specified period of time

\* because securities / loans are substitutes, interest rates on different securities move broadly together

**Term Structure of Interest Rates** is the relationship between interest rates on bonds that are similar in all respects except maturity; same issuer;  
difference between interest rates of diff. maturity

- **term premium**: a long maturity bond has a higher interest rate than short maturity bonds
- graph is called a **yield curve**.

**Nominal interest rate** ( $i$ ): rate at which nominal value of an asset incr. over time; no allowance for inflation

**Real interest rate**: rate at which the real value on the assets incr. over time; takes inflation into account; amount of extra purchasing power a lender must be paid for the rental of his/her money

**Risk Structure of Interest Rates** is the relationship between bonds w/same maturity but diff characteristics (diff borrowers)

- 1. **Default risk**
- 2. **Liquidity**: how easy to buy + sell
- 3. **Tax treatment of the interest payments**
  - i.e. tax-free or taxable payments

→ **ex ante real rates**: interest rate adjusted by subtracting expected changes in the price level (inflation) to accurately reflect the real cost of borrowing  
→ **ex post real rates**: adjusted for actual Δ's in price level + describes how well a lender has done in real terms after the fact

\* **Importance of real interest rates**: when it is low, there is incentive to borrow + invest but not save + lend

**Fisher equation** defines real interest rates in precise terms + is the relationship between nominal + ex ante real interest rates + expected inflation.  $\pi^e = i - r$  or  $i = r + \pi^e$

**Credit markets** are markets in which households + business firms get funds from each other

**Zero lower bound**: when interest rates cannot go negative

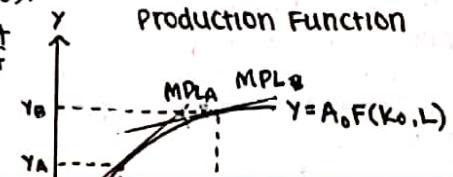
**Inflation protection bonds**: bonds w/real interest rates associated w/it

Real GDP is determined by

1. The amount of the factors of production (inputs in the production process) + labor L (number of work hours) + capital K (stock of productive assets; physical K is from the investment side of GDP)
  - **total factor of productivity** (A): determines the effectiveness with which the factors of production are used to produce economic output;  $A = Y/F(K, L)$ 
    - ↳ like a recipe indicating how K + L produce econ. output; anyone can use w/o diminishing other uses
    - ↳ cannot directly measure or observe; find residual from production divided by input
2. The **production function** which shows transformation of factors of production into output through the total factor of productivity ( $Y = A \cdot F(K, L)$ ); output produced from given A, K, + L

The production function between output + labor shows how much output is produced,  $Y$ , depends on the size of the labor force ( $L$ ) for a given capital stock ( $K_0$ ) + given level of tech ( $A_0$ ).

**Cobb-Douglas Production Function** incorporates the idea that an efficient economy will produce more w/the same quantity of  $L + K$ , and shares of labor + capital income in US have remained constant over time (relatively); it is represented by  $Y = F(L, k) = A_0 K^{1-\alpha} L^\alpha$

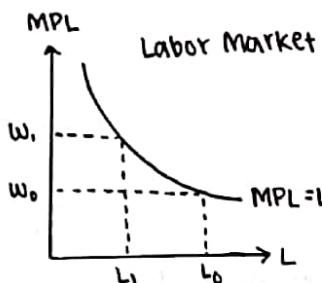


### 1. Increasing returns to labor

→ constant returns to scale (CD specific): incr. inputs by percentage + outputs will incr. by the same percent

### 2. Diminishing marginal product

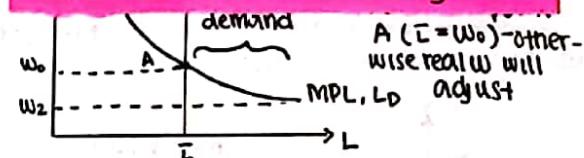
as the amount of one factor increases, holding other inputs constant, the incr. amount from an extra unit of input (marginal product) declines



- \* MPL is the additional revenue
- \*  $W$  is the cost to hire a worker
- \* In a competitive environ, you want  $MPL = \Delta Y / \Delta L = W$
- \* So MPL is also the demand for labor,  $L_D$
- \* MPL is slope of the PF

Assumptions for equilibrium of labor + capital markets:

1. Labor market is competitive
2. Workers are homogeneous
3. Supply of capital is fixed
4. Firms maximize profits
5. Individuals maximize utility



In perfect competition, firms take market prices as given + are not large/powerful enough to change it.  
→ economic profits: revenue from g+s minus cost of inputs

→ real economic profits: equation divided by  $P$

$$\Pi = F(K, L) - (R/P)K - (W/P)L$$

↳ real rental price: of capital: rental price in terms of g+s;  $r_C = R/P$

↳ real wage rate: wage in terms of goods + s  
 $w = W/P$

↳ thus we get the equation

$$\Pi = F(K, L) - r_C K - w L$$

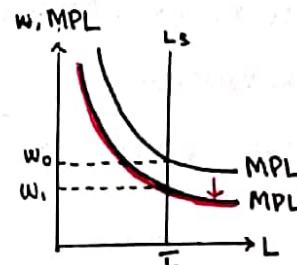
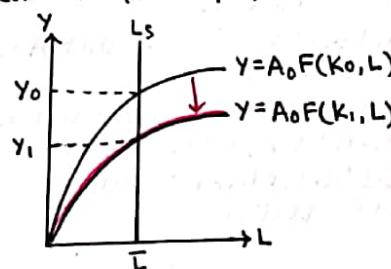
Profit maximization implies:

1. Firms will want an amount of capital that will make  $MPK = r_C$
2. Firms will hire an amount of labor that will make  $MPL = w$

Factors that shift the demand curve ( $L_D$ ):

1. Changes in capital stock ( $\Delta K$ ): increases in  $K$  raises the  $MPL$  + shift  $L_D$  to the right.
2. Changes in total factor productivity ( $\Delta A$ ): incr. in  $A$  raises  $MPL$  + shift  $L_D$  to the right

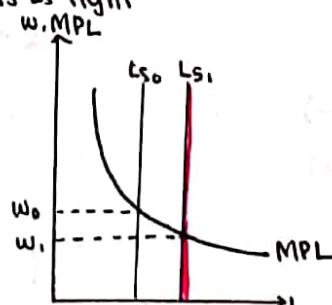
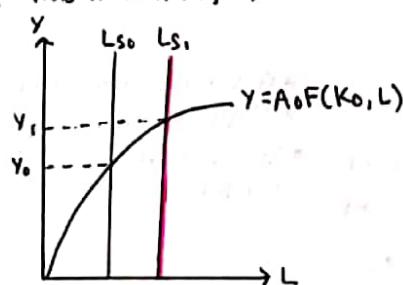
Ex: Decrease in capital equipment



\* workers become less productive with smaller capital stock

Factors that shift the labor supply curve ( $L_S$ ):

1. Changes in wealth: incr. in wealth reduces labor supply + shift  $L_S$  left (leisure is a superior good)
2. Changes in expected future real wage: like incr. in wealth, incr. in this will shift  $L_S$  left
3. Changes in working-age population: incr. in pop incr. labor supply + shift  $L_S$  right
4. Changes in labor force participation rate: incr. potential labor supply (even though size of working pop. has not changed) incr. labor supply + shifts  $L_S$  right



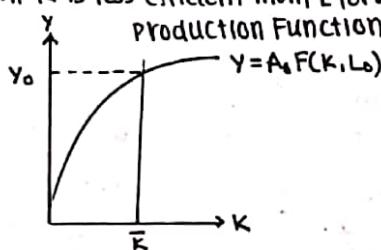
**Production function** between output  $\rightarrow$  capital, shows how economic output ( $Y$ ) depends on the size of the labor force ( $L$ ) for a given labor force ( $L_0$ ) + given level of technology ( $A_0$ )

Two properties of the production function:

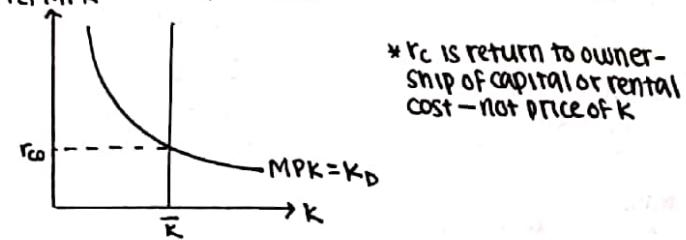
1. Increasing returns to capital

2. Diminishing marginal product ( $MPK = \Delta Y / \Delta K$ )

\* In general  $K$  is less efficient than  $L$  for a given amt



capital market

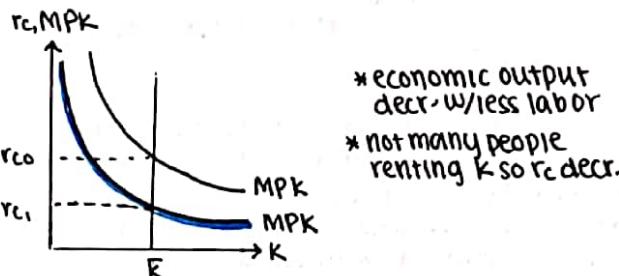
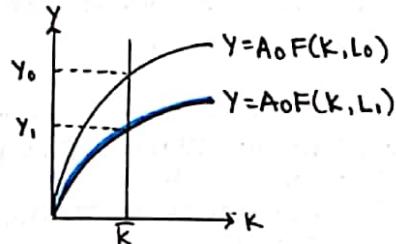


\*  $r_c$  is return to ownership of capital or rental cost - not price of  $K$

Factors that shift the demand for capital curve ( $K_D$ ):

1. Changes in the labor force ( $\Delta L$ ): incr. in  $L$  raises  $MPK$  + shifts  $K_D$  left
2. Changes in total factor productivity ( $\Delta A$ ): incr. in  $A$  raises  $MPK$  + shifts  $K_D$  left

Ex: labor force becomes smaller



- \* economic output decr. w/ less labor
- \* not many people renting  $K$  so  $r_c$  decr.

National income is divided between payments to labor + capital w/ the size + Q of payments determined by  $MPL + MPK$ ; Total output produced in economy = real labor income ( $WL = MPL \cdot L$ ) + real capital income ( $r_c K = MPK \cdot K$ )

Full employment (or potential) output is the level of output when the labor market is in LR equilibrium

$$Y^P = AF(K, \bar{L}) \text{ where } Q_0 = Q_s \text{ (est. to be around 6%)} \rightarrow \text{Also known as the long-run aggregate supply (LRAS)}$$

Factors that change full-employment output:

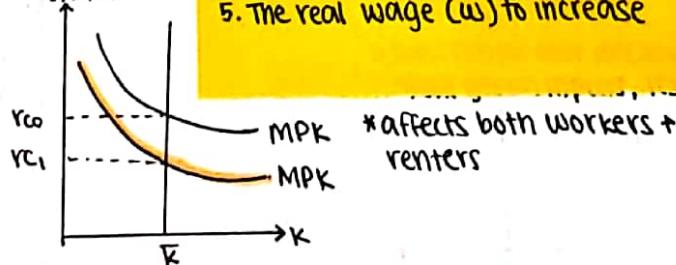
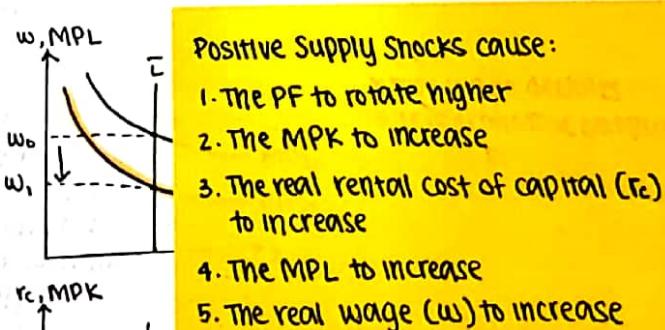
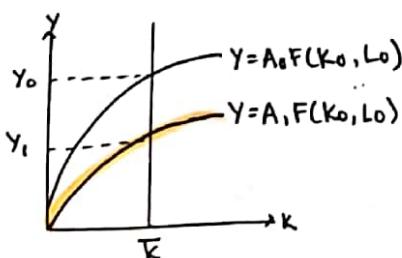
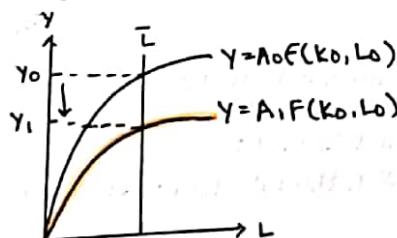
1. rotation in the production function (shifts in the demand for capital or for labor)
2. shifts in the supply of capital (more or less inputs will give us more or less employment)
3. shifts in the supply of labor

Supply shock (or total factor productivity) shock is the change in output an economy can produce from the same amount of capital + labor; involves change in TFP or  $A$ ; they can occur because

1. Technology shocks
2. Natural environmental shocks: temporarily disrupts production
3. Energy shocks: important factor separate from labor + capital
4. Financial crises

- Positive (favorable or beneficial): incr.  $A$  for given  $L + K$ ; rotate PF up
- Negative (unfavorable or adverse): decr.  $A$  + output for given  $L + K$ ; rotate PF down
  - ↳ also causes  $MPL + MPK$  to fall vice versa for positive

Ex: Negative shock  $\rightarrow$  decr.  $A$



\* affects both workers + renters

National wealth is a country's holdings of assets minus its liabilities at a particular point in time  
Savings is current income minus current spending; it is a flow variable.

National savings is the sum of private savings + gov't savings or GDP minus spending on current needs (consumption expenditure + gov't purchases);  $S = S_p + S_g = Y - C - G$

1. Private savings is private disposable income minus consumption expenditure;  $S_p = Y - T - C$ 
  - $\rightarrow Y = \text{real GDP}$
  - $\rightarrow T = \text{net taxes}$ : tax revenues minus gov't transfers + interest payment on debts
  - $\rightarrow C = \text{consumption}$
  - $\rightarrow \text{Private disposable income is GDP minus net taxes}; Y_p = Y - T$
  - $\rightarrow \text{Private savings rate is the proportion of } Y_p \text{ that is saved}; s_p = \frac{S_p}{Y_p} = \frac{S_p}{Y - T} \cdot 100$
  - $\rightarrow \text{investment not subtracted from disposable income bc it adds to future income + wealth}$

2. Government savings: net gov't income less gov't consumption (includes state + local gov't);  $S_g = T - G_c \approx T - G$ 
  - $\rightarrow G = \text{total gov't purchases (investment usually not included bc it is small)}$ 
    - $\hookrightarrow G_c = \text{gov't consump. purchases}$
  - $\rightarrow \text{Gov't budget balance}$ 
    - $\hookrightarrow \text{budget surplus: } T - G > 0; \text{ saving}$
    - $\hookrightarrow \text{budget deficit: } T - G < 0; \text{ dissaving}$ 
      - $\rightarrow \text{outlays} > \text{receipts}$
  - $\rightarrow \text{Government Savings rate: } s_g = \frac{S_g}{Y} \cdot 100$ 
    - $\hookrightarrow \text{note different denominator}$

Thus national savings is  $S = S_p + S_g = Y - T - C + T - G = Y - C - G$ .

The national savings rate is the share of national income saved by the gov't + households; thus, we have  $s = S/Y \cdot 100$

\* value-added tax: tax paid by producer on difference between receipts of goods + costs

National Income:  $Y = C + I + G + NX$

National Savings:  $S = Y - C - G$

Use-of-Saving Identity:  $S = (C + I + G + NX) - C - G$   
Identity:  $S = I + NX$

Use-of-Saving Identity: saving either goes into investment (acquire K goods + boost K stock) or net exports (sell goods to foreigners for foreign currency assets);  $S = I + NX$

Net capital outflow (net foreign investment) is how capital flows from the domestic economy to foreigners than flows into the domestic economy from abroad; the difference between saving + investment. The net capital outflow identity:  $S - I = NX$  (flow of money to finance exports)

- $\rightarrow$  when  $NX > 0$ , there is net capital outflows (excess savings are invested abroad) — also called a net foreign investment or net foreign lending (holding of foreign assets are greater than foreign holding of domestic assets) — bc  $S > I$  or  $S - I > 0$
- $\rightarrow$  There is also a trade surplus (when the trade balance, or net export,  $NX = S - I$ , is positive), or current account surplus

- $\rightarrow$  when  $NX < 0$ , there is a trade deficit (net exports is negative)
- $\rightarrow$  also  $I > S$  or  $S - I < 0$  thus there is net capital inflows (excess investment is financed abroad w/ borrowing) or net foreign borrowing

\* balance of payments account: bookkeeping system for recording all receipts + payments that have a direct bearing on movements of funds between a nation + foreign accounts

Net foreign assets: domestic-owned foreign assets minus foreign-owned domestic assets

\* no direct link between savings + wealth; valuation of assets fluctuate a lot in the SR

If  $S = I + NX + S = S_p + S_g$  then  $S_p = I - S_g + NX$ . Private savings finances domestic investment, gov't budget deficits, + net export surpluses. First people to borrow is the gov't, then business/domestic investors, + then we borrow from foreigners. If gov't has a surplus,  $-S_g$ , adds to saving

National savings is determined by  $Y, C, + G$

1. Economic Output ( $Y$ ) from the Production Function:  $Y = AF(K, L)$

2. Consumption ( $C$ ) from the Consumption Function:  $C = \bar{C} + c(Y - T, r)$

3. Gov't Purchases ( $G$ ) from the Gov't Purchase Function:  $G = \bar{G}$

$\rightarrow \bar{C}$ : autonomous consumption; not affected by taxes or interest rates; affected by:

1. Changes in wealth: incr. wealth incr. current C (don't have to save as much)
2. Changes in future expected income: incr. future income incr. current C
3. Changes in consumer confidence: incr. cause incr. in current consump.

\* people hold wealth in financial assets + housing

$\rightarrow T$ : tax payment function where  $T = \bar{T}$

$\rightarrow r$ : real interest rate

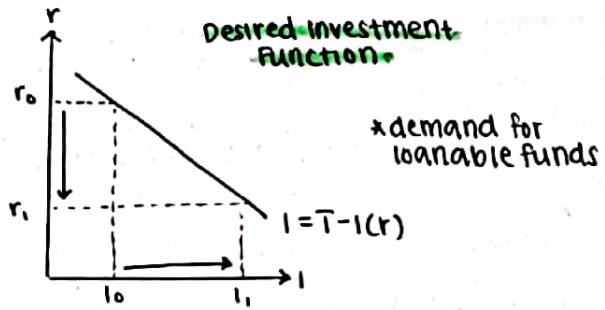
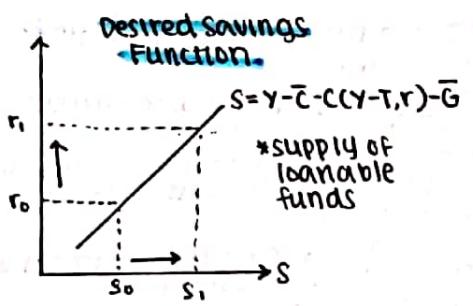
National savings can now be written as  $S = Y - \bar{C} - c(Y - \bar{T}, r) - \bar{G}$

$\rightarrow Y, \bar{T}, + r$  are positive derivatives

meaning savings is a positive function of real interest rate, taxes, + output/income

$\rightarrow$  National savings is a negative function of consumption + gov't purchases

Supply of loanable funds: now savings is sometimes understood because national savings is a positive function of interest rates (people spend less w/ interest rates are high)



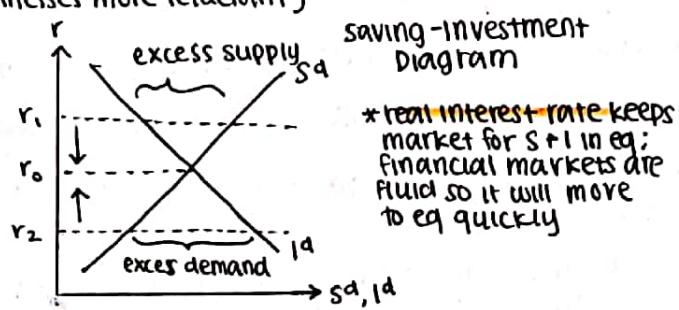
The investment function is  $I = T + I(r)$ , where  $T$  is the autonomous investment (not affected by  $r$ ) — it is affected by:

1. changes in expected future MPK: incr. in future MPK incr. current  $I$  (profitability)
2. changes in effective corporate tax rate: an incr. causes a decrease in current  $I$
3. changes in business confidence: an incr. incr. current  $I$
4. changes in tech: incr. in tech incr. current  $I$  (affect total factor productivity or capital)

Investment is a negative function of interest rates thus the demand for loanable funds, investment activities need to be financed (when  $r \uparrow$ , businesses more reluctant)

Assumptions:

1. Closed economy: closed to international trade w/ no net exports ( $NX = 0$ )
2. Prices are flexible; long-run analysis (time sufficient to consider all prices to be fully flexible)
3. All markets are in equilibrium — there is perfect competition



National Income Identity:  $Y = C + I + G$

National Saving:  $S = Y - C - G$

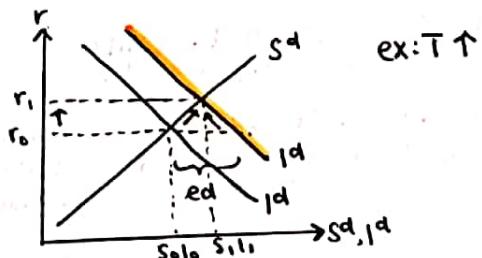
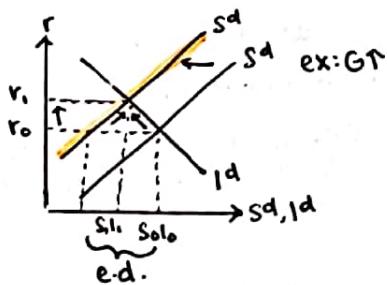
Goods Market Equilibrium condition:  $S = I$ , where the savings + investment curve intersect

→ excess supply:  $r > r_0$ ; supply of loanable funds > demand

→ excess demand:  $r$  is too low; borrowers want to borrow > savers want to save

Closed Economy's Response to

1. Changes in saving: Autonomous consumption + effects of fiscal policies (taxes + gov't purchases)
  - incr. in desired savings (rise in taxes): reduce real interest rate + incr.  $I_d$
  - incr. in desired investments (rise in  $\bar{C}$  or  $G$ ): incr.  $r + S^d$
  - ↳ ex: Rise in  $G$  = reduce  $S^d$ , excess demand,  $S^d \uparrow + I^d \downarrow$ ,  $r$  rises (crowding out)



2. Changes in Autonomous Investment: incr. in optimism or tax code (benefit) =  $I + r$  rises

→  $I^d$  shifts right, excess demand, supply  $\uparrow$ , demand  $\downarrow$ ,  $r \uparrow$ ,  $S^d, I^d \uparrow$  (see ex 1)

→ Investment tax credit: changes in tax code which give businesses a tax break when they make an investment in physical  $K$ ; encourage business to expand  $I$  @ any given interest rate

Assumptions:

1. Open economy: engage in international trade; open trade + flows of capital across borders
  - exports + imports are positive:  $X + M > 0$
  - net exports can be positive, negative, or zero
2. Perfect capital mobility: no restrictions on (financial) flow of capital between domestic + foreign residents
  - lends will lend funds to highest rate of return approx by interest rate
  - domestic real interest rates = world interest rates ( $r = r^w$ )

$x$  world real interest rate ( $r^w$ ): interest rate found in world markets
 

- if  $r > r^w$  then domestic residents + gov't will borrow abroad

National Income:  $Y = C + I + G + NX$

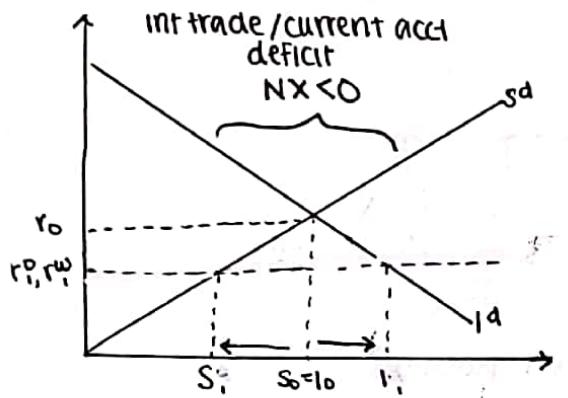
National Savings:  $S = Y - C - G$

(Goods Market) Equilibrium:  $S = I + NX$  or  $S - I = NX$

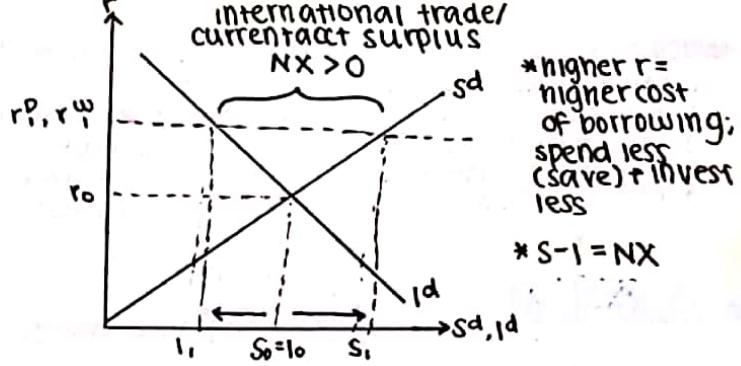
→ desired world savings = desired world investment
 

- in large open economies, the amt of foreign lending = excess desired saving / desired invest.
- ↳ if trade surplus, then  $r^w$  will fall bc large economy wants to lend a lot

- A small open economy is an economy that:
1. Is open to international trade + capital flows (movement of goods + money between countries to pay for imports + exports)
  2. Is too small relative to the world economy to affect the world interest rate.  
→  $r^w$  is given (exogenous variable) + may be  $>$ ,  $<$ , or  $=$  the  $r$  at which  $S=I$



\* lower  $r$  = reduce cost of borrow; investment incr; spend more w/same income level



- \*  $S - I = NX$
- If  $r^w > r_0$ , then  $S > I + NX > 0$ ; excess funds go to foreign lending so net foreign lending is positive  
→ savings > investment  
→ international trade + current acct surplus  
→ net financial capital outflow  
→ net foreign investment  
→ net foreign lending

\*  $I + S$  move endogenously

If  $r^w = r_0$  then  $S = I + NX = 0$ : no net foreign lending or borrowing

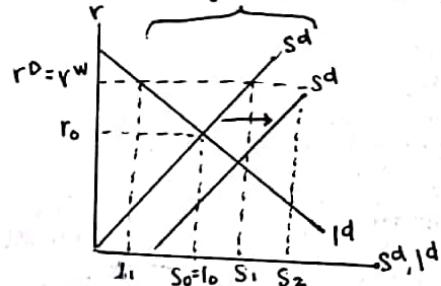
If  $r^w < r_0$  then  $I > S + NX < 0$ : net foreign borrowing is positive

- demand for loanable funds > supply of loanable funds (borrow excess from foreigners)
- net financial capital inflow, net foreign borrowing, net export deficit

An increase in desired savings will

1. not change that country's real interest rate or their desired investment
2. incr. the country's net export balance (deficit smaller or surplus larger); outflow
3. incr. the country's net foreign lending or reduce net foreign borrowing

Ex: decrease in gov't purchases (exogenous variable) shifts savings to the right

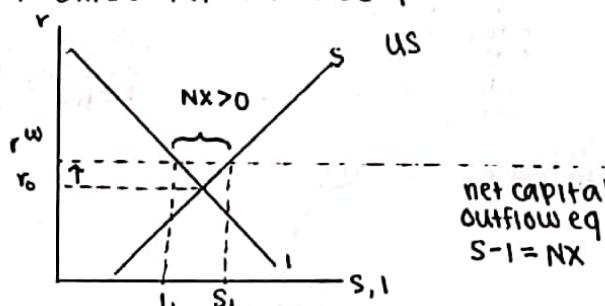


- we assume  $r^w > r_0$
- $r^w$  is not affected
- desired investment will not change
- net export balance/surplus incr  
↳ outflow, foreign investment

\* twin deficit: a phenomenon of a simultaneous trade deficit + gov't budget deficit

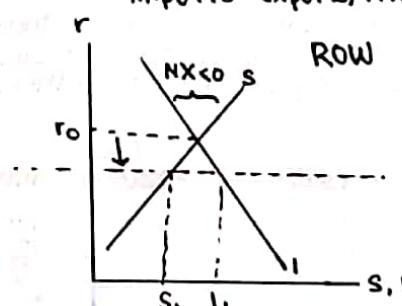
A large open economy is an economy that

1. Is open to international trade + capital flows
2. Is large enough relative to the world economy that affect the real world interest rate  
→  $r^w$  is endogenous (not given)  
→  $r^w$  can be  $>$ ,  $<$ ,  $=$   $r$  where  $S=I$



- net export surplus = net foreign lending  
→ incr.  $r$  = invest less + save more

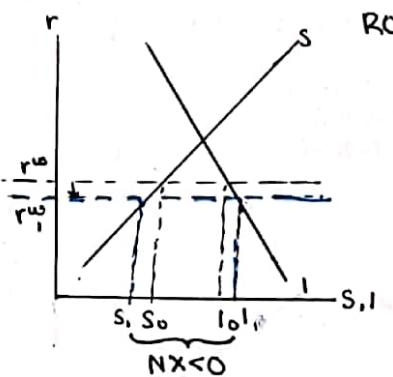
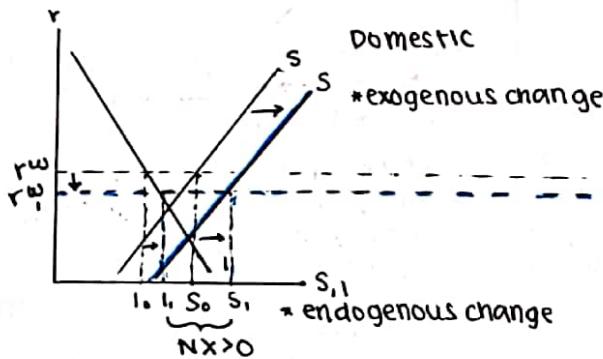
\* net capital outflow identity comes from nation income + expenditure identity + savings identity



- net export deficit = net foreign borrowing  
→ decr.  $r$  = invest more + save less

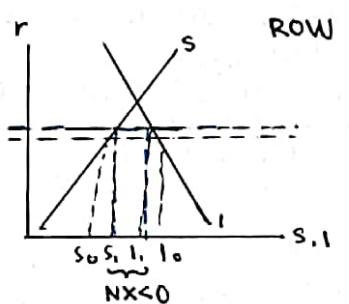
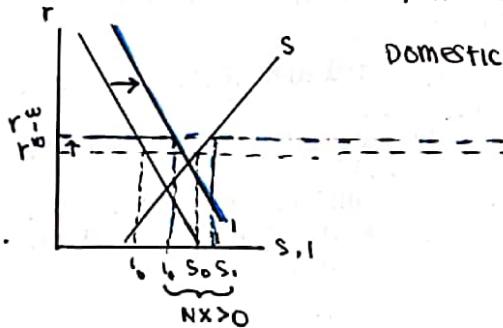
## Increase in desired savings: decline in $\bar{C}$ , tax incr, or decline in gov't purchases

1. causes real world interest rates to fall
2. raises investment in both the domestic economy + the rest of the world (demand for loanable funds)
3. incr. domestic net export balance: raises trade surplus + net capital outflows  
→ incr. foreign lending or reduce net foreign borrowing
4. raises trade deficit + capital inflows in the rest of the world



## Increase in desired investment: increase in $\bar{I}$ , tax decr (interest rate)

1. causes real world interest rates to rise
2. raises desired savings (endogenous) in both the domestic economy + rest of the world
3. reduce net export balance: lowers trade surplus + net capital outflows  
→ incr. foreign borrowing or reduce net foreign lending
4. lowers trade deficit + capital outflows in the rest of the world



The financial system's role in the economy is to coordinate the channeling of funds

1. From households, businesses, gov't, + foreigners with surplus funds (lenders)
2. To households, businesses, gov't, + foreigners with a shortage of funds (borrowers)

Direct finance is a route that channels funds from saver-lenders to spender-borrowers directly through financial markets

→ Securities or financial instruments: claims on the borrowers' future income or assets in the form of stocks or bonds (receive money directly)

↳ equities: ownership share of savings

↳ bonds: debt instrument

→ securities are liabilities for the firm or person who buys them

→ Financial markets include

↳ exchanges: central location where buyers + sellers of securities conduct business

↳ investment banks: financial institutions that trade securities + assist businesses + gov't issue them by guaranteeing a price + selling them

Indirect finance is a route that channels funds from saver-lenders to spender-borrowers through a financial intermediary

→ financial intermediary: a type of financial institution such as a bank, insurance company, finance company, mutual fund, or pension fund/hedge fund

→ financial intermediation: linking the  $S-1$  to  $B-1$  w/ the financial intermediaries

↳ obtain credit (microcredit,  $< \$100$ )

↳ important source of financing businesses (60% of funds)

→ have expenses but savers may prefer this because it is less risky

→ more direct + less intermediation = advanced.

→ diff. between various intermediaries are the types of liabilities each issues + types of assets each holds



**Convergence** is when countries with different initial levels of per capita income gravitate to similar level of per capita income; growth miracles undergo convergence big time; growth disaster is the opp.

**Long-term economic growth** is about the annual average growth rate of real economic output, generally over periods of 10 years or longer

→ because of pop size changes + labor force changes, economic output is generally measured in per capita or per-worker terms (this was historically constant but not anymore)

\* small changes in growth rates makes a very large difference over long periods of time

→ **Rule 72**: divide 72 by the country's average annual growth rate to approximate how long it takes for an economy to double in size (China's 7% means they will double in ~10 years)

**Solow Growth Model (Neoclassical Growth Model)**: explains average value of growth periods over an extended period of time; explains how saving rates + labor force growth rates determine capital accumulation, which in turn affects economic growth

Assumptions:

1. The labor force growth rate is constant ( $g_L = x$ )  
→ the labor force growth rate is fixed  $g_L = x$

2. There is no productivity growth ( $g_A = 0$ )  
→ level of productivity is fixed at  $A_0$

3. The economy is closed ( $x = M = NX = 0$ ):  $S = I$

4. There is no govt spending ( $G = 0$ )

5. Savings is a fixed portion of income ( $s_t = s_0 y_t$  where  $s_0$  is the fixed savings rate between 0 + 1)

6. Therefore national income is  $y = c + i$

→ per worker income  $\frac{y_t}{L_t} = \frac{c_t}{L_t} + \frac{i_t}{L_t}$

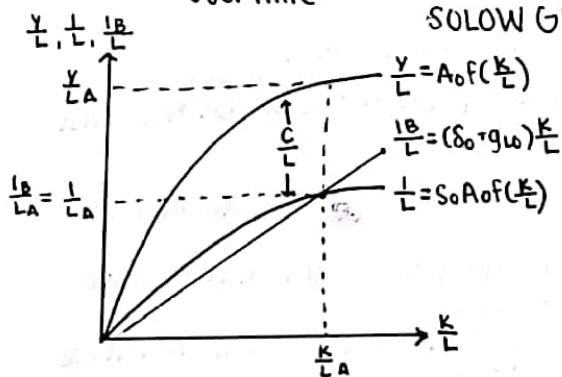
**Capital accumulation** is the change in the capital stock per worker or new capital investment minus the loss from depreciation

→ capital accumulation equation:

$$\Delta k/L = 1/L - S(k/L)$$

↳ **Investment**: the purchase of new factories + machines that add to capital stock  
↳ **Depreciation** ( $S$ ): the loss of capital from the wearing out of machinery + factories over time

### SOLOW GROWTH MODEL



Suppose  $\frac{K}{L} < \frac{K}{L}_s$  (i.e. capital is destroyed): drop in capital or increase in labor force relative to the other variables

1. If  $(K/L) < (K/L)_s$  then at  $(K/L)$ ,  $\frac{Y}{L} > \frac{I_B}{L}$
2. If  $\frac{Y}{L} > \frac{I_B}{L}$ , then  $K/L$  will increase  
→  $\frac{Y}{L}$  falls more than  $\frac{I_B}{L}$  because  $\frac{Y}{L}$  has diminishing MPK
3. Process continues until  $K/L = (K/L)_s$  bc you invest more
4. As long as  $\frac{Y}{L} > \frac{I_B}{L}$ ,  $K/L$  will rise until you reach the original steady state  
→ natural forces will take it back to the steady state, assuming no other forces have changed  
→ additional growth in  $K$  is growing smaller  
↳ gap between  $\frac{Y}{L} + \frac{I_B}{L}$  smaller due to DMPK

Suppose  $\frac{K}{L} > \frac{K}{L}_s$

1. If  $\frac{K}{L} > \frac{K}{L}_s$  then at  $\frac{K}{L}$ ,  $\frac{Y}{L} < \frac{I_B}{L}$
2. If  $\frac{Y}{L} < \frac{I_B}{L}$ , then  $K/L$  will fall
3. This capital-labor decreases until  $K/L = K/L_s$

**Per-worker production function** is the economy's production function divided by  $L_t$

$$\frac{y_t}{L_t} = A_0 f\left(\frac{K_t}{L_t}\right)$$

→ **capital-labor ratio** ( $\frac{K}{L}$ ): amt of  $K$  per worker  
→ time subscript imp. because it describes what is happening over time  
→ **diminishing marginal returns to capital**

**Per-Worker Savings / Investment Function**: if  $S_t = s_0 y_t$  then  $\frac{I_t}{L_t} = s_0 A_0 f\left(\frac{K_t}{L_t}\right)$

→ **savings rate** ( $s_0$ ): fraction of income saved  
→ **National Income Identity** in per worker terms is  $\frac{I_t}{L_t} = \frac{Y_t}{L_t} - \frac{C_t}{L_t}$   
→ higher  $K/L$  → higher  $Y/L$  → higher  $S/L + I/L$

**Per-Worker Balanced Investment Function**: amt of investment needed to keep capital-labor ratio const.

→ **Balanced Investment**:  $I_B = (s_0 + g_w) K$

↳ **Investment**:  $I_t = Y_t - C_t$

↳ **Depreciation**:  $D_t = s_0 K_t$

→ **fixed depreciation rate** ( $s_0$ )

↳ **change in K stock**:  $\Delta K_t = I_t - D_t$

↳ **growth rate of K**:  $g_K = \frac{\Delta K}{K} = (I - D)/K$

→ on a per worker term, we divide by  $L$  to get  $\frac{I_B}{L} = (s_0 + g_w) \frac{K}{L}$

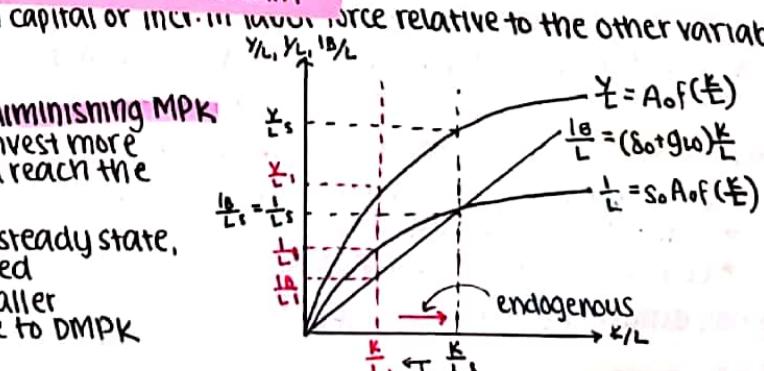
The **steady state** occurs when  $\frac{I_B}{L} = 0$  which will occur when investment per-worker ( $s_0 A_0 f(\frac{K}{L})$ ) = balanced investment per worker ( $s_0 + g_w) \frac{K}{L}$

→ IF  $\Delta(\frac{K}{L}) = 0$  then  $g_K = g_L$

→ IF  $\Delta(\frac{Y}{L}) = 0$  then  $g_Y = g_L$

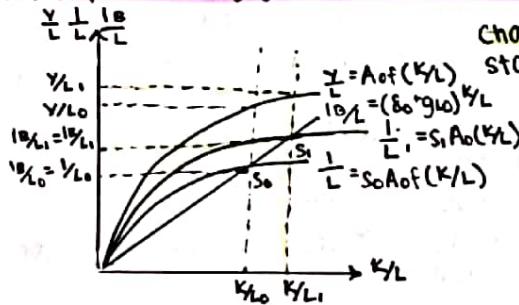
→ IF  $g_A = 0$  then  $g_Y = g_L = g_K$

**Capital dilution**: growth in labor force that leads to less  $K/L$  because  $K$  is constant



\* usually doesn't apply unless there was a sharp drop in the labor force

With no productivity growth, the economy reaches a steady state over time with constant  $K/L + Y/L$



Changes in Savings Rate: suppose an economy is in its steady state + the savings rate,  $s$ , increases

1. Savings/investment per-worker function shifts up
  2. At  $K/L_0$ ,  $Y/L > 1/B/L$
  3.  $K/L$  will increase
  4. Due to diminishing marginal product of capital, incr. in  $Y/L$  is smaller than incr. of  $1/B/L$  for an incr. of  $K/L$
  5.  $Y/L = 1/B/L$  at steady state  $S_1$ .
  6. Economy is still growing at the same force as labor force  
→ higher income per worker grows  
→ during transition period, faster growth rate  
→ does not really affect economic growth
- \* At  $S_0 + S_1$ ,  $g_y = g_{L0} + g_{L1}$  during the transition period  $g_y > g_{L0}$   
\* Level effect but not growth effect

Incr. in savings rate results in:

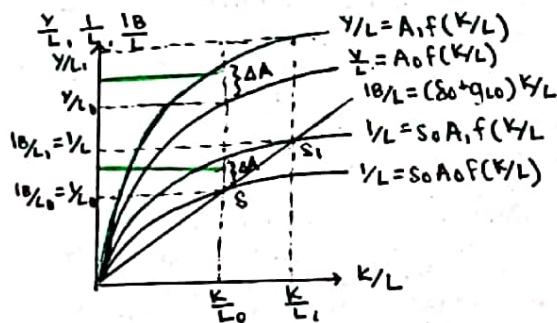
1. higher  $K/L$ ,  $Y/L$ ,  $1/L$ ,  $1/B/L$
2. Faster growth during the transition period
3. No Δ in long-term economic growth rate

changes in labor force growth rate: economy at its steady

state has  $g_L$  slow down

1. Rotates per-worker balanced investment function down so that it is flatter
2. At  $K/L_0$ ,  $Y/L > 1/B/L$  so  $K/L$  will increase
3. Due to diminishing MPK, incr. in  $Y/L <$  incr.  $1/B/L$
4.  $Y/L = 1/B/L$  at a higher steady state  $S_1$ ,  
→ economy is also growing slower because  $g_{L0}$  slowed  
→ income per worker is higher

- \* At  $S_0$ ,  $g_{y0} = g_{L0}$  → At  $S_1$ ,  $g_y = g_{L1}$ ,  
→ because  $g_{L1} < g_{L0}$ ,  $g_y < g_{y0}$   
→ during the transition period between  $S_0 + S_1$ ,  $g_y > g_{y0}$  because  $Y/L$  was increasing



Incr. in productivity  $A$  results in:

1. higher  $K/L$ ,  $Y/L$ ,  $1/L$ ,  $1/B/L$
2. Faster growth in transition periods
3. No Δ in long-term economic growth rate

\* dominant factor in determining how quickly standards of living rise

→ savings rate + labor force growth rate cannot rise + fall forever but productivity can improve

Summary of the Solow Model

1. Economies w/ similar PF + savings rates that have low initial per capita income will have higher growth rates + those w/ higher per capita income have lower growth rates
2. Higher rate of saving + hence higher level of investment relative to income, leads to higher levels of capital + output per worker, but does not affect their long run growth rates
3. Higher population reduces output per person
4. Incr. in  $A$  have amplified effects on per capita income from direct effects through the PF + additional positive effect from a higher  $K/L$  ratio

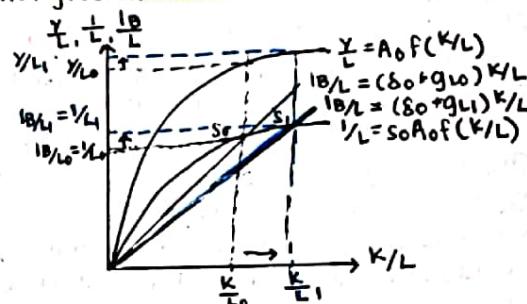
Growth Accounting Equation:  $g_y = g_A + x g_K + (1-x) g_L$

- $g_A$  = contribution from productivity growth
- $x g_K$  = " from capital growth
- $(1-x) g_L$  = " from labor growth

\* has diminishing MPK + MPL

Factor accumulation: growth of labor + capital

\* Solow Model poorly explains why modern economies have sustained incr.



Slowing of  $g_L$  results in:

1. higher  $K/L$ ,  $Y/L$ ,  $1/L$ ,  $1/B/L$
2. Faster growth during transition
3. Slower long-term economic growth.

changes in total factor productivity: economy in steady state has the level of productivity (not growth rate) incr.

1. rotates  $Y/L + 1/L$  function upward
2. At  $K/L_0$ ,  $Y/L > 1/B/L + Y/L$  is higher
3.  $K/L$  incr. until  $Y/L = 1/B/L$  at  $S_1$
4. At  $S_0$ ,  $g_y = g_{L0} = g_K$
5. At  $S_1$ ,  $g_y = g_{L1} = g_K$
6. During transition from  $S_0$  to  $S_1$   
→  $Y/L$  incr. because  $g_y > g_{L0}$   
→  $K/L$  incr. because  $g_K > g_{L0}$

\* bigger changes than savings + labor force growth rates

Improvement in productivity has 2 effects

1. Gains directly before Δ in  $K/L$  (in highlighter)
2. Incr. national savings + indirectly causes LR  $K/L$  to rise

Solow residual:  $A_t = \frac{Y_t}{K_t^{1-\alpha} L_t^{\alpha}}$

- unexplained residual part of the PF
- also total factor productivity

The growth accounting formula is  $g_y = g_A + \alpha_K g_K + \alpha_L g_L$ , where  $\alpha$  is the output elasticity +  $\alpha_K + \alpha_L = 1$  due to diminishing marginal returns to labor + capital

### Accounting for Growth:

1. Collect data on  $g_y$  (GDP),  $g_K$  (capital stock), +  $g_L$  (employment info)
2. Estimate  $\alpha_K + \alpha_L$  from historical data
3. Calculate total factor productivity w/ the Solow residual as  $A_t = Y_t / F(K_t, L_t)$   
→ remember you cannot calculate total factor productivity directly

Total factor productivity is the most important source of growth in the growth accounting formula + Solow  
→ more important source of variation in growth rates than is factor accumulation

- ↳ long-term growth rate is most responsive
- ↳ primary determinant how fast an economy grows over time
- ↳ direct + secondary effect from Solow

  
→ no diminishing returns to A

- ↳ coefficient for A is 1 in growth acc. formula

### Policies to Promote Productivity

1. Encouraging Research + Development, efforts to directly incr. the growth rate of tech (research shows weak positive relationship between R+D + productivity growth)

→ Gov't can promote R+D through:

#### 1. Direct gov't expenditures

- ↳ direct engagement in gov't labs + funding at universities + private labs
- ↳ gov't R+D usually focuses on basic - rather than commercial - research (foundation in changes in science + tech)

#### 2. Providing tax incentives for private R+D spending: reduce tax burden + incr. tax return

- ↳ tax credits or expensing for R+D expenditures (Economic Recovery Act of 1981: 20%)
- ↳ accelerating tax depreciation of R+D investments
- ↳ Private R+D usually focuses on commercial - rather than basic - research (practical + to be utilized immediately)

#### 3. Providing patents, copyrights, + other intellectual property rights protection

- ↳ protections grant intellectual property rights to investors that give them the sole right to use, make, or sell licensing rights to others for a set period of time (~20 years)
  - "temporary" grant of quasi-monopoly power to minimize the effects of non-excludability of private R+D activities (charge high price)
- ↳ Difficulty of properly balancing protection against diffusion (large for economic growth)
  - patent trolls: buying patents to extract large payments
- ↳ Difficulty enforcing intellectual properties

2. Increase human capital, knowledge + skills worker acquire through education + training (strong, positive correlation between amt + quality of human capital + productivity growth)

→ Gov't can encourage human capital by

#### 1. Educational policies + worker training programs

- ↳ college premium: higher wage over their lifetime for college graduates compared to HS

#### 2. Public health programs

3. Removing barriers to business formation to promote human capital in the form of entrepreneurial sk

3. Building infrastructure, the highways, bridges, utilities, dams, airports, etc. that support the transports + distribution of goods (movement of factors of production) - strong, positive correlation

→ Gov't can promote improved infrastructure by

#### 1. Direct gov't expenditure: usually uneconomical for private firms to produce but raises stand. of living (buildings, roads, bridges, ports, tunnels)

- ↳ US Interstate Highway System: largest highway system in the world (50k)

#### 2. Providing tax incentives for private infrastructure spending (i.e. pipelines)

#### 3. Streamlining or removing barriers for private sector investment in infrastructure

- ↳ rearrange rules to have same protections but faster + easier to accomplish

→ easier + cheaper = more efficient

→ debate when its effective, who should pay, amt to spend, + political aspects

In modern, high-income economies, A is analogous with technology

→ Tech increases efficiency with which labor + capital are used together

→ Tech can be treated as a factor input in production process but is diff from L + K

capital + labor are physical objects + are rival (one person can use the factor at a given time) + excludable (owner of the factor can prevent others from using the factor)

Technology is a set of instructions, designs, or ideas which are nonrival (more than one can use it) + non-excludable (cannot prevent use)

→ expensive so private sector likely to spend too little on developing new techs

In low income economies, A is not always analogous with tech:  $g_A = g_y - \alpha_R g_K - \alpha_L g_L$

→ **Productivity** is everything that contributes to economic growth over labor + capital

**Institutions** are a set of rules, customs, practices + organizations that govern the behavior of individuals + firms

→ **social capital** which includes: political culture + practice, legal code + justice system, property rights, financial system, corporate governance, + the tax system

**Strong social capital** creates:

1. Productive investment structures
2. Clarity + ease in the ability to create business or economic value for society (risk included)
3. Robust + efficient legal systems w/ predictable enforcement (contracts, adjudicate disputes)
4. Financial systems that allocate capital productively
5. Limited political + elite interference in the wealth-creation process
6. Limited rent seeking, appealing to govt to give you more money directly or indirectly without creating more economic value

Strong social capital provides institutional arrangements that est. +/or maintain proper incentives for economic resources to be used 1) efficiently, 2) creatively, + 3) productively.

→ countries w/ high social capital: incentive structures aligned, frictional cost reduced, reward for innov + A  
↳ "rich" because social capital use of avail. econ conditions + infrastructure res. to generate productivity g

**Property rights** (social capital): protection of property, including intellectual property, from expropriation by the govt or other individ or firms

→ basic + fundamental to provide incentives (strong property rights) or disincentives (weak property rights) for undertaking investment + accumulating capital

→ capital stock matters!

↳ ↓ k = ↓ investment in physical capital = ↓ levels of K/L = ↓ levels of Y/L

Obstacles to Effective Property Rights.

1. High cost of est. legal businesses: illegal businesses w/ no property rights emerge when process is too arduous; job creation comes from new businesses (80-90% fail in first 5 years); WB's Doing Business Rep.
2. Corruption: raises cost of business + reduce profit margins / incentives to undertake new bus. act.  
→ property rights can be expropriated to highest bidder (create uncertainty)
3. Kleptocracies: behavior of high level of govt that → grabbing hand: govt officials arbitrarily expr. id → continual wars or threat of force

Money is a financial asset generally accepted as the payment

Three functions of money:

1. **Unit of account**: money is how value in the economy is measured (indicates prices of g+s in the economy)

2. **Store of value**: a repository of purchasing power that lasts over time; means of preserving purchasing power until spent  
→ no rate of return on cash so you don't want to hold a lot of it

→ **liquid**: how easy it is to convert to the medium of exchange (money)  
↳ convert something you can use in transactions easily + costlessly

3. **Medium of Exchange**: money is a financial asset used to finalize transactions; used to pay (generally accepted payment of g+s + repayment of debts)

→ efficient: min transaction costs

↳ **barter**: exchange g+s for other g+s  
→ "double coincidence of wants"

→ credit cards not included bc after use, you enter into another transaction w/bank

Property rights est. through effective legal system that operates quickly at low cost:

1. Ability to enforce contracts
2. Adequate resources for courts w/sufficient number of qualified, independent, + timely judges
3. Access to adequately (+ independent) lawyers

\***common law**: law is continually reinterpreted by judges + evolve w/changing economic circumstances (opp. of Napoleonic code)

Both money aggregates rise + fall but usually have large discrepancies;  
So the Fed focuses on interest rates for monetary policy

M1 + M2 is the amount of money circulating in the economy + owned by the non bank public (not govt or bank but households, firms / businesses, + individuals)

→ **checkable deposits**: remainder of checking acct held by households (\$ 451.0 b)

→ **Total**: \$ 25 22.6 b  
↳ rise after 2008 because of insurance (risk adverse) + low interest rates

2. **M2**: all of M1 + less liquid asset types  
→ **small time deposits** (<100k for small period of t) (\$ 567.7 b)

→ **savings deposits** (\$ 6857.1 b)

→ **Retail Money Market Mutual Funds** (\$ 651.5 b)

→ **Total**: \$ 10598.8 b  
↳ not a medium of exchange (minus M1) but can move to M1 easily - "near money"

↳ Fed looks more at M2

→ **Small time deposit** (\$ 67.7 b)  
↳ \$ 100 in bank for small period of time

TWO types of money:

1. **Flat money**: no intrinsic value
2. **Commodity money**: has intrinsic value

\* Money is NOT wealth (total collection of property as a store of value): "He has a lot of money"

Money is NOT income (flow of earnings per time): "she makes a lot of money"

Where does money come from? → currency + coins issued by the govt

→ "other money" (checking accounts) issued by the financial system

Three Groups which affect money supply:

1. The central bank (the Fed): conducts monetary policy

→ creates money when buying assets from the public so money will go into circulation

→ decree by govt of legal tender, meaning it is accepted as payments for tax liabilities (pub + priv)  
↳ people become more willing to buy + exchange

→ open market operations: buying + selling of (typically) its domestic govt securities in the open market (open to public sector + transparent)

↳ open market purchase: when cb buys its domestic govt securities in open market (NY Fed)  
→ incr. commercial banks' deposits + reserves (purchased by central bank + transfers credit to seller's bank account when buying assets)

→ banks increase their lending

→ households + firms deposit their borrowing in their checking accounts

→ incr. money supply

\* affect interest rates + the amt of liquidity in the banking system

↳ open market sale: when cb sells its domestic govt securities in the open market  
→ decreases commercial banks' deposits + reserves  
↳ money held by the nonbank public goes to the cb + disappears from money supply

→ banks decrease their lending

→ household + firm's checking account will decline ⇒ decreases money supply

→ the Federal Reserve: 12 Fed banks + Board of Governors of the Fed

↳ conduct monetary policy, issue currency, clear checks, + provide supervisory oversight of the financial system

↳ Federal Open Market Committee (FOMC): directs OMO (5/12 bank presidents vote); 7 members of the Board of Governors, president of NY Fed Bank, 4 other Fed presidents banks meet 8 times a year

↳ Board of Governors (7 members appointed by the president - all from FOMC) involved in monetary policy (majority of votes w/staff of professional economists)  
→ chair: advises president, testify in Congress, represents the Fed in media

2. Depository Institutions (banks): accept deposits + make loans

3. The public (people + firms): holds money as currency + coins + as bank deposits

Quantity theory of money explains the relationship between money supply + nominal income

→ theory about the long run because it is derived under the assumption wages + prices are flexible, meaning they quickly adjust to LR equilibrium at which supply = demand

→ Equation of exchange (identity): relates nominal income to quantity of money + velocity

$$M \times V = P \times Y$$

↳ M = money supply

↳ V = velocity of money

↳ P = general price level

↳ Y = real GDP

↳ PY = market value of transaction

→ Velocity: average number of times per year that a dollar is spent, or "turns over" in buying gts produced in econ.

↳ determined by how individ. conducted transactions

$$V = P \cdot Y / M$$

→ demand for real money balances: Q of money people want to hold in terms of gts it can purchase is proportional to income

$$M \Delta P = \frac{1}{V} \cdot Y$$

→ changing Equation of exchange to quantity theory of money requires 3 assumptions

1. The velocity of money is constant: V is determined by the institutions that affect the way consumers + businesses conduct transactions + institutions + payment tech were assumed to change gradually  $M \times V = P \times Y$   
↳ level of nominal income/output / PY is determined solely by M, Q of money

2. Real economic output is determined by the quality/quantity of the factors of production + total factor productivity

↳ real variables (L, K, A; Y) unaffected by changes in nominal variables M + P

\* Y, K, L, A, ↳ "The Classical Dichotomy": because nominal variables have no effect on real variables affected by r, + w not Δ in P in the long run, the real + nominal sectors of the economy are independent of one another.  
→ does not mean real cannot affect nominal ( $Q \rightarrow P$  but not  $P \rightarrow Q$ )

↳ (long-run) neutrality of money: changes in money supply (nominal variable) will not affect any real variables; ΔP does not affect real variables

### 3. Causation runs from money supply to prices

- because the cb controls money supply,  $M + \Delta M$  is exogenous policy variable ( $\Delta M = \Delta \text{nominal GDP}$ )  
↳  $\Delta M$  cause  $\Delta P \cdot Y$
  - because economic output is independent of money supply + the price level, then changes in money supply leads to proportional changes in the price level
  - because cb controls the money supply, it is responsible for general price level + inflation
- \* nominal income is determined solely by movements in  $M$ , the quantity of money

**Quantity theory of inflation:** indicates that in the LR, the inflation rate equals the growth rate of the money supply minus the growth rate of aggregate output (real economic output)

$$\rightarrow \text{If } M \cdot V = P \cdot Y \text{ then } g_M + g_V = g_P + g_Y \text{ but } g_V \text{ is assumed to be } 0 \Rightarrow g_P = \pi$$

$$\rightarrow g_M \approx \pi + g_Y \text{ or } \pi = g_M - g_Y$$

→ **hyperinflation:** period of extremely rapid price increases of more than 50% a month  
→ because of volatile velocity, post 1990s do not follow this trend

**Fisher effect:** nominal interest rates will change proportionally w/expected inflation when real interest rate is constant; when expected inflation rises, interest rates will rise ( $\Delta i \approx \Delta \pi_e$ ) + vice versa

→ **Fisher equation:**  $i = r + \pi_e$

↳ **Classical Dichotomy:** real interest rates are unaffected by inflation or expected inflation ( $r$  is fixed)  
→ real interest rate is fixed + determined by desired savings + investment only

The Fisher effect is:

1. In the long-run, reasonably accurate (nominal interest rate + inflation move together)

→ Post 1980: deregulation of financial markets, money transfers from  $M_1$  to  $M_2$  (computerized banking, rise of mutual funds), financial crisis (hold  $M_1$  but not spend)

2. In the short-run, not very accurate (real interest rate not constant)

**Costs from anticipated inflation** (should not affect the wellbeing of people)

1. **shoe-leather costs:** time/fuel spent on making bank trips
2. **menu costs:** costs from changing prices
3. **tax distortions:** tax rates do not adjust fully; discourage investment when inflation is high
4. **increased variability of relative prices:** firms competing in the same market do not  $\Delta$  prices at the same time
5. **loss of dollar yardstick:** tough time comparing relative costs of goods w/a yardstick simplified price comparison

**Costs from unanticipated inflation**

1. **increased uncertainty:** incorrect savings + investment decisions can be costly to you + the economy
2. **increased variability of various prices:** firms may make wrong production decision from interpreting the market wrongly
3. **Inflation uncertainty is higher when the level of inflation is high**

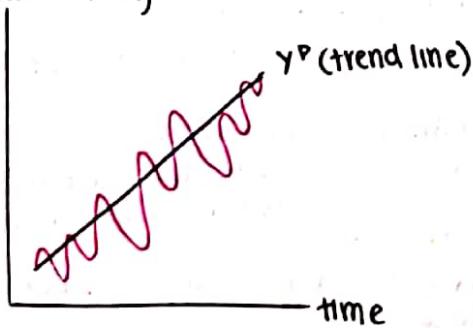
**Business cycles** are short-run fluctuations in aggregate economic activity around its long-run growth path and where many economic activities expand + contract together in a recurring but not periodic fashion

1. **Trough:** lowest level that aggregate economic activity reaches before it begins a sustained expansion\*
2. **Peak:** maximum level that aggregate economic activity reaches before it begins to contract \*
3. **Contraction or recession:** period from peak to trough; when aggregate economic activity is shrinking (GDP)  
→ **depression:** particularly long + severe recession
4. **Recovery** (trough to previous peak) + **expansion** (incr. in economic activity beyond that): period of time when aggregate economic activity is growing  
→ **boom:** extended economic expansion where aggregate economic activity is very high relative to potential output  
→ **growth recession:** agg. economic activity is expanding but at such a slow pace that unemploy.

\* only know until after the fact

GDP is measured quarterly + recessions monthly so you can have a period of growth in recessions (vv)

business activity



- **Business cycle:** peak to peak or trough to trough

→ **turning points:** peaks + troughs

↳ designated by NBER Business Cycle Dating ~9-24 mon. after the fact

↳ don't use GDP because of quarterly data

→ monthly industrial production, spending, personal income, employment

**Potential output:** level of output reached in LR when prices fully adjust so all resources are utilized

**Output gap:** deviation from PO in SR; how big the boom or recession is

→ more time spent below  
→ trend - actual GDP

Business cycles are

1. **Pervasive**: must be in more than one or two industries (despite how big it is) or in/beyond a small geographic area in the country
2. **Recurrent**: show up again + again
3. **Non-periodic**: not on a fixed schedule + only occurs when there are imbalances beyond a tipping point in the economy
4. Differ in magnitude:
5. Differ in length: more severe, longer it lasted  
→ though there is a longer period of time of growth, this does not mean an economy is at potential

Direction of movement w/aggregate economic activity can be:

1. **Procyclical**: move together
2. **Countercyclical**: move in opp. dir.
3. **Acyclical**: no consistent relation.

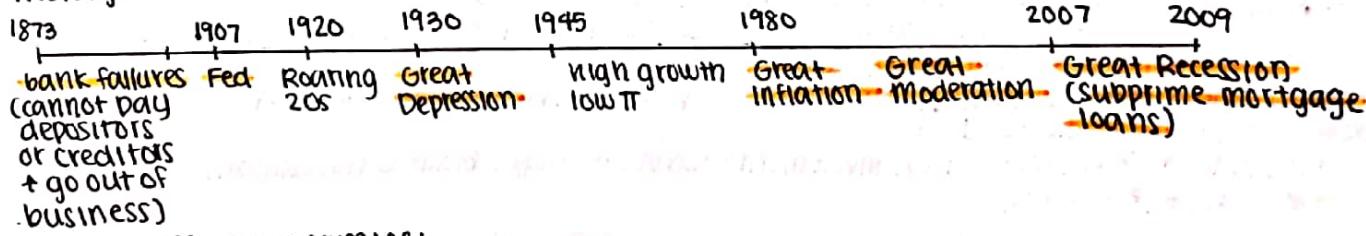
Real GDP is such a broad measure that it is sometimes viewed as a proxy for the business cycle itself

- **consumer spending**: procyclical, coincident, similar volatility (77% of GDP)
- **business fixed investment**: procyclical, coincident (less than CS), more volatile
- **residential fixed investment**: procyclical, broadly coincident, more volatile
- **exports**: weakly procyclical, not designated, similar volatility
- **Treasury bills** (short-term US govt bonds): countercyclical + leading
  - ↳ financial assets tend to move w/business cycle
  - ↳ financial markets have become more integrated → spillovers

Other variables:

1. **Unemployment rate**: countercyclical, used to be coincident (now in growth recession)
2. **Consumer price inflation**: procyclical but lagging indicator
3. **Interest rates (federal funds rate)**: procyclical but lagging (policy interest rate by Feds)
4. **Interest rate time spreads**: difference between interest rates on long dated securities + short-term securities; countercyclical + good predictor of recessions
5. **Interest rate credit or default spreads**: difference between interest rates on risky issuers
  - countercyclical: risk premium incr. during recessions (private vs. govt)

Brief History:



Time Horizons in Macroeconomics:

1. **Flexible-price models**: in the LR, prices of goods (+ prices of factor inputs) are flexible + adjust all the way to LR equilibrium where  $S = D$   
→ validate Classical Dichotomy + long-run neutrality of money
2. **Sticky-price models**: in the SR, prices of some goods + factor inputs are slow to respond to  $\Delta s$  in supply + demand  
→ invalidates Classical Dichotomy + LR neutrality of money

Classical economists emphasize:

- Long run models where
  - ↳ prices are completely flexible
  - ↳ markets are quick to adjust to eq.
- policy should focus on economic growth + not short-term business fluctuations
  - ↳ LR equilibrium growth
  - ↳ govt role in SR is limited
  - ↳ ex: keep inflation low

**Co-movement of Economic Variables:**

- regular + predictable pattern of movement over the course of a business cycle
- classified by the
  - 1. **Direction**,
  - 2. **Timing**,
  - 3. **Volatility**.

of their movement with economic activity

**Index of leading indicators**: 10 variables to forecast  $\Delta s$  in the economy

Timing of movement w/aggregate economic activity can be:

1. **Leading**: move Before GDP (permits) like the stock market
2. **Coincident**: move w/GDP
3. **Lagging**: move after GDP
4. **Not designated**.

Volatility of movement w/aggregate econ act:

1. **Higher**.
2. **Similar**.
3. **Lower**.
4. **Not designated**.

\* Volatility occurs from investment, housing construction, + imports

Keynesian economists emphasize:

- short run models where
  - ↳ prices are sticky
  - ↳ markets are slow to adjust to LR eq
- policy should focus on stabilization
  - ↳ govt intervention can help economy return more quickly to eq.

\* Differing views about price flexibility vs. price stickiness reflects different views about market structures

1. If markets are perfectly competitive (price takers) then price flexibility is more likely
2. If markets exhibit monopolistic competition (price setters) then price stickiness is more likely

Price stickiness can also result from

1. **menu costs**: cost associated with changing prices  
→ many hidden costs
- **rational inattention**: making price decisions at infrequent intervals bc info is costly
- may alienate customers when prices  $\Delta$

2. **staggered price setting**: different firms changing wages + prices at different times  
→ slows down the adjustment process

	Direction	Timing	Volatility
consumer spending	procyclical	coincidental	similar
stock market	procyclical (invest + earnings funct.)	leading (predict the future)	higher (speculation)
unemployment	countercyclical (less income = less demand)	lagging (last 4 weeks def., layoffs + job search after change)	lower (hiring + firing = sticky; structural issues)
private investment	procyclical (consumer D + GDP up)	coincidental (track consumer demand)	higher (companies are volat)
inflation	procyclical (weaker effect; stable inflation = more econ gr.)	lagging (Fed + prices are reactionary)	lower (prices are sticky)
interest rate on T-bills (short-term US bonds)	procyclical (high r = gov't poor borrowing ability)	leading (gov't ability to repay)	lower (gov't bonds are stable)

The production function analysis indicates the economy's full employment output level (supply-side of the economy) which is determined by factor inputs + total factor productivity.

The demand side of this economy is the aggregate demand, total output demanded in the economy  
→ AD + AS are both important for explaining short-term fluctuations

**Planned expenditures** ( $Y_{Pe}$ ) is the total amt of spending on domestically produced goods + services that households, businesses, gov't, + foreigners want to make/spend; equivalent to aggregate demand  
→ **Actual expenditures**,  $Y$  or output actually produced, is the total amt of spending on domestically produced goods + services that household, businesses, gov't, + foreigners actually make/spend

↳ economy is in equilibrium when  $Y_{Pe} = Y$

Planned expenditures include (1) consumption expenditure, planned investment spending ( $I^P$ ), gov't purchases ( $G$ ), + net exports ( $NX$ )

→  $I^P$  can be different from actual investment — source of major business fluctuations

$$Y_{Pe} = C + I^P + G + NX$$

**consumption** has 3 components

1. **Durable goods spending**: spending by households on goods that last 3 years or longer
2. **Nondurable goods spending**
3. **Service spending**

The consumption function is  $C = \bar{C} + mpc(Y - T) - cr$

1. **Autonomous consumption** ( $\bar{C}$ ) are exogenous to the model of consumption; includes:
  - consumer confidence/sentiment (+)
  - household wealth (+): stock prices + housing
  - expected future income (+)
2. **Disposable Income** ( $Y - T$ ): total income avail. for spending, aggregate income - taxes
3. **Marginal propensity to consume** (mpc):  $\Delta$  in cons. spending resulting from a change in  $(Y - T)$ 
  - $mpc = \Delta C / \Delta(Y - T)$
  - assumed to be constant +  $0 < mpc < 1$
  - $\Delta$  income =  $\Delta C + \Delta$  spending
4. **Real interest rate** ( $r$ ): primarily affects durable
5.  **$C$**  = a parameter reflecting how sensitive  $C$  is to  $r$

Investment has 2 components

1. **Fixed investment**: planned spending by firms on equipment + structures + p.s. on new resid. housing  
→ resid. housing invest is more sensitive than business fixed invest. b/c they can finance
2. **Inventory investment**: spending by firms on additional holdings of raw materials, parts, + finished goods  
→ smaller component of  $I^P$  + can be unplanned

**Planned investment function:**  $I^P = T - d(r + f)$

1. **Autonomous investment** ( $T$ ): exogenous
  - business confidence /sentiment (+)
  - expected future profits +/or cash flow (+)
  - changes in tech (+)
2. **Interest rates** real on short-term safe debt instrum. controlled by c-bank (businesses borrow at)
  - as  $r$  ↑, housing investments go down
  - $\Delta$  in interest rate makes a huge diff.
3. **Autonomous financial friction** ( $F$ ): additions to real cost of borrowing caused by barriers to efficient functioning of financial markets

The consumption function indicates that consumer spending depends upon:

1. Autonomous consumption (+)
2. Disposable income (+)
3. Real interest rate (-)

**Net exports** has 2 components:

1. Exports: spending by foreigners on domestic gts
2. Imports: spending by domestic on foreign gts

Net export function:  $NX = \bar{N}X + x\bar{Y}_F - mY - eE$

1. Autonomous net exports ( $\bar{N}X$ )

→ domestic preference for foreign goods (-)  
→ foreign preferences for domestic goods (+)  
→ foreign trade barriers (-)

2. Autonomous foreign real economic activity ( $\bar{Y}_F$ )

3. Domestic real economic activity ( $Y$ )

4. Real exchange rate ( $E$ ): price of one currency in terms of another currency

5. Exports ( $x$ ), imports ( $m$ ), +  $e$ : parameters reflecting how sensitive  $NX$  is to  $\bar{Y}_F$ ,  $Y$ , +  $E$  respectively

Net export function indicates  $NX$  spending depends:

1. Autonomous net exports (+)
2. Foreign real economic activity (+)
3. Domestic real economic activity (-)
4. Real exchange rate (-)

**Goods market equilibrium** exists when  $Y = Y^{pe}$  (i.e. when planned spending = amt. actually produced)

$$Y = C + I^P + G + NX \longrightarrow Y = (\bar{C} + MPC(Y - \bar{T} - eY) - Cr) + (\bar{T} - d(r + f)) + \bar{G} + (NX + x\bar{Y}_F - mY - eE)$$

The IS curve:

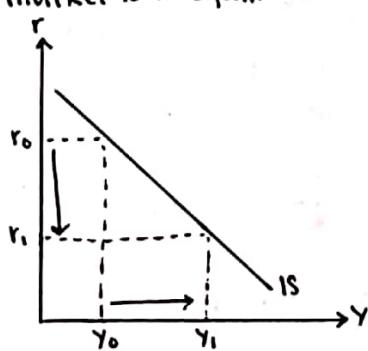
$$Y = \frac{\bar{C} + \bar{T} - d\bar{f} + \bar{G} + \bar{N}X + x\bar{Y}_F - MPC\bar{T}}{1 - MPC(1-t) + m}$$

Interest rate elasticity:  
how sensitive consumer + i expend. are to  $\Delta$  in  $r$

collection of exogenous rate, real interest rate, + real exchange rate
how economic output is related to real exchange rate
now economic output is related to real int. rate

**Denominator**: how much of a dollar made is being spent + repaid; how much of the dollar of expend is going around; how is their spending affecting investment  
→ mpc of after-tax income is how much spent → mp to import is how much spent on imported goods  
In a closed economy, goods market eq. exists only when  $I = S$

The IS curve is the inverse relationship between aggregate output + real interest rate when the goods market is in equilibrium



- \* horizontal axis is the one under investigation
- \* slope =  $\frac{-C + d}{1 - MPC(1-t) + m}$
- if this  $\Delta$ , int. rate sensit  $\Delta$
- \* cost of borrowing inv. to interest rate

If not on the IS curve, we are not at equilibrium

1. **Unplanned inventory investment**: inventory is rising, then we are on the right of the IS curve  
→ producing more than people are willing to buy  
→ decr. production, employment, income, expenditure if  $r_0$
  2. **Unplanned inventory disinvestment**: people are buying more than production  
→ incr. production, income, expenditure, employment
- \* assume interest rates as constant

→ financial frict. are reflected in a credit spread, the diff. between interest rate on loans to businesses,  $r_i$ , + the interest rate on completely safe assets,  $r_f$ :  $f = r_i - r_f$

→ widen during recessions b/c more expensive to borrow at any given rate (policy)

→ premium over what is indicated by policy int. rate  
→ can be negative - banks more willing to lend

4.  $d$ : parameter reflecting how sensitive  $I^P$  is to  $(x+f)$

The  $I^P$  indicates that planned invest. spending depends:

1. Autonomous financial functions (-)

2. The real interest rate (-)

3. Autonomous investment (+)

Tax function:  $T = \bar{T} + tY$

1. Autonomous taxes ( $\bar{T}$ )

2. Marginal tax rate ( $t$ ): how much tax revenue would rise if income goes up

3. Real economic output ( $Y$ )

The function indicates tax revenues depend on

1. Autonomous tax revenues (+)

2. Marginal tax rate (+)

3. Real economic activity (+)

Gov't purchases has 2 components:

1. Fed. gov't purchases

2. State + local govt purchases

Gov't purchase function  $G = \bar{G}$

→ Autonomous govt. purchase (political system)

Goods Market equilibrium depends on:

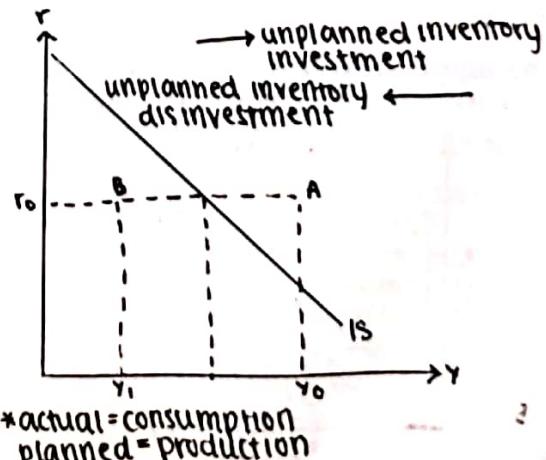
1. Autonomous expenditures (+)

2. Autonomous taxes (-)

3. Autonomous financial frictions (-)

4. Real exchange rate (-)

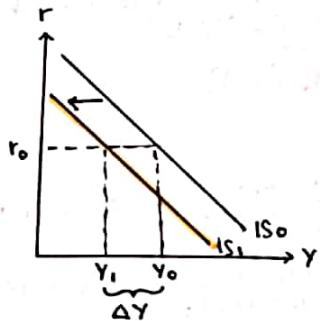
5. Real interest rate (-)



IS Curve shifts with a change in

1. Autonomous consumption,  $\bar{C}(+)$
2. Autonomous planned invest.,  $I(+)$
3. Autonomous net exports,  $\bar{N}X(+)$
4. Autonomous gov't purchases,  $G(+)$
5. Autonomous foreign real economic activity,  $\bar{Y}_F(+)$
6. Autonomous financial frictions,  $\bar{F}(-)$
7. Autonomous taxes,  $\bar{T}(-)$

effect on output would be same for identical changes in these



effect on output would be opp + smaller

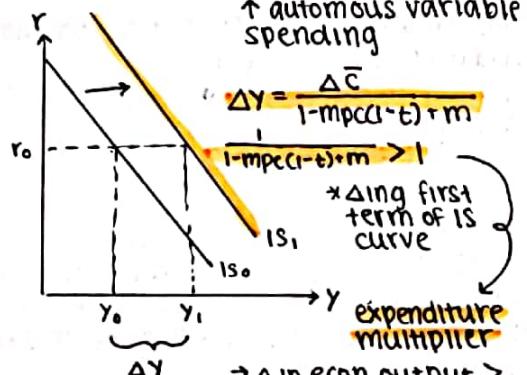
IF  $T \uparrow$  then  $y \downarrow$  because  $(y - T) \downarrow$   
 → reduce spending only by the mpc  
 → most adjustments come out of expenditure + some on savings

$$\Delta Y = \frac{-mpc \Delta \bar{T}}{1-mpc(1-t)+m} \rightarrow \text{tax multiplier } \frac{-mpc}{1-mpc(1-t)+m}$$

expend. mult. > tax mult.

$\Delta$  in econ output >  $\Delta$  in auton. consump

↑ autonomous variable spending



Central banks use nominal short-term interest rates ( $i$ ) as their primary policy tool

→ the Fed sets the federal funds rates; the interest rate banks lend to one another on an overnight loan of excess reserves - usually for commercial banks

- ↳ control by varying the liquidity it provides to the banking system (more liquidity → more money to lend → federal funds rate falls)
- ↳ control w/ open market operations by affecting amount of reserves in the system
- ↳ remember interest rates move together (differ in term + risk premium)
- cannot control real interest rate + thus real economic activity in the long run b/c prices are flexible
- ↳ From Fisher equation:  $r = i - \pi^e$ 
  - If the  $\Delta$  in  $\pi^e$  is constant,  $\Delta$  in nominal will affect  $\Delta$  in real in the SR
  - ↳ If prices are sticky,  $\Delta$  in MP that affect short-term nominal interest rates will not have an immediate effect on either actual or expected inflation.
    - any given  $\Delta$  in price + demand,  $i$  will not  $\Delta$  quickly
    - thus when cb  $\Delta i$ , then  $r$  also change in the same direction short-term
    - ↳ does not imply cb can control in the long-run

The monetary policy curve is the positive relationship between the real interest rate the cb sets + inflation

→ central banks seek to keep inflation low + relatively stable

↳ Taylor Principle: to stabilize inflation, the cb will raise the nominal interest rate by more than any rise in expected inflation so that  $r$  rises when  $\pi$  rises (reflected in upward MP curve slope)

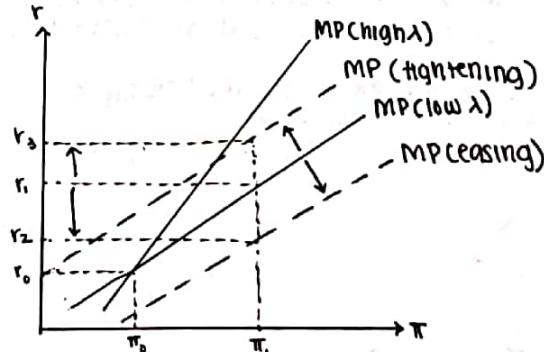
Monetary policy curve, MP, is given by  $r = \bar{r} + \lambda \pi$

→  $\bar{r}$ : autonomous component of  $r$  set by monetary authorities

→  $\lambda$ : responsiveness of  $r$  to  $\Delta$  in  $\pi$

↳ high value implies an aggressive cb fighting inflation  
 ↳ reflected in slope of MP curve

↳ automatic adjustment:  $\Delta$  driven by Taylor reflected as movements along the curve



Discretionary monetary policy changes: cb make autonomous adjustment to MP by changing  $\bar{r}$  (independent of  $\lambda\pi$ )

1. Autonomous tightening of policy or contractionary monetary policy  $\Delta \bar{r} > 0$ : for any given  $\pi$  rate, higher  $r$  which means MP curve shifted up (economy contract +  $\pi$  fall)

2. Autonomous easing of policy or expansionary monetary policy  $\Delta \bar{r} < 0$ : for any given  $\pi$  rate, lower  $r$  which means MP curve shifted down (stimulate economy +  $\pi$  rise)

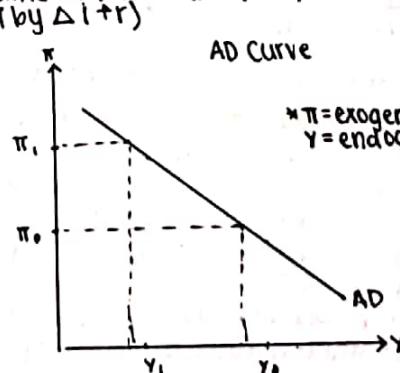
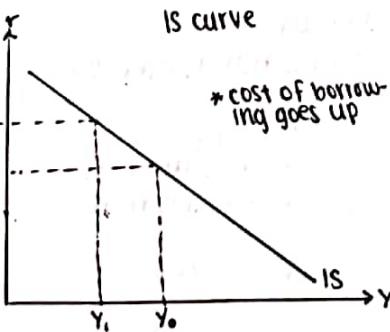
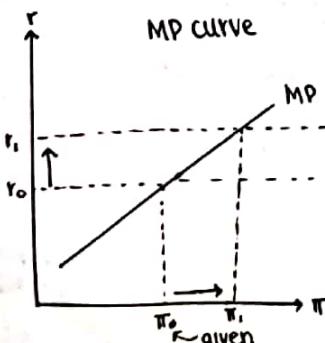
MP curve tells us how cb react to  $\pi$  + other things

The aggregate demand is the inverse relationship between inflation + economic output  
 → derived from IS curve ( $\Delta$  in  $r$  affect  $Y$ ) + MP curve (cb respond to  $\Delta$  in  $\pi$  by  $\Delta i + r$ )

$$\pi \rightarrow r \rightarrow \frac{1}{Y}$$

AD Curve

\*  $\pi$  = exogenous  
 $Y$  = endogenous



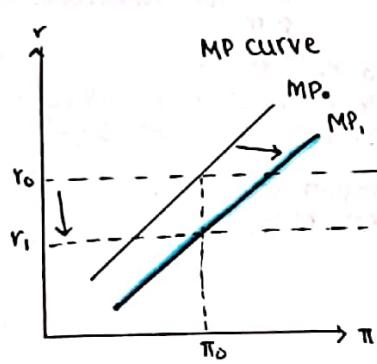
AD curve is downward sloping because:

1. As  $\pi$  rises,  $r$  incr. along MP curve
2. As  $r$  rises,  $y$  decreases along IS curve
3. Thus, higher  $\pi$  leads to low  $y$

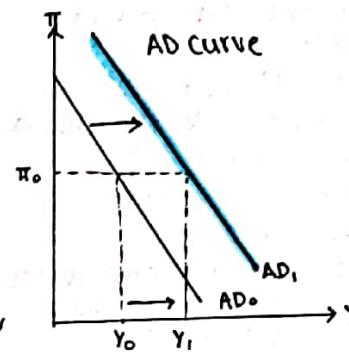
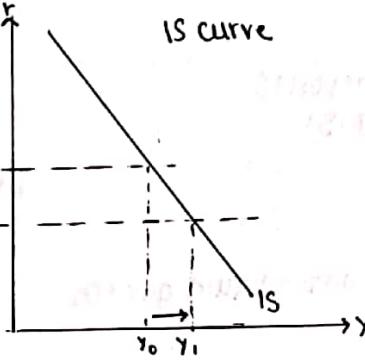
The IS curve will shift if there are  $\Delta s$  in:

1. Autonomous consumption  $\Delta C (+)$
2. Autonomous planned investment  $\Delta I (+)$
3. Autonomous govt purchases  $\Delta G (+)$
4. Autonomous net exports  $\Delta NX (+)$
5. Foreign real economic activity  $\Delta Y_f (+)$
6. Autonomous financial frictions  $\Delta F (-)$
7. Autonomous taxes  $\Delta T (-)$
8. Real exchange rate  $\Delta E (-)$

Any factor that shifts the IS curve will shift the AD curve in the same direction.



\* monetary policy easing



- MP curve shifts if:
 

1. Autonomous tightening of MP  $\Delta F > 0$
2. Autonomous easing of MP  $\Delta F < 0$

 \*  $\downarrow$  MP  $\rightarrow \pi_0 \rightarrow \downarrow r \rightarrow \uparrow y$   
 endogenously  $\rightarrow$  AD right  
 Any factor that shifts MP curve will shift AD curve in the same direction (L/R)

The Fed was created by an act of Congress on December 23, 1913; responsibilities include:

1. Functions as the govt bank
2. Regulates + supervises banks + thrift institutions
3. Acts as a lender of last resort: makes sure there is enough liquidity in the economy
4. Implements monetary policy: automatic adjustment + discretionary policies

Consists of:

1. Board of Governors in DC
  - 7 members w/ overlapping 14 yr terms
  - appointed by Pres + approved by Senate
  - Chairman (Yellen) + Vice Chairman have 4 year terms
2. 12 Regional Federal Reserve Banks
  - Regional bank pres appointed by the Board of Directors
  - renewable 5 year terms
  - approved by Board of Governors
3. Federal Open Market Committee
  - 12 voting members (7 BG, Pres of NY Fed due to operational responsibility for OMO, 4 other regional bank presidents on an annual rotating basis, 7 non-voting, Chair, Vice Chair)
  - meet 8x a yr @ 5-8 week intervals
    - min 4 wth conference calls
  - provide direction for OMO

The Fed's Balance Sheet

1. Assets: generate income
  - Govt securities: Fed's holdings of bonds mainly from OMOs
  - Discount loans to depository institutions (comm. banks): borrowing from Fed or borrowed reserves
    - discount rate: interest rate the Fed charges banks for these loans
  - Incr. in either incr. MS

Independent within the Govt

1. Independent (14 yr term)
  - appointment of Governors, Bank Pres.
  - financed from own resources
    - ↳ supplies turned over to Treasury
    - ↳ accumulated revenues from govt securities in OMO)
2. Within the govt:
  - established by + ultimately responsible to Congress
  - current proposals: audit + formalized rules (policies more predictable)

\* Policy statement: any policy action, summary of eco + inflationary conditions, policy bias (symm or asymm)  
 the votes  
 minutes released 3 wks later  
 press conference: conducted by chairman quarterly  
 Monetary Policy Report (semi-annual): typ in Feb + Jul presented by chairman to congress  
 meeting transcripts: 5 yr lag

2. Liabilities: things you will pay out

- currency in circulation (held by nonbank public); currency in depository institutions are reserves
- reserves: deposits at the Fed + vault cash (assets for banks but liability for Fed b/c banks can demand them)
  - ↳ required reserves ( $rr$ ): legal min banks hold in depos.
  - required reserve ratio ( $rr$ ): fraction held in reserves
  - ↳ excess reserves: additional reserves (no return)

\* Create money when acquire real assets from public + liabilities are used to create money (this is the monetary base or high powered money)

Monetary base is  $MB = C + R$  (not money supply which is currency + deposits)  
 → reserves affected by OMO primarily + bank borrowing from the Fed (discount loans), reserve  
 →  $\Delta$  in C or discount rates will  $\Delta$  MB but so small  
 → Fed controls nonborrowed MB + less tightly borrowed reserves

Fractional reserve banking system: incr. in MB leads to an expansion - multiple expansion of the MS  
 → total incr. in deposits from initial incr. in reserves will be the reciprocal of rr  
 → critique: loans can be held in cash, banks may not buy securities / lend

Money multiplier ( $m$ ) is how much MS can be supported by the MB;  
 So  $m = M/MB$  or  $\Delta M = m \Delta MB$

1. currency holding ratio: currency holding to deposits  $c = S/D$   
 $\rightarrow c > 0$  + determined by public
2. required reserve ratio:  $rr = RR/D$   
 $\rightarrow 0 \leq rr \leq 1$  + determined by the central bank
3. excess reserve ratio:  $er = ER/D$   
 $\rightarrow er \geq 0$  + determined by commercial banks

$$R = RR + ER$$

thus  $MB = (rr + er + c)D$  or  $D = MB/(rr + er + c)$

→ if  $c < 0.9$  then  $D > MB$

→  $MS = D + C = D + cD = (1+c)D$  then substitute deposits

$$\hookrightarrow M = (1+c)/(rr + er + c) \times MB \text{ (how MS } \Delta \text{ MB)}$$

→  $MS > MB$  given a low rr + er

Money multiplier is  $m = (1+c)/(rr + er + c)$

→ as long as  $rr + er < 1$  then  $m > 1$

→ cb influence MS through MB / OMO due to deep + liquid gov't sec.  
 (those w/o use reserve requirements)

→ m decr. lately so need larger OMO

Factors that determine MS:

1.  $\Delta$  in nonborrowed MB ( $\uparrow$ )
2.  $\Delta$  in borrowed reserves from the Fed ( $\uparrow$ )  
 $\rightarrow \uparrow$  discount loans  $\Rightarrow$   
 $\uparrow$  borrowed r  $\Rightarrow$   
 $\uparrow$  MB + reserves  $\Rightarrow$   
 $\uparrow$  multiple deposit crea  $\Rightarrow$   
 $\uparrow$  MS

3.  $\Delta$  in rr ( $\downarrow$ )

4.  $\Delta$  in currency holdings ( $\downarrow$ )

5.  $\Delta$  in excess reserves ( $\downarrow$ )

\* high-powered money is when  $m > 1$

Quantitative easing (large scale asset purchase): OMO that differs in size + long/med term securities

→ goal: not affect policy r but long term r (mortgages, inventory, expansion)

↪ typically use gov't bonds + high mortgage-backed securities

↪ reduce longer term interest rates, reducing cost of borrowing for consumers + businesses  
 $\rightarrow$  substantial incr. in balance sheet

→ criticism: lead to higher inflation (quantity theory of money)

↪ MB grows but m decreases

→  $\pi$  is a monetary phenomenon (q-theory of inflation)

↪ c decreased, deposits grew due to safety + gov't insurance

→ er increased: reserves are stuck, not creating M2 + thus velocity falls

The Phillips curve is the inverse relationship between inflation + unemployment rate; it is downward sloping b/c:

1. When unemployment is low (LM are tight),  $L^d > L^s$  so wages will rise more quickly

→ incr. wages to attract more workers

2. when unemployment is high,  $\pi \downarrow$  because workers do not negotiate so prices do not  $\Delta$  rapidly

wages are major input in TC, rapidly rising wages = higher inflation  
 \* originally, it was based on the inverse relationship of nominal wages + unemployment, but

1. Did not distinguish b/t real + nominal wages 2. Did not recognize in LR (wage + price flex),  
 $\rightarrow$  labor market incentives for working + hiring based on real wages unemployment will be at full or natural  
 $\rightarrow$  workers + businesses adjust nominal rate of unemployment (UN)  
 $\rightarrow$  consistent w/ slow LR steady state

$\rightarrow$  workers + businesses adjust nominal wages so real wages do not  $\Delta$

$\rightarrow$  natural unemployment as benchmark

Expectations-augmented Phillips Curve:  $\pi = \pi^e - \omega(U - U^e)$  where  $\omega$  = sensitivity of inflation to  $U - U^e$

→  $U - U^e$ : unemployment gap (measure of tightness in labor markets)

→ actual inflation is positively related to  $\pi^e$  (workers want  $\uparrow w \uparrow P \uparrow$  so self-fulfilling prophecy) + inversely related to output gap  $U - U^e$

→ LR Phillips Curve: when  $U = U^e$  so  $\pi = \pi^e$  (vertical)

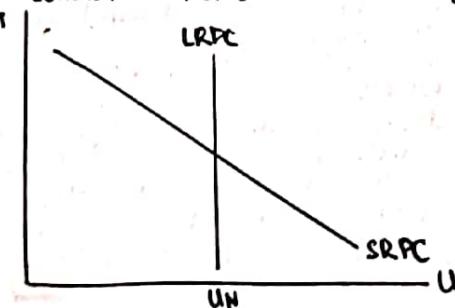
↪ no LR trade-off between inflation + unemployment / at the steady state

↪ consistent w/classical dichotomy

→ SR Phillips Curve: SR trade off between inflation + unemployment

↪ inconsistent w/classical dichotomy

↪ given  $\pi^e$ , policy makers can attain lower unemploy. rate at expense of higher inflation



- Price shocks or supply shocks are events which  $\Delta \pi$  directly but independent of labor market conditions (tightness of LM) or  $\pi^e$
- ex:  $\Delta$  in commodity prices (energy or agricultural),  $\Delta$  in cost structure (cost-push shocks where workers push for wages  $>$  productivity),  $\Delta$  in exchange rate, regulatory  $\Delta$ s
  - SR expectations-augmented PC:  $\pi = \pi^e - \omega(u - u_n) + p$  where wages + prices are sticky
  - more flexible (incr.  $\omega$ ), more responsive to unemployment gap
    - ↪ if completely flexible,  $\omega = \infty$  + SRPC = vertical = LRPC
  - Adaptive expectations or backward-looking expectations assume  $\pi^e = \pi_{t-1}$  (past = future)
  - SRPC:  $\pi_t = \pi_{t-1} - \omega(u_t - u_n) + p$ 
    - convenient to use
    - 2 explanations why prices are sticky:  $\pi^e$  adjust slowly as past  $\Delta$  + some wages or prices are dependent on  $\pi_{t-1}$
  - Accelerationist Phillips Curve:
 
$$\Delta\pi = -\omega(u - u_n) + p$$
    - ↪ if  $u_t < u_n$ , then  $\Delta\pi_t > 0$  + inflation accelerates
    - ↪ if  $u_t = u_n$ , then  $\Delta\pi = 0$  + inflation does not change (non-accelerating inflation rate of unemployment or NAIRU)

LRAS is the vertical relationship between inflation + potential output (natural rate of output)

- $Y_P$  is the output that is sustained in the LR when at natural rate of unemployment

LRAS is vertical @  $Y_P$  because  $\Delta \pi$  causes

1. No  $\Delta$  in size of labor force ( $L$ )
2. No  $\Delta$  in size of capital stock ( $K$ )
3. No  $\Delta$  in TFP ( $A$ )
4. No  $\Delta$  in natural rate of unempl.: ( $u_n$ )

\* Remember Classical Dichotomy:  $\Delta \pi$  will have no  $\Delta$  in real variables

SRAS curve replaces unemployment gap ( $u - u_n$ ) w/ output gap ( $Y - Y_P$ ) so  $\pi = \pi^e + \gamma(Y - Y_P) + p$

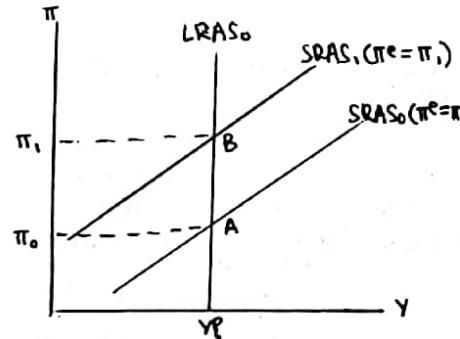
- Okun's Law: negative relationship between these 2 variables where  $u - u_n = \beta(Y - Y_P)$ 
  - ↪ labor hoarding: when  $Y \uparrow$ , firms do not incr. employers but incr. current worker hours

SRAS is positively sloping because

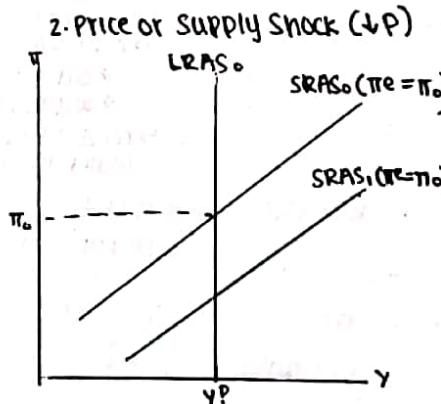
1. As firms expand production, they hire more
2. Offer higher wages to attract
3. Raise prices to protect profit margins

SRAS curve will shift if there is

1.  $\Delta$  in  $\pi^e$  (ex: incr.  $\pi^e$ )

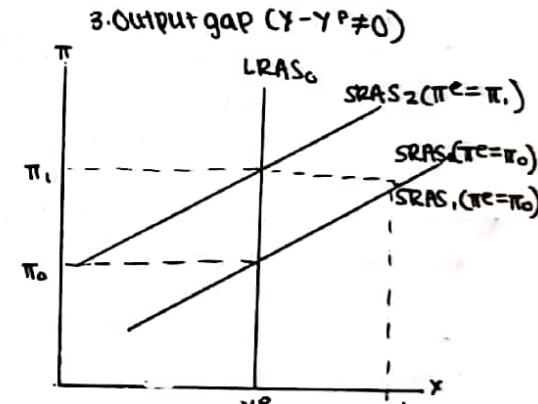


→ not necessarily @ B



→ π^e not Δ in t=1 because based on previous year

Combining LRAS + SRAS curves w/ AD curve provides a SR model of SR fluctuations in economic output ( $Y$ ) + inflation ( $\pi$ )



→ where you are in t=2 is unknown  
→ SRAS shift in t=2 when π^e Δs

Summary of Different Shifts:

→ AD curve shifts w/a  $\Delta$  in:

1. Autonomous consumption,  $C$  (+)
2. Autonomous planned investment,  $I^P$  (+)
3. Autonomous govt purchases,  $G$  (+)
4. Autonomous net exports (+)  $\bar{N}X$
5. Foreign real economic activity (+)  $\bar{Y}_F$
6. Autonomous taxes,  $T$  (-) \* indirect
7. Financial frictions,  $F$  (-)
8. Autonomous Monetary Policy,  $R$  (-)

→ LRAS shifts w/a  $\Delta$  in

1. Quantity of labor,  $L$  (+)
2. Quantity of capital,  $K$  (+)
3. Total factor productivity,  $A$  (+)
4. Natural rate of unemployment  $u_n$  (-)

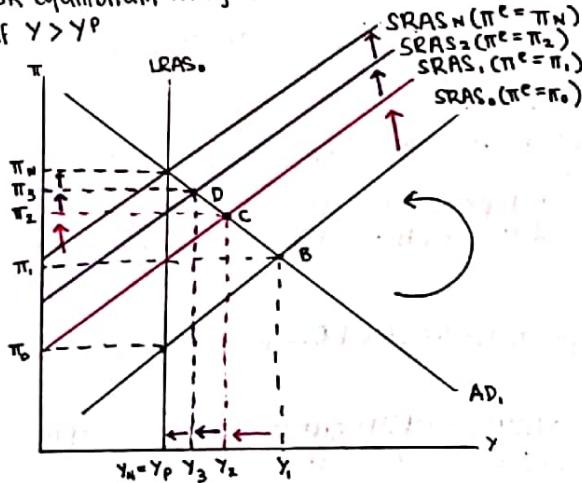
→ SRAS shifts w/a  $\Delta$  in

1. Expected inflation,  $\pi^e$  (+)
2. Price or supply shock (+),  $p$
3. Output gap,  $Y \neq Y_P$  (+)

**General equilibrium** exists when all markets are simultaneously in eq so  $AD = SRAS = LRAS$   
 → in both LR + SR equilibrium, inflation is stable + not changing, output is at potential

The SR equilibrium may not be at  $Y^P$  so there are self-correcting mechanisms

→ If  $Y > Y^P$

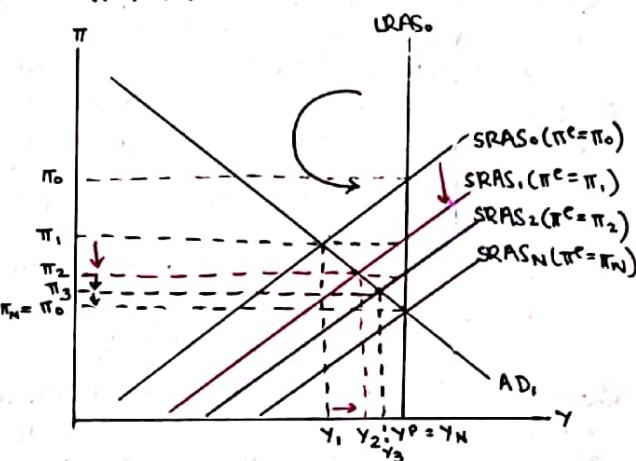


- ↳ tight market w/u < U<sub>N</sub> (excess demand)  
 → drive up wages from incr. demand which will increase prices

- ↳ higher inflation due to output gap  
 → CB raises policy r w/Taylor Principle  
 → borrowing more expensive so spending will decline → less economic output

- ↳ SRAS will shift w/inflation expectations

→ If  $Y < Y^P$



- ↳ excess slack in labor markets (excess supply)  
 → slower incr. in wages  
 → slower inflation → slower inflation expectations  
 → CB lowers policy r in Taylor P  
 → people borrow + spend more so economic output incr.
- ↳ SRAS shift w/inflation expectations

**Self-correcting mechanism:** Economy adjusts to general eq. over time because inflationary expectations change

Aggregate demand shocks are events that cause AD to shift, thus changing the level of economic output

→ Positive/Favorable/Beneficial Demand Shocks

↳ economic output incr. so  $\Delta Y > 0$

↳ AD shift right

→ excess demand  
 → price + inflation + r incr.  
 → economic output incr.

↳ on SRAS curve, businesses move up to produce more output (more workers = higher wage = higher prices)

↳ no Δ in economic output but permanent higher inflation

→ Negative/unfavorable/Adverse Demand Shocks

↳ economic output decr. so  $\Delta Y < 0$

↳ AD shift left

→ excess supply  
 → prices, π, + r decrease  
 → economic output increases  
 ↳ on SRAS businesses move down to cut back on production  
 → wages, prices, inflation, + r decrease

↳ no Δ in economic output but permanent lower inflation

Aggregate supply shocks are events that cause SR or LRAS curves to shift

1. Positive/Favorable/Beneficial Supply Shocks:

initially causes inflation to decrease  $\Delta\pi < 0$

Temporary Positive Supply Shocks

→ SRAS shift right

↳  $\Delta\pi < 0$

↳  $\Delta Y > 0$

→ results in no Δ to economic output or inflation,

Permanent Positive Supply Shocks

→ SRAS + LRAS shift right

↳  $\Delta\pi < 0 + \Delta Y > 0$

→ results in permanent incr. in economic output + decr. in inflation

2. Negative/unfavorable/Adverse Supply Shocks:

initially cause inflation to increase  $\Delta\pi > 0$

Temporary Negative Supply Shock

→ SRAS shift left

↳  $\Delta\pi > 0$

↳  $\Delta Y < 0$

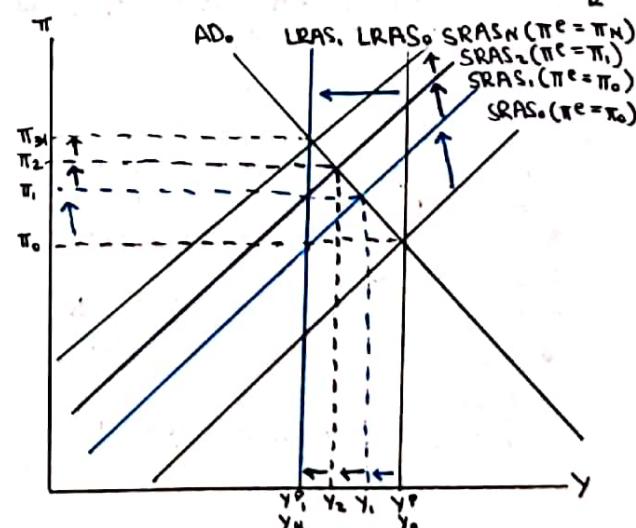
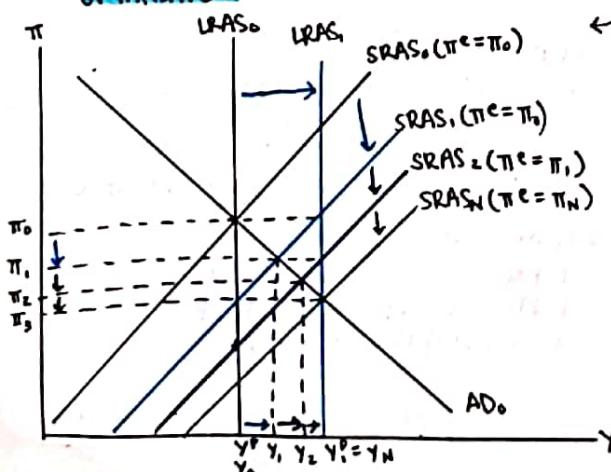
→ no Δ to economic output or inflation

Permanent Negative Supply Shock

→ SRAS + LRAS shift left

↳  $\Delta\pi > 0 + \Delta Y < 0$

→ results in permanent decr. in economic output + incr. in inflation



**Business fluctuations** are caused by a comb of demand shocks (usually) + supply shocks (occasionally), hitting the economy both simultaneously + sequentially

	Initial Levels		Result	
	Inflation ↑	Economic Output ↑	Inflation ↓	Economic Output same
Positive AD Shocks	↑	↑	↓	same
Negative AD Shocks	↓	↓	↓	same
Positive Temp AS Shocks	↓	↑	same	same
Negative Temp AS Shocks	↑	↓	same	same
Positive Perm AS Shocks	↓	↑	↓	↑
Negative Perm AS Shocks	↑	↓	↑	↓

### Economic Activity + Output Gap

Inflation	Recession ( $Y < Y^P$ )	Normal ( $Y = Y^P$ )	Boom ( $Y > Y^P$ )
rising	Negative Temp Supply Negative Perm Supply		Positive AD
stable		Full-Employy Steady State	
falling	Negative AD		Positive Temp Supply Positive Perm. Supply

### Three Key Characteristics of Shadow Banks:

1. More lightly regulated than banks
2. More highly leveraged (ratio of assets to equity) than banks
3. Fund themselves primarily w/ short-term borrowings

Banks are important for 3 reasons:

1. Banks are depository institutions (take deposits which is how the public holds money)
2. Central bank's OPO directly affect bank deposits (lynchpin of MP)
3. Multiple expansion of the money supply is conducted through an incr. in bank loans + deposits

Balance sheets can lead to instability in the financial systems

1. Assets which includes
  - cash: primary reserves
  - liquid securities holding: secondary reserve
  - investment securities: hold until maturity
  - loans
    - ↳ consumer loans: borrow money for cons.
    - ↳ real estate loans: mortgage, home equity, construction (incr. large proportion of bank assets)
  - other financial assets + nonfinancial assets

2. Liabilities include
  - Deposits
  - Non-deposit borrowings: short-term or long-term
    - ↳ think of yield curve
  - equity capital: money owners put into businesses when it starts
    - ↳ can also acquire through issuing brand new stock

### Asset-Liability Mismatch

- most bank assets are relatively long-term + relatively illiquid (max interest income - return from assets)
- most bank liabilities are relatively short-term + liquid (min interest expense - cost of liabilities)

Banks profit primarily through net interest margin, the difference between the interest income on their assets + the interest expense of their liabilities (as % of interest earning assets)

- return on equity: profitability measure which shows how much the shareholders actually made
  - ↳  $ROE = (\text{return on assets} - \text{cost of liabilities}) / \text{equity capital}$
  - ↳ can incr. by increasing assets or buying back shares
  - ↳ can incr. by increasing leverage ratio for a given interest margin
  - leverage ratio = assets/equity capital

### Asset-Liability Management Issues:

1. Bank Runs: depositors attempt to withdraw more cash from the bank than the reserve amount
  - bank may be forced to quickly sell some of its more illiquid asset
    - ↳ sell assets or loans to other banks → banks buy it cheap → prices + assets fall → sell more loans
    - if equity falls = liquidity crisis ⇒ solvency issue

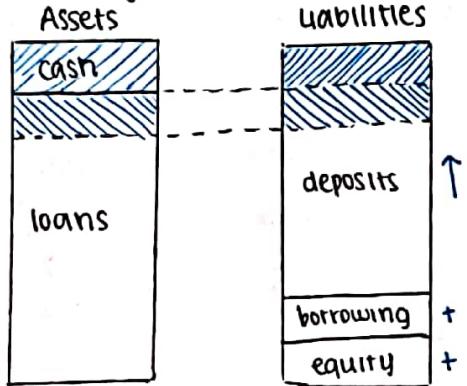
Financial intermediaries include:

1. Banks (depository institutions)
2. Non-bank financial intermediaries (shadow banks)
  - insurance companies
  - pension funds
  - finance companies
  - mortgage companies
  - mutual funds
  - hedge funds

Two Diff. between financial intermed:

1. Types of liabilities that each issues
2. Types of assets each holds

- okay if deposits decrease by cash amount
- bc assets are illiquid, their price may decline substantially in order to facilitate a quick sale
- ↳ liquidity crisis  $\Rightarrow$  solvency crisis

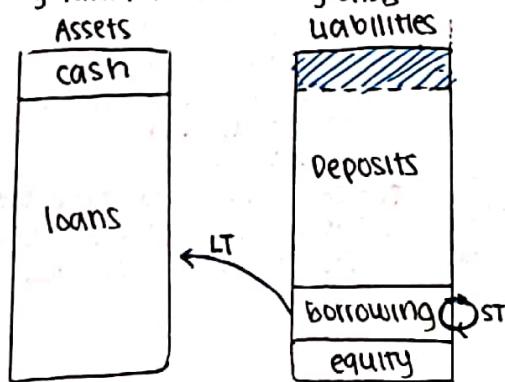


#### To prevent bank or deposit runs:

1. Have banks hold more reserves
2. Have banks incr. their equity capital  
→ bigger cushion for liabilities to fall after assets
3. Have banks incr. their borrowing
4. Have the central bank provide a liquidity injection;  
some borrowing can come from central bank  
(discount loans)
5. Have deposit insurance

2. **Liquidity Crisis**: occurs when providers of short-term financing do not roll-over the loans or cannot be renewed

→ bank may be forced to quickly sell some of its more illiquid assets in order to raise additional cash  
→ b/c these assets are illiquid, price may decline quickly to facilitate easier sale  
→ may turn into a solvency crisis



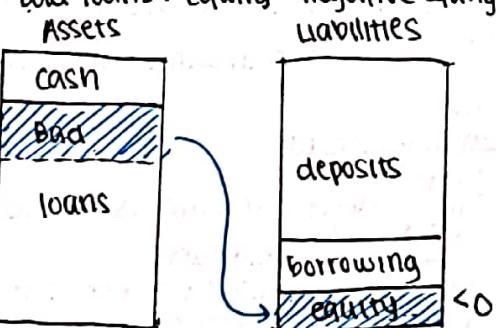
#### To prevent liquidity crisis:

1. Have banks increase their long-term borrowings (from the short-term borrowings)  
→ liabilities come down so you must sell off loans
2. Have banks incr. their equity capital
3. Have the central bank provide a liquidity injection

3. **Solvency Crisis**: occurs when a de

in the value of the bank's assets cause equity capital to become negative (applies more to mortgage + financial institutions)

→ IF bad loans > equity = negative equity capital



#### To prevent solvency crisis:

1. Have banks hold higher levels of equity capital
2. Have the govt seize + liquidate the bank
3. Have the govt prepared to make equity injection (bank bail-outs)
4. Let banks fail  
→ generally doesn't happen due to interbank lending → collateral damage

Financial intermediaries exist for 2 reasons:

1. **Asymmetric information**: exists when one party to a transaction has more accurate info than the other party which can lead to a less efficient allocation of funds due to problems w/

→ **Adverse Selection**: arises because the party most eager to engage in a transaction is the one most likely to produce an unfavorable outcome for the other party

↳ occurs before the transaction

↳ ex: loans to bad credit risks

market for lemons

pricing complicated items

insurance

→ **Moral hazard**: arises when other party will engage in activities that are undesirable from the first party's POV

↳ occurs after the transaction

↳ creates bad incentives

↳ "too big to fail": know if you are big enough, banks will bail you out

2. **Free-Rider Problem**: barriers to info collection that would help solve asym. info

→ take advantage of resources other parties collect

→ fewer resources devoted for collecting necessary info

Financial intermediaries help solve asymm. info by

1. Issuing **private (non-traded) loans** to reduce free-rider problems
2. Using credit standards to avoid adverse selection
3. Impose **loan covenants** to prevent moral hazard
  - often include **collateral**, property the borrower promises to contract to the lender if the borrower defaults on debt
  - reduces AS + MH problems

As financial system develops, info about firms are easier to acquire.

Two approaches to decrease / incr. info quality in financial markets:

1. **Gov't Regulation**: promoting transparency
  - disclosure of financial information by public firms (SEC)
  - adherence to generally accepted accounting standards (Standard Accounting Principles)
2. Providing a **safety net**
  - depositors will be more willing to provide banks w/funds
  - deposit protection reduces contagion from one bank failure to another
  - MH: banks take on more risk + depositors do not respond

**Prudential Regulation** is the rules set by the gov't to prevent banks from taking on too much risk by

1. Limiting banks' risk levels by promoting disclosure of their activities
2. Restrict activities + asset categories that gov't considers too risky for banks
3. Encourage bank to diversify assets
4. Promoting accurate disclosure of bank's financial conditions to the public
5. Holding adequate levels of capital as cushion against loans that go bad

**Prudential supervision** is the activity that gov't engage in to enforce prudential regulation usually through regular examination of bank's assets + loans

Macroeconomic policies have 2 objective:

1. Stabilizing output around potential output
2. Stabilizing inflation at a low level

**maximum sustainable employment**: when  $y_t = y^*$  then  $U_t = U_N$

→ a zero unemployment rate is unattainable + undesirable because of frictional + structural emp.

→ unemployment is central to stabilization policy because high unemployment

1. involves substantial personal suffering for the unemployed

↳ equity cost: small subset bears most of the suffering

2. leaves labor + capital resources idle, reducing economic output, expenditures, + income

→ Determining the **natural employment**

1. neither simple nor straightforward (not observable),

2. is subject to much uncertainty, +

3. can change over time for a variety of reasons which leads to much controversy + many stabilizing/stabilization policy challenges

↳ there is also a lag so we do not see the effects until much later

We stabilize inflation at a low + steady rate due to known costs of high inflation

1. High inflation is accompanied by high variability of inflation → risks
  - many people are risk adverse (less willing to take long-term economic commitments)
  - claims Classical Dichotomy does not hold
2. Empirical evidence shows high inflation reduces long-run economic growth
  - smaller capital stock from less investment

many cb pursue price stability (low + stable inflation) as the primary MP goal

→ goal of maintaining actual inflation close to the inflation target,  $\pi^T$  (between 1% + 3%)

→ try to minimize the inflation gap,  $\pi - \pi^T$

→ IF inflation targets are too low:

1. Risks deflation + raises the possibility of debt-deflation downward economic spiral
  - prices fall → business income ↓ → most money spent paying back → spend less
  - AD shifts left, putting more pressure on inflation decline
  - postponement of expenditures to take adv. of lower interest rates
  - AD keeps decreasing

2. Risks central bank encountering zero lower bound for nominal interest rates, losing the ability to autonomously ease monetary policy

↳ AD moves left + renders MP useless

**Hierarchical mandates** require achieving the primary policy as a pre-condition of pursuing other policy goals

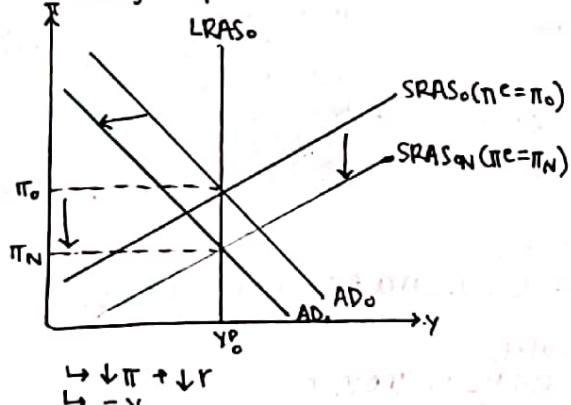
**Dual mandates** require pursuing 2 policy goals as co-equal objectives even if there is a conflict between the 2 goals.

- Banks have several practices:
1. **Screening**: collecting info about potential borrowers before a transaction occurs to avoid AS problems
  2. **monitoring**: collecting info after a transaction to prevent MH problems
  3. **Restricted covenants**: prov. in debt contracts that restrict borrower's habits

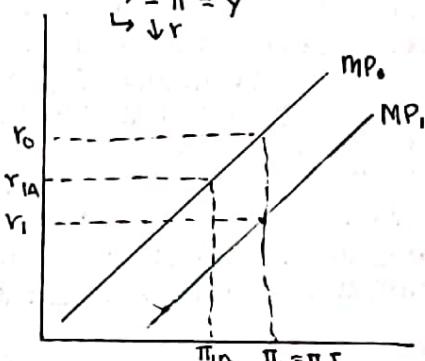
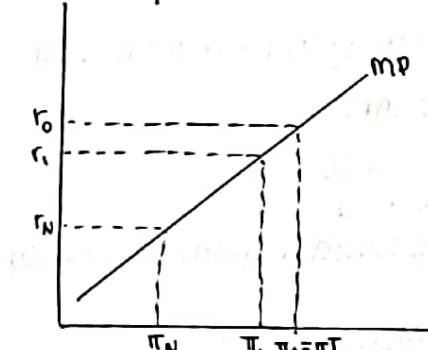
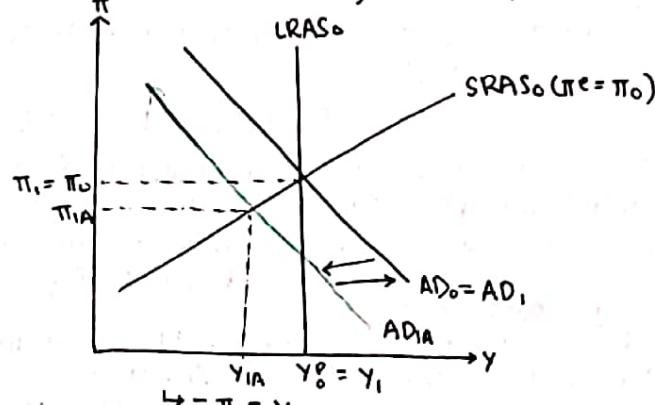
Equilibrium real interest rate,  $r$ , is the one that prevails when the output gap is zero ( $LR \cap r$ )

### Response to an Aggregate Demand Shock (Negative)

→ No Policy Response



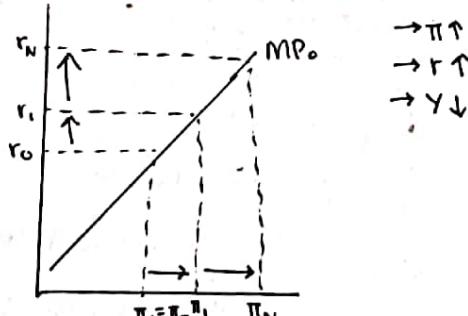
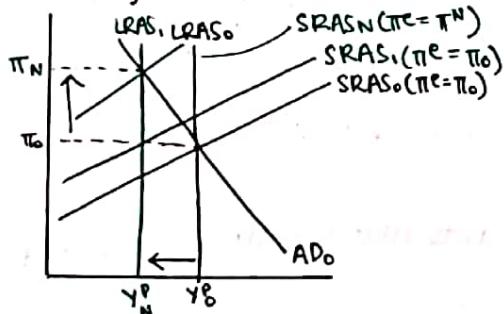
→ stabilizing SR Policy (inflation)



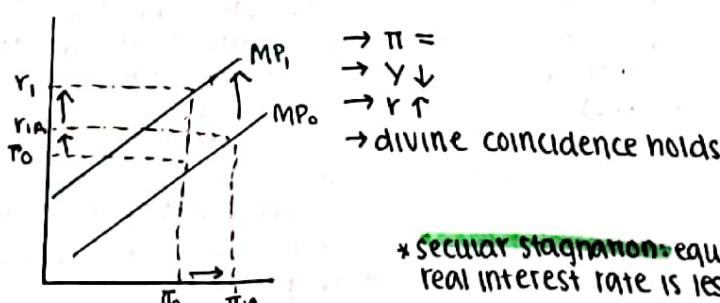
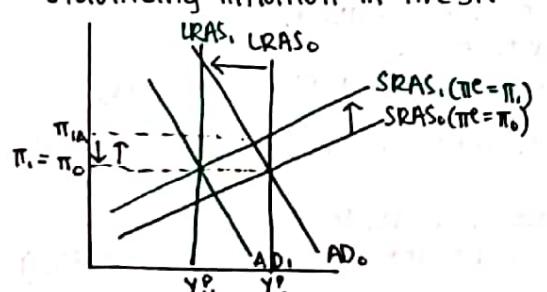
\***Divine coincidence**: no conflict between the dual objectives of stabilizing inflation + economic act.

### Response to a Permanent Supply Shock (Negative)

→ No Policy Response



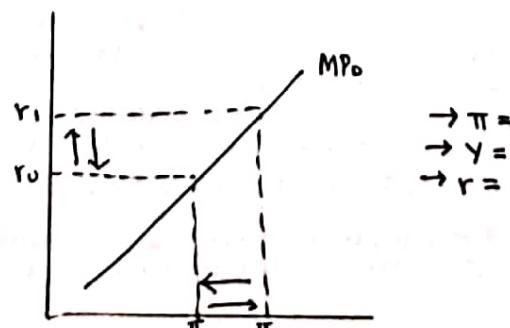
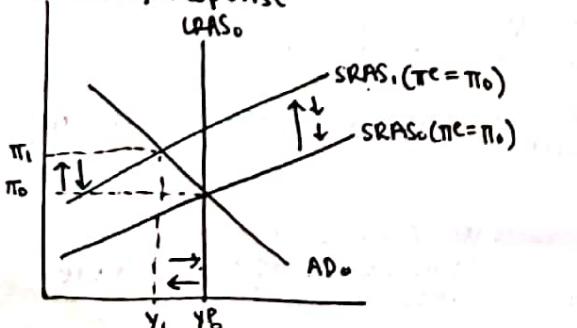
→ Stabilizing Inflation in the SR



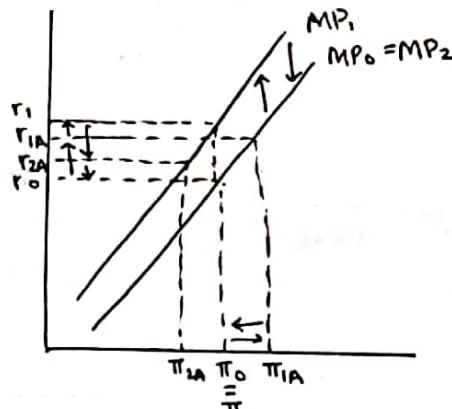
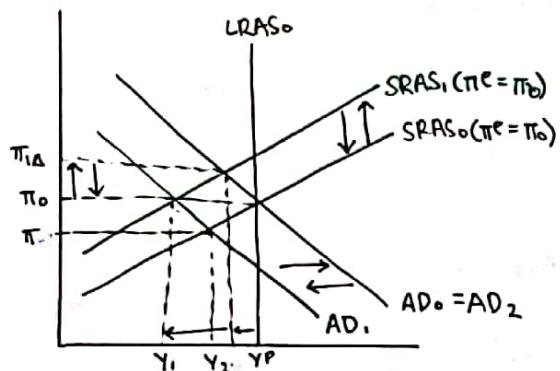
\***Secular stagnation**: equilibrium real interest rate is less than 0

### Response to a SR Aggregate Supply Shock

→ No Policy Response



## → Policy Response to Stabilize Inflation



→ in SR, the divine coincidence does not hold  
 $\rightarrow \pi =$   
 $\rightarrow y =$   
 $\rightarrow r =$

### Conclusions

1. If most shocks to the economy are AD shocks, then a MP that stabilizes  $\pi$  will stabilize  $y$  - even in SR
2. If most shocks are permanent AS shocks, then MP that stabilizes  $\pi$  will also stabilize  $y$  (at new potential output), even in the SR
3. If most shocks are SRAS, then a policy to stabilize  $\pi$  (output) will lead to a larger deviation in the output gap (inflation gap) in the SR
4. If most shocks are SRAS, then a policy to stabilize  $\pi$  will still stabilize  $y$  in the LR

**Nonactivists (classical)** believe that wages + prices are very flexible - even in the SR - so the economy's SR self-correcting mechanism is rapid  
 $\rightarrow$  govt intervention unnecessary

**Activists (keynesian)** believes wages + prices are sticky so the economy's self-correcting mechanisms is very rapid  
 $\rightarrow$  govt activity is justified

### Lag on Policy Implementation (Fiscal or Monetary Policy)

1. **Data lag:** time for collecting data about the economy (volatile data)  
 $\rightarrow$  accurate GDP data not available until months after the quarter
  2. **Recognition lag:** time for signalling of data on course of the economy (NBER declare recession 6 months)
  3. **Legislative lag:** time to pass legislation (especially fiscal)
  4. **Implementation lag:** time to  $\Delta$  policy instruments to new policy (not case for MP)
  5. **Effectiveness lag:** time for policy to have an actual impact on the economy (long + variable)
- Reduces activism argument - if long enough, they can be procyclical

**Taylor Rule** is a guide to how CB should set real or nominal federal funds rate target depending on both the inflation + output gap:  $r = 2 + \frac{1}{2}(\pi - \pi^*) + \frac{1}{2}(y - y^*)$

$\rightarrow$  equal weights on inflation + output due to dual mandate

$$i_{FF} = \pi + 2 + \frac{1}{2}(\pi - \pi^*) + \frac{1}{2}(y - y^*)$$

$\rightarrow$  Taylor Principle: nominal rises by more than inflation so real interest rates will incr.

$\rightarrow$  Has same intuition as MP curve

1. CB should incr. real interest rates as  $\pi$  incr.

2. CB should incr. real interest rates as  $y$  incr., similar to auton. MP tightening when CB stabilize  $\pi$

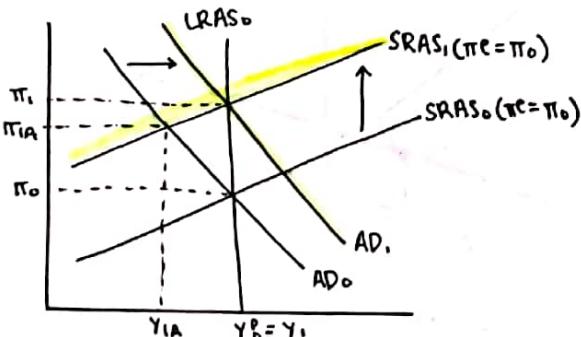
CB can determine inflation in LR but not  $y^*$  or  $r^*$  (classical dichotomy + LR neutrality of money)

Inflation from policies designed to target / promote high employment goal

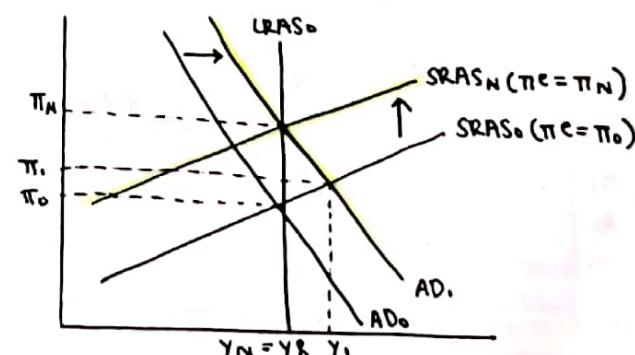
1. **Cost-push inflation:** results from temp. neg. supply shocks, including wage incr. beyond what productivity gains would justify  
 $\rightarrow$  can be generated from demand-pull  $\pi$

2. **Demand-pull inflation:** results from AD policies that attempt to maintain agg. output above potential output

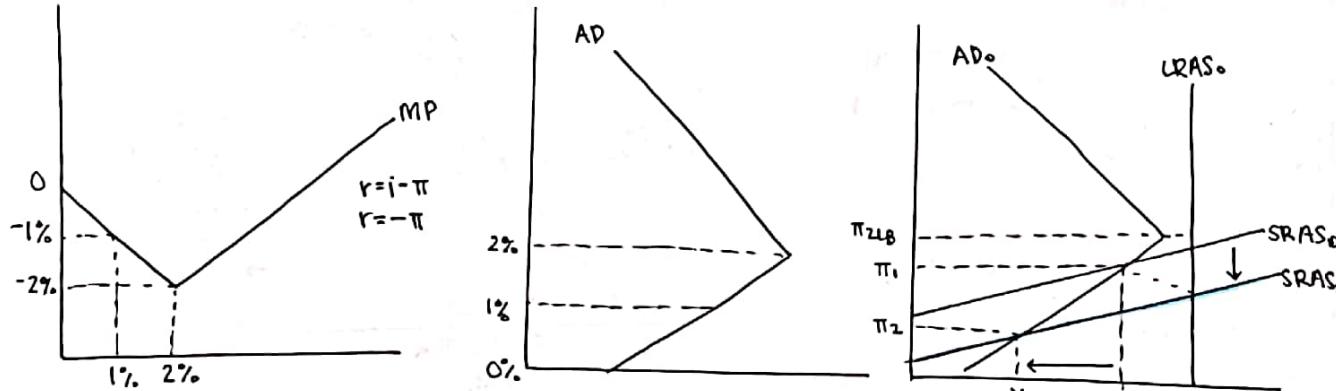
ex: General eq  $\rightarrow$  neg. SRAS shock  $\rightarrow$  govt want to incr. employment



In the LR:  $y = y^*$ ,  $u = u_N$ ,  $r = r^*$ ,  $\pi \uparrow$



**zero lower bound** is the zero floor on the policy interest rate  
 → MP curve + therefore AD curve are different once the ZLB is in effect



→ Self-correcting mechanism no longer operational when ZLB in effect

↳ Negative output gap implies  $\pi < \pi^e$

1. SRAS shifts downward

2. AD curve is upward sloping so both  $\pi + Y$  will decline  $\Rightarrow \pi^e = \downarrow SRAS$

3. disinflationary spiral

**Conventional MP tools** (OMO, discount lending, +  $\Delta$  in rr) no longer effective

**Nonconventional MP tools** ease MP without lowering policy interest rate; help  $\uparrow Y + \pi$  by lowering  $\bar{r}$  in AD/AS

\* Liquidity Provision: incr. lending facilities in order to provide liquidity to impaired markets

1. **Quantitative easing**: large incr. in CB balance sheet (doesn't matter what they buy)

↳ **Credit easing**: incr. in CB balance sheet that results in significant  $\Delta$  in composition of balance sheet (typ. involves medium or long-term govt securities +/or private assets)

→ QE unlikely to affect CB real interest rate ( $r$ ), financial frictions ( $F$ ), or real interest rate for investment ( $r_i$ )  $\Rightarrow$  not likely to affect  $Y$  meaningfully

→ credit easing unlikely to affect CB  $r$

↳ But may affect  $F$  (reducing term premium) +  $r_i$

↳ so may have meaningful impact on  $Y$  (lower  $r$ , but cannot make people borrow more)

→ Conducted through either

1. **Liquidity provisions**: CB intend to inject liquidity in impaired markets so they can quickly return to normal functions (lender for banks when no one else will)

↳ financial frictions are increased

↳ goal:  $\uparrow$  liquidity + reduce  $F$ , shifting IS + AD right

2. **Asset purchase** of private securities: lower credit spreads between private securities + risk-free assets (credit spread widen  $\rightarrow \bar{r}$  incr.)

↳ goal: reduce credit spread +  $F$ , shifting IS + AD right

2. **Management of expectations**: committing to future policy action of keeping FF @ lower rate

↳ **expectations for SR/short-term interest rate**

↳ LT interest rates partly reflect expect. about path of ST interest rates

↳ CB promise to keep the ST interest rate low for a "considerable period of time" should also dampen LT interest rates

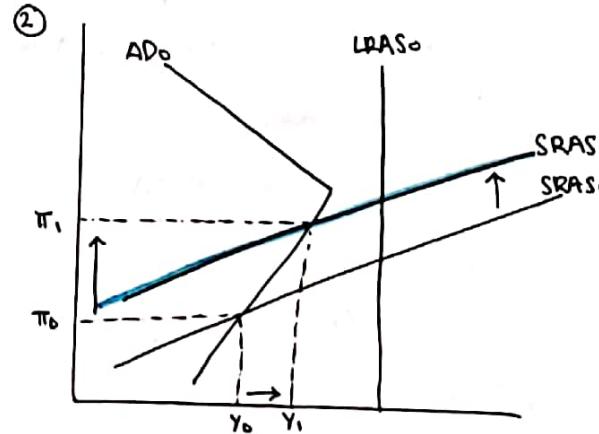
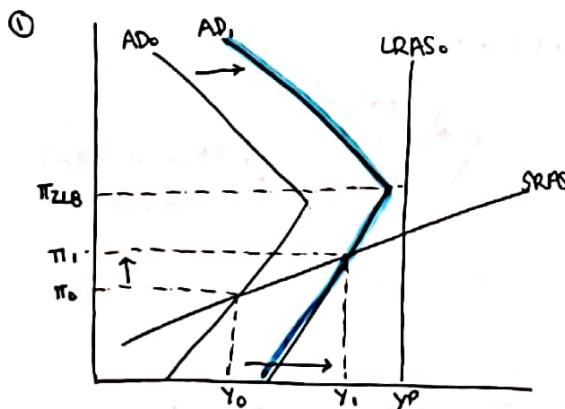
↳ If successful, this would reduce  $F$ , shifting IS + AD curve right

→ **Inflation expectations**

↳ CB incr.  $\pi^e$  by committing to do whatever it takes

→ to be successful, public must believe it will incr. in future

↳ If successful, SRAS shift up, incr.  $\pi$  while reducing  $r +$  incr.  $Y$  along AD curve



The Government budget consists of

→ Gov't Outlays or Spending

1. Gov't purchases: expenditures on goods + services (26% of federal + 67% of state/local),  $G = G_c + G_i$ 
  - Gov't investment: spending on capital goods like highways + schools,  $G_i$
  - Gov't consumption: (5/6 of purchases) fed spends on defense; state spend more for services,  $G_c$

2. Transfer Payments: direct payment to individ for where there is no g/s given in return (50% of federal + 24% state/local)
3. Grants-in-aid: fed assistance to state/local gov't (12% of federal)
4. Net Interest Payments: interest paid to holders of gov't debt (US Treasury bonds) less interest paid to gov't for debts (12% of fed + 9% of S/I)

→ Receipts or Tax Revenue

1. Personal (income) taxes: include property tax
2. Contributions for social insurance: primarily SS tax (fixed % of wage) (35% of fed + 1% of S/I)
3. Taxes on production + imports (tariffs): primarily sales tax (4% of fed + 44% local)
4. Corporate taxes: tax on business IT (13% of fed + 2% S/state/local)

5. Grants-in-aid to state + local gov't: 2nd largest source of funds (19%) of state/local

\* Designed to have the fed + state/local gov't to have diff. source of revenue + purchases

\* all gov't outlays financed by tax revenues or by borrowing

The gov't budget deficit =  $G - T = \Delta B$  (change in total debt outstanding) = flow variable

The gov't debt =  $\sum \text{deficit}$  = stock variable

\* most gov't run budget deficits most of the time so global gov't debt outstanding has grown over time

\* Debt-to-GDP ratio is the amt of debt relative to the available income to pay back

→ a change to the ratio =  $(\text{deficit} - \text{to} - \text{GDP}) - (\text{debt} - \text{to} - \text{GDP})(\text{growth of nominal GDP}) = \Delta(\frac{\Delta B}{\text{GDP}}) = \frac{\Delta B}{\text{GDP}} - \frac{B}{\text{GDP}} \cdot g_p$

Gov't purchase:  $G = \bar{G}$

(Net) tax revenue:  $T = \bar{T} + tY$

The budget balance is given by  $BB = T - G = \bar{T} + tY - \bar{G} \rightarrow BB = (\bar{T} - \bar{G}) + tY$

→ where  $(\bar{T} - \bar{G})$  = autonomous budget +  $tY$  = induced/endogenous budget

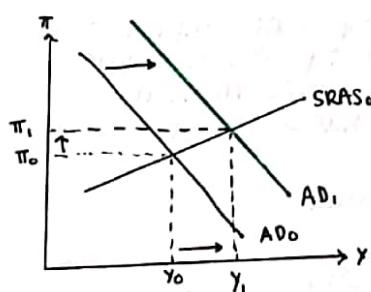
→ economic output is determined in AD/AS model  
→ BB is determined along the BB line

Fiscal policy includes both:

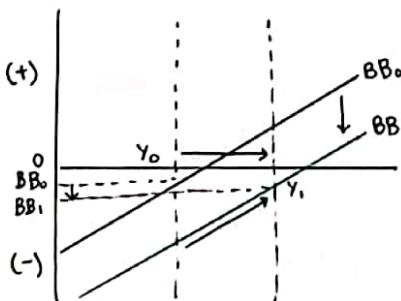
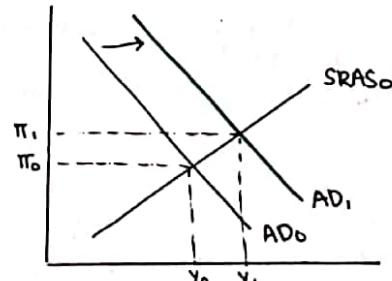
1. Automatic stabilizers: cause fiscal policy to be counter-cyclical by  $\Delta$ ing gov't outlays +/or tax revenue endog.  
→ during recessions, unemployment insurance payments automatically incr. b/c number of unemployed incr.  
→ during recessions, tax revenues decline auto. due to income deduction  
→ Because of auto stabilizers, gov't BB will automatically decline during rec. + ↑ during exp.  
→ cause  $\Delta$ s in BB from induced (net) tax  $\Delta$   
↳  $BB = (T - G) + tY$  where  $\Delta T = t \cdot \Delta Y$   
↳  $\Delta BB = \Delta(T - G) + t \cdot \Delta Y$   
↳ movements on given BB line

2. Discretionary fiscal policy changes: deliberate  $\Delta$  in
  - autonomous gov't purchases,  $\bar{G}$  > cause a parallel shift in BB line
  - autonomous tax revenues,  $\bar{T}$  > cause a parallel shift in BB line
  - tax rate,  $t$ : cause a rotation of BB line

ex 1: increasing  $\bar{G}$  or decreasing  $\bar{T}$



ex 2: decreasing tax rate,  $t$



How do we compare  $\Delta$  in  $\bar{G}$  (measured in \$) w/ $\Delta t$  (measured in %)

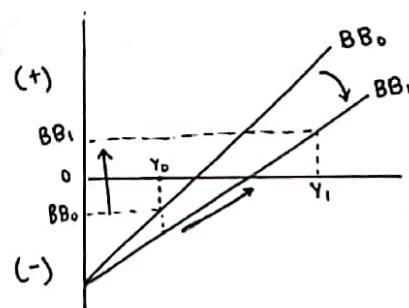
→ Structural budget balance

(SBB): BB measured at economy's potential output; what the BB would be if in general equilibrium

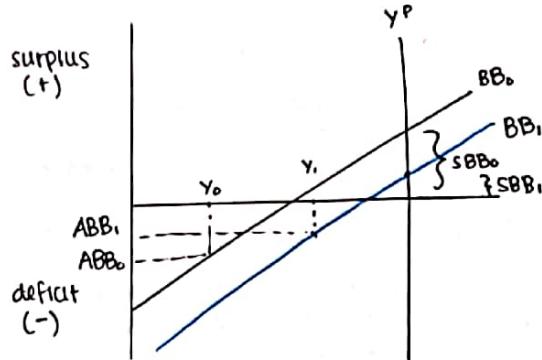
→  $SBB = (\bar{T} - \bar{G}) + tY^*$

↳ does not  $\Delta$  w/business cyc  
↳  $\Delta$ s w/discretionary fiscal policy =  $\Delta$ s in discr. fiscal represented in  $\Delta SBB$   
↳  $SBB = \text{expansionary}$   
↑  $SBB = \text{contractionary}$

→ Standardized BB  
cyclically adjusted BB  
natural employment BB  
full employment BB

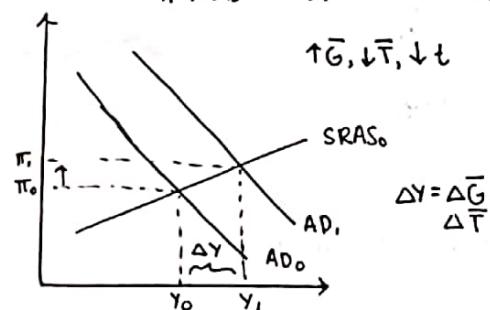


### ex 1: increasing $\bar{G}$ or decreasing $\bar{T}$



There are 3 budget measures:

1. **Actual Budget Balance**: measured @ actual  $Y$
2. **Structural BB**: measured @  $Y^P$
3. **Cyclical BB**: when economy is not @  $Y^P$   
 $\rightarrow CBB = ABB - SBB$   
 $\hookrightarrow$  If  $ABB < SBB$ , then  $CBB < 0$



**Expenditure multiplier** is the  $\Delta$  in economic output for a given  $\Delta$  in gov't purchases:  $\Delta Y / \Delta G$

Tax multiplier should always be smaller than the expenditure multiplier

1. Initial  $\Delta$  in spending from incr. gov't purchases is a **direct incr.** in spending
2. Initial  $\Delta$  in spending from decr. taxes causes disposable income to  $\Delta \rightarrow$  cause a  $\Delta$  in consumption (but not one-to-one due to MPC)  $\rightarrow$  **indirect incr.** in spending

But expenditure multiplier may be smaller because

1. As gov't purchases rise, inflation rises so real interest rates rise, leading to a cutback in private spending (**crowding out**) on investment, consumption expenditure, + net exports  
 $\rightarrow$  borrow funds to finance spending  $\rightarrow$  no more for businesses to borrow  $\rightarrow$  price of credit  $\Delta$   
 $\rightarrow$  result in overall smaller incr. in economic output
2. Households + businesses **may anticipate** that higher gov't purchases will lead to higher budget deficits that will require financing w/ higher taxes  
 $\rightarrow$  decr. spending to save more to pay for future anticipated tax incr.  
 $\rightarrow$  stronger expectations = less outward movement in fiscal policy

When fiscal stimulus is required

1. **Tax cut proponents** emphasize both incr. in spending + reduction in tax distortions (diff. b/t gross + net pay)  
 $\rightarrow$  incr. net pay = income + work effect ( $\uparrow A \uparrow L$ )  
 $\rightarrow$  more political decision  
 $\rightarrow$  reduce marginal tax rate

2. **Gov't spending proponents** emphasize direct incr. in AD + potential incr. in gov't expenditure/investment in infrastructure + human capital

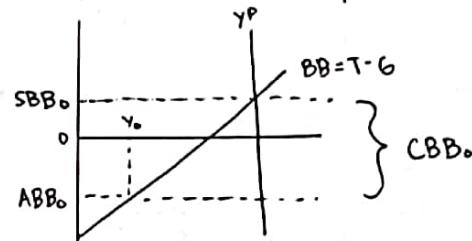
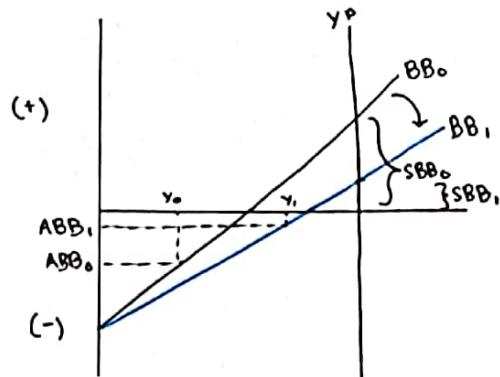
Fiscal multiplier substantially larger when policy rate has hit the zero lower bound

- $\rightarrow$  Normal:  $\bar{G} \uparrow \Rightarrow \pi \uparrow \Rightarrow \bar{t} \downarrow \Rightarrow Y \uparrow$  by a small amount
- $\rightarrow$  ZLB:  $\bar{G} \uparrow \Rightarrow \pi \uparrow \Rightarrow$  policy rate fixed at zero  $\Rightarrow t$  decr.  $\downarrow \Rightarrow \bar{t} \uparrow \Rightarrow Y \uparrow$  by large amount

Fiscal Policy can also affect AS

- $\rightarrow$  **Payroll tax**: taxes on wages (i.e. SS taxes)
- $\rightarrow$  Payroll tax cut on employee's contributions would
  1. incr. disposable income + incr. AD
  2. act like a temporary supply shock  
 $\rightarrow$  less cost of labor = less cost of production  
 $\rightarrow$  economic output incr. even more  
 $\rightarrow$  inflation does not incr. as much

### ex 2: decreasing tax rate, $t$



In the SR, expansionary fiscal policies increase AD + economic output (+ usually inflation) by shifting the AD curve right. This can be either:

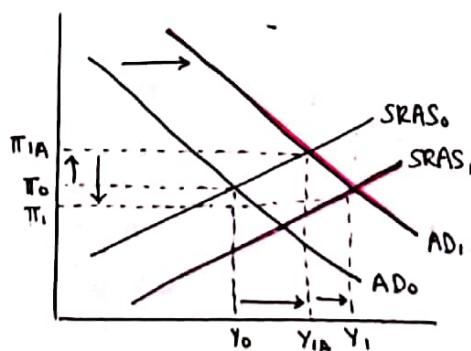
1. incr. in autonomous gov't purchases,  $\bar{G}$
2. decr. in autonomous (net) taxes,  $\bar{T}$
3. decr. in tax rate,  $t$

**Tax multiplier** is the  $\Delta$  in economic output for a given  $\Delta$  in tax revenues:  $\Delta Y / \Delta T$

Households + businesses **may anticipate** that higher gov't purchases will lead to higher budget deficits that will require financing w/ higher taxes

1. decr. spending to save more to pay for future anticipated tax incr.
2. stronger expectations = less outward movement in fiscal policy

2. Gov't spending proponents emphasize direct incr. in AD + potential incr. in gov't expenditure/investment in infrastructure + human capital



- Supply-side economists emphasize positive effects of tax cuts on AS**
- Permanent reductions in marginal tax rates, even the ones that do not directly lower costs, reduce tax distortions + after-tax income increases
    1. Incr. disposable income + AD
    2. Incr. incentives to work, invest, + AS
    3. lower wage cost of production
      - Incr. total hours worked, expansion of capital stock, more laborers, etc.
      - potential to  $\Delta$  LRAS

\* decr. in marg. tax rate → income effect (workers work more hours + more people look for jobs) → but also substitution effect (leisure)

Reducing budget deficit requires either

1. Decr. in gov't spending > both reduce AD + Y in SR
2. Incr. in tax revenues

However, a smaller budget deficit - esp from reduced gov't spending - may also have positive AD effects

1. Smaller budget deficits may imply future taxes will be lower
2. Lower taxes in the future will reduce future tax distortions
  - Incr. incentives to work + invest = permanent positive supply shock

### EFFECTIVE SR Fiscal Policy Considerations

#### 1. Size of the fiscal stimulus

- size of negative output gap (Un hard to est)
- how quick? ave. recession = 1 yr
- eliminate all or portion of neg. output gap

#### 2. Consumption of fiscal stimulus

- gov't expenditure mult > tax multiplier
- importance of incentive effects of transfer payments +  $\Delta S$  in tax rate
- political decision

#### 3. How gov't spending should be incr.

- which spending (defense, infra. service, etc.)
- new or replacement spending
- how quickly are the funds spent?
- large multiplier effects (inputs? imports?)

#### 4. How personal taxes should be decr.

- which taxes should be reduced
- which taxpayers (high income =  $\downarrow$  mpc)
- needs to be permanent to see  $\Delta$

#### 5. How corporate taxes should be reduced

- which taxes
- should be temporary for investment
- how quickly can tax cuts be implemented

**Tax smoothing** is a policy of keeping tax rates relatively stable even when tax revenues + gov't spending fluctuate w/ economic activity

- minimize tax distortions from high or volatile taxes
- justifies budget deficits when incr. in gov't spending likely to be temporary not perm.

In SR, expansionary fis. policy = higher inflation

In LR,  $\pi$  does not rise if cb. maintains target, but large budget deficit makes this hard

#### → monetizing the debt (or printing money): c.b. issue newly created money to finance deficit

↳ **Q theory of money**:  $\pi \approx \Delta M/M \approx g_m$

→ large budget deficits financed by printing money =  $\uparrow \pi$

$$\rightarrow \Delta M/P \approx \pi \cdot M/P$$

#### → seigniorage: revenue gov't receives (saves) by issuing currency rather than bonds

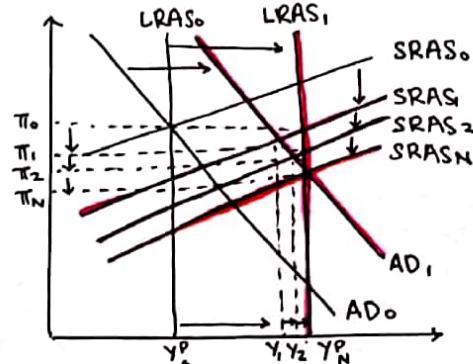
↳ like an inflation tax b/c resulting higher  $\pi \downarrow$  the real value of outstanding money supply

↳ adverse feedback loop

→  $\uparrow$  probability of default ⇒ investors pull out bonds ⇒ decline in prices ⇒  $\uparrow$  interest

rate debt ⇒  $\uparrow$  gov't interest payments on newly issued debt ⇒  $\uparrow$  deficit

→  $\uparrow$  debt-to-GDP ratio ⇒  $\uparrow$  prob. of default ⇒  $\uparrow$  interest payment ⇒  $\uparrow$  deficit



\* some believe tax base (income that is taxed) will rise = tax revenue rise

However, a smaller budget deficit - esp from reduced gov't spending - may also have positive AD effects

1. Smaller budget deficits may imply future taxes will be lower
2. Lower taxes in the future will reduce future tax distortions

→ Incr. incentives to work + invest = permanent positive supply shock

### Long-Run Debt on Future Generations

1. Gov't debt is not a burden if spending for gov't investment activities incr. A

↳ **capital**: stock of productive assets  
↳ rate of return excess of borrowing

↳ **human capital**

↳ income risen in future enough to pay interest on debts  
↳ additional tax revenue

2. Gov't debt is a burden if

→ reduction in national savings  
↳ crowds out productive private invest  
↳ if private assets > gov't assets

→ Spending for gov't consumptive act + not for investment act  
↳ consumption on transfer payments  
↳ SR assets

→ Gov't invest. has low rate of return  
↳ below the borrowing cost

→ redistribution of income + transfer wealth from taxpayers to bondholders

→ indebtedness to foreigners: ↓ nat saving

→ **Debt intolerance**  
↳ debt repudiation: fail to pay all debts  
→ fear gov't will default

→ Negative incentives

↳ **distortions**: small potential output  
↳ **tax wedge**: reduce efficiency

- Ricardian equivalence implies tax cuts have no effect on spending + national savings
- Assumes households recognize a tax cut today that creates a larger deficit means higher taxes in the future
  - B/c expected future (disposable) income will ↓, consumers will not Δ spending today
    - how budget is financed does not matter (borrowing or taxing)
    - ↪ does not make a difference to national saving
    - forward-looking adjustment of behavior

Ricardian equivalence implies that tax cuts

- will not incr. or Δ AD (no impact on consumer spending)
- Create budget deficits that will not affect national savings + will not burden future generations
  - fall in taxes + gov't spending offset by rise in private savings
- Create budget deficits that do not Δ π (not Δ AD)
  - only inflationary if gov't has trouble selling bonds used to finance budget deficits

Assumes consumers are

- Forward-looking**
- Not subjected to borrowing constraints
- Care about future generations

Objections: consumers are

- Myopic + shortsighted
- Subject to borrowing constraints + incr. spending
- Little concerned about future generations

International trade +/or financial transactions require the exchange of diff. currencies

Exchange rates are the price of one currency in terms of another

→ Nominal exchange rate ( $E$ ): price of one currency in terms of another currency (#currency exchanged for another currency)

↪ Foreign exchange market: place where trading of currencies + bank deposits denominated in particular currencies to determine  $E$  occurs
 

- over-the-counter market of several 100 dealers (mainly banks) actively buying + selling bank deposits denominated in foreign currencies (6-7 trill in a single day)

↪ Quoted in 2 ways

- Direct quote: amt of foreign currency per unit of domestic currency (positive relationship)
- Indirect quote: amt of domestic currency per unit of foreign currency

↪ Δs in  $E$ :

1. Appreciation: currency rises in value so that it is worth more units of another currency (it has increased or strengthened)

2. Depreciation: currency falls in value so it is worth less units of another (decreased or weakened)

↪ Two types of  $E$

1. Spot exchange rate: used for spot transactions, immediate exchanges of bank deposits (current)
 

- dominant + occurs within 2 days

2. Forward exchange rate: used for forward transactions, exchanges of bank deposits at some specified future date

→ Real exchange rate ( $E$ ): relative price of goods in 2 countries; rate at which you exchange domestic goods for foreign goods

↪ also called terms of trade (purchasing power)

$$\hookrightarrow E = E \cdot (P/P_f) \text{ where } P = \text{domestic general price level} + P_f = \text{foreign general PL}$$

↪ Δs in  $E$ :

1. Real appreciation: price of goods in one country incr. relative to the price of similar goods in another (domest. goods = more exp.)

2. Real depreciation: price of goods decreases relative to price in another (dom. goods = cheaper)

↪ Relativity

→ when  $E < 1$  (low), domestic goods are cheaper (easy to export)

→ when  $E > 1$  (high), domestic goods are more expensive (hard to export)

↪ In the SR, if prices are sticky then Δs in nominal exchange rates affect  $E$  (relative prices)

↪ Currency appreciation

↪ exported goods are more exp ⇒ exports ↓  
imported goods cheaper ⇒ imports ↑ ⇒  
 $NX \downarrow$

→ Nominal + real exchange rates move together

↪ Foreign exchange trade: competitive market because dealers facilitate exchanges

Exchange rates in the long run equal 1

→ flexible price + arbitrage opportunity (cheap price relative to another ⇒ demand ↑ ⇒ prices equalize)  
→ Purchasing Power Parity (PPP): exchange rates between any 2 countries will adjust to reflect Δs in price levels of 2 countries;  $E$  adjust to make price of goods in diff. countries equal

↪ Application of the Law of One Price: if 2 countries produce an identical good + transportation costs + trade barriers are low, then price of good will be the same  
→ Δs in  $E$  will bring about this

↪  $E = E \cdot (P/P_f) = 1$  so  $P = P_f/E$  (equal price + purchasing power)

→ Percentage Δ terms of  $E$ :  $\% \Delta E \approx \% \Delta E + \% \Delta P - \% \Delta P^f$  or  $\% \Delta E \approx \% \Delta E + \pi^f - \pi$

↪ this is the change in real exchange rate

→ Δ in  $E$ :  $\% \Delta E \approx \% \Delta E \cdot \pi^f - \pi$

↪ Nominal appreciation due to either (1) real appreciation +/or (2) higher relative foreign inflation / lower relative domestic inflation

↪ Relative PPP:  $E$  movements only reflect differences in relative  $\pi$

→ PPP must hold,  $\Delta E = 0$ , + identical products must be produced

↪ Big Mac Index: PPP ( $E=1$ ) did not hold

→ indicate which currencies are overvalued ( $E > 1$ ) or undervalued ( $E < 1$ )

} If predicted < actual, then local currency is undervalued

- PPP does not hold in the SR because
1. countries produce diff goods
  2. many goods are not traded internationally (non-tradable)
  3. There are **transportation costs + legal barriers** to trade

## Exchange Rates in the Short Run

Nominal exchange rates are determined

1. In a **fixed exchange rate system** by the govt which intervene in the foreign exchange market to maintain a fixed exchange rate
2. In a **flexible (or floating) exchange rate system** where the demand for domestic currency-denominated assets equals the supply of dollar-denominated assets.
  - nominal exchange rate will appreciate or depreciate whenever there is a  $\Delta$  in either
  - 1. **The supply of domestic currency-denominated assets** (quantity of dollar assets supplied is primarily the quantity of bank deposits, bonds, + equities in the US)
    - assumed to be fixed + independent of both nominal + real exchange rate
    - therefore, supply curve is vertical w/r respect to nominal wages
  - 2. **The demand for domestic currency-denominated assets**
    - determined by the expected return on domestic assets relative to foreign assets (usually used when buying foreign goods or making an investment)
    - expected return: any payment from the asset (i.e. interest) + any expected  $\Delta$  in value as a fraction of its price
    - assume perfect capital mobility, then expected return includes
      1. Interest earned +
      2. Any expected  $\Delta$  in value of assets, including expected future exchange rate ( $E_{t+1}$ )

Suppose that we have \$1 mil to invest in one year

- US domestic interest rate = 5%
- Japanese foreign interest rate = 10%
- Yen-dollar spot exchange rate = ¥100:\$1

	Year 0:	Year 1:
US:	\$1000,000	→ 5% → \$1,050,000
↓		
Spot:	¥100:\$1	

Japan:	¥100,000,000	→ 10% → ¥110,000,000
--------	--------------	----------------------

If future exchange rate was expected to be more than the forward exchange rate ( $E_{t+1} > ¥104.76$ ) then:

1. People will invest in the US
2. Demand for US dollars will incr.
3. Leading to an appreciation of the dollar
4. Which leads to a depreciation of the yen

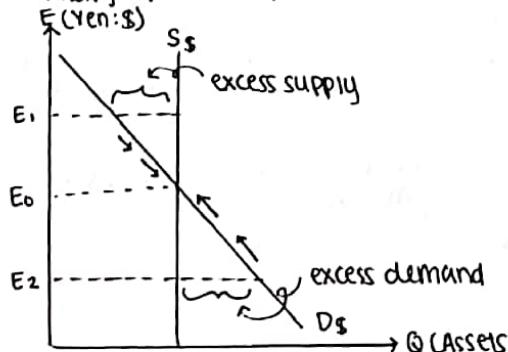
The **quantity of dollar assets demanded** will be inversely related to the exchange rate (downward)

- for a given expected future exc. rate  $E_{t+1}$ , the lower the current exchange rate is, the more likely the dollar will appreciate

↳ incr. expected return on dollar assets → incr. demand for dollars

- If expectations of future exch. rates change, the curve will shift

Foreign exchange market is in equilibrium when quantity dollar-denominated assets demanded exactly equals the quantity of dollar denominated assets supplied



- **Excess supply**: an E higher than equilibrium E implies the Q of dollar assets supplied > Q demanded
- **Excess demand**: a lower E than eq. E implies the Q of dollar assets supplied < Q demanded
- assuming the supply curve does not shift, all  $\Delta$ s in the exchange rate are caused by changes in demand

Demand from uncovered interest parity:  $E_t = \frac{1 + i^D}{1 + i^F} \cdot E_{t+1}$

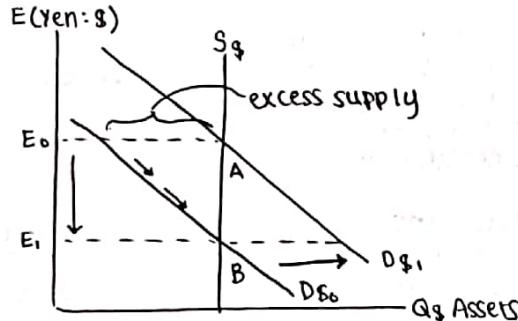
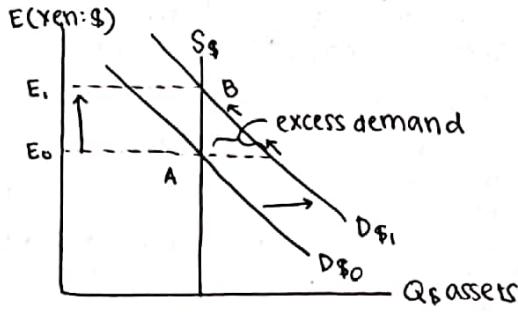
- in SR when prices are sticky,  $\Delta$  in nominal interest rates cause similar  $\Delta$ s in real interest rates

\* In deep liquid markets, exchange rates will not be in disequilibrium for long  
→ adjustments are usually rapid

The demand curve for domestic currency-denominated assets shift if there are  $\Delta$ s in:

### 1. Domestic real interest rate ( $r^D$ )

- an incr. in  $r^D$  shifts the demand for domestic assets  $D_{\$}$  to the right, causing currency to appr.  
↳ higher  $\pi$  + higher  $r$  = excess demand  
↳ rate of return on dollar denominated assets is bigger = higher demand = appreciation
- a decr. in  $r^D$  shifts the demand for domestic assets to the left, causing currency to depreciate.

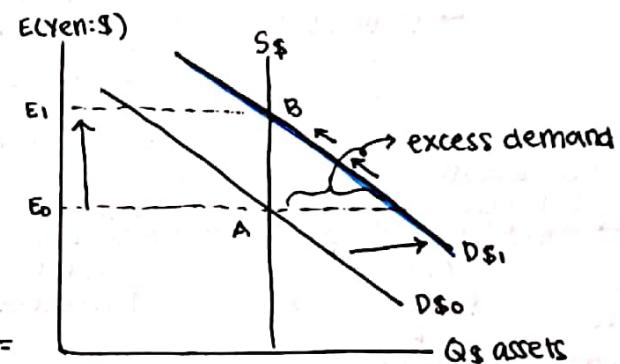


### 2. Foreign real interest rate, $r^F$

- an increase in  $r^F$  shifts the demand curve for domestic assets,  $D_{\$}$  to the right, causing domestic currency to depreciate  $E \downarrow$
- a decrease in  $r^F$  shifts the demand curve to the right, causing domestic currency to appreciate  $E \uparrow$

### 3. Expected future exchange rate, $E_{t+1}^E$

- a rise in  $E_{t+1}^E$  shifts demand to the right + causes domestic currency to appreciate  $E \uparrow$
- a fall in  $E_{t+1}^E$  shifts D to the left + causes domestic currency to depreciate  $E \downarrow$
- any factor that ↑D for domestically traded goods relative to foreign traded will cause LR apprec. of domestic currency b/c domestic goods will continue to sell well even when the value of the domestic currency is higher  
↳  $E_{t+1}^E \uparrow \Rightarrow \uparrow$  expected return on dollar assets = D shift right =  $E \uparrow$



In the SR, appreciation/depreciation of nominal exchange rate implies app/depr. of real exchange rate  
→ Appreciation of Exchange rate ( $E \uparrow$ )

#### 1. Negative AD shock

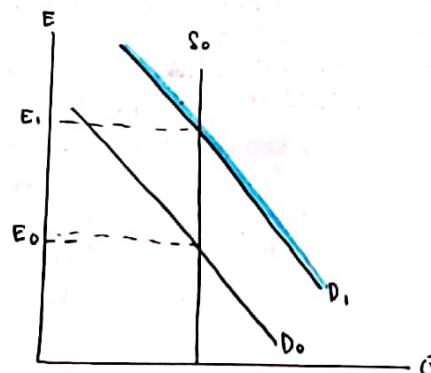
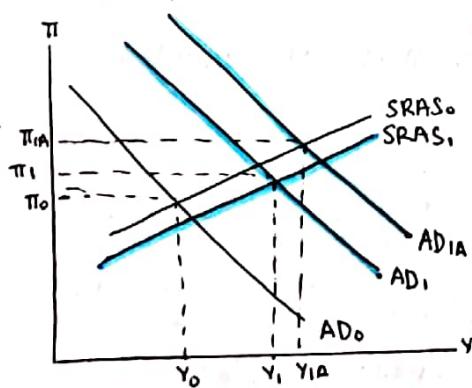
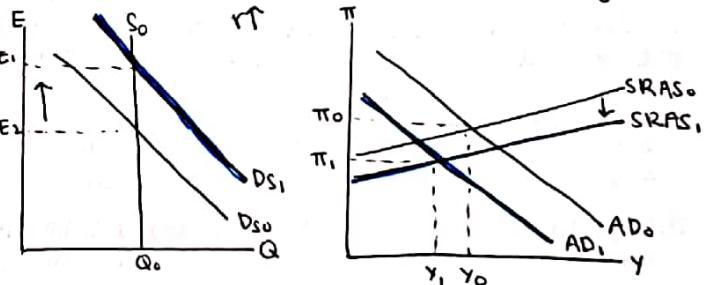
- exports are more expensive to foreigners  $X \downarrow$
- imports less expensive to residents  $M \uparrow$
- $NX \downarrow$

#### 2. Temporary Positive SR supply shock

- imports (inputs) are less expensive
- reduces domestic aggregate price level

\* In other words,  $E \uparrow \rightarrow NX \downarrow \Rightarrow Y \downarrow + E \uparrow \Rightarrow \pi \downarrow$

An appreciation of E leads to both decline in economic activity + inflation



EX: G↑

- AD shifts right
- currency appreciates due to higher r  
↳ AD shifts partially left
- SRAS shift down due to cheaper imports

\* reg. qualitative results but diff quant. results

Historically there have been 2 ways to fix an exchange rate

1. Fixing the value of domestic currency to a commodity such as gold (gold standard)
2. Fixing the value of domestic currency to that of a large, low-inflation country (anchor country)

With fixed exchange rates, the value of domestic currency is pegged by govt relative to the value of another (anchor currency)

→ the exchange rate that is pegged by the govt is the official rate / par / pegged rate

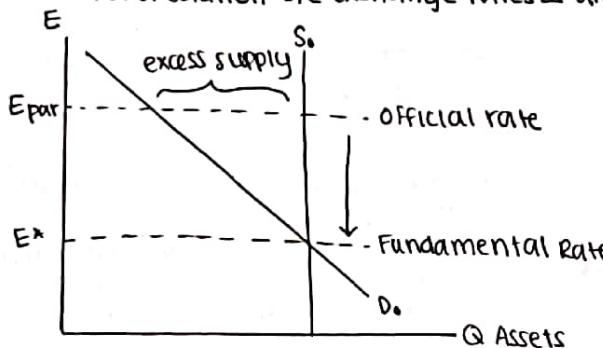
→ the cb offers to buy (excess supply;  $P \downarrow$ ) or sell (excess demand;  $P \uparrow$ ) domestic currency pegged by gov't relative to the value of another currency at a fixed exchange rate

→ Fixed rate regime w/**currency board**: domestic currency 100% backed w/anchor currency  
 ↳ low confidence, however, may result if cb buys back own currency  
 ↳ if low anchor currency, speculative action may occur to see reliability  
 ↳ no guarantee it will work

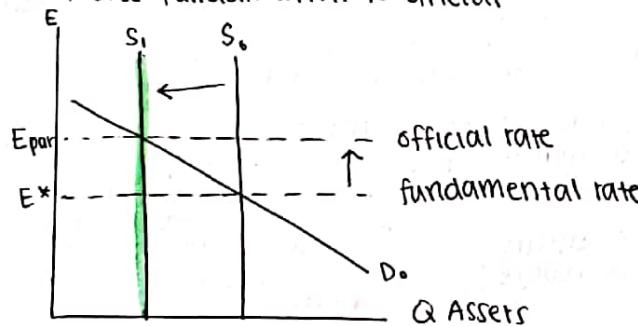
### When Official Rate Differs from Fundamental Rate

→ **overvaluation** ( $E_{par} > E^*$ ): excess supply

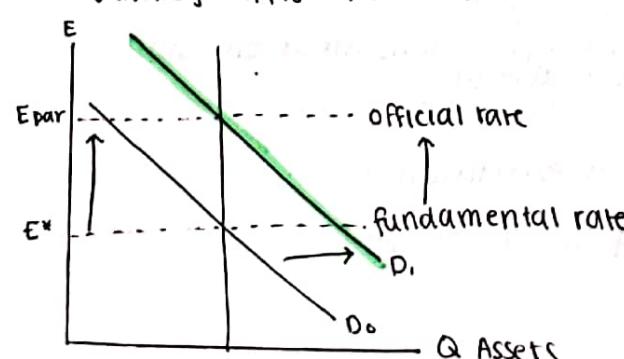
1. Gov't could devalue currency, reducing official rate to the fundamental
- **devaluation**: cb resets par at a lower level (this is not depreciation)
- generally does not happen bc cb will eventually run out of international reserves by maintaining overvalued currency
- not a solution b/c exchange rates  $\Delta$  always



2. Gov't can impose (**financial**) capital controls, reducing supply of domestic-currency-denom. assets  
 → restrict foreigners from curr.-denom assets  
 ↳ but people may be hesitant to send in money in the future even if you relax it  
 ↳ issue for investor because affects how much you take out
- moves fundamental to official

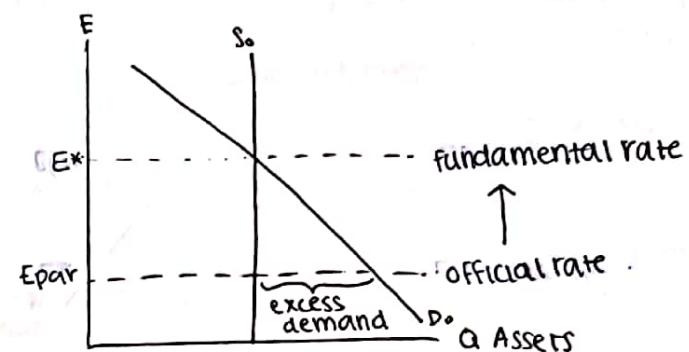


3. CB can intervene in **foreign exchange market** by buying its own currency, incr. fund to official  
 → Foreign exchange interventions: international financial transactions engaged by cb to influence exchange rates (like OMO)  
 → CB will buy domestic currency ( $M^s \downarrow$ )  
 → CB sells foreign currency-denom assets  
 ↳ international reserves: foreign currency-denom asset holdings on cb balance sheet  
 → ↓ money supply  $\Rightarrow \uparrow r^o \Rightarrow TD$

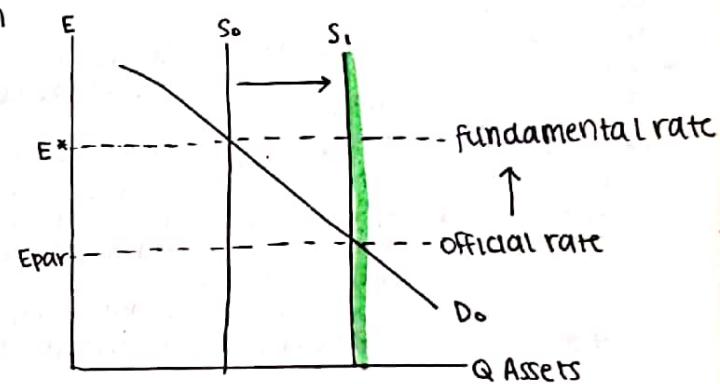


→ **undervaluation** ( $E_{par} < E^*$ ): excess demand

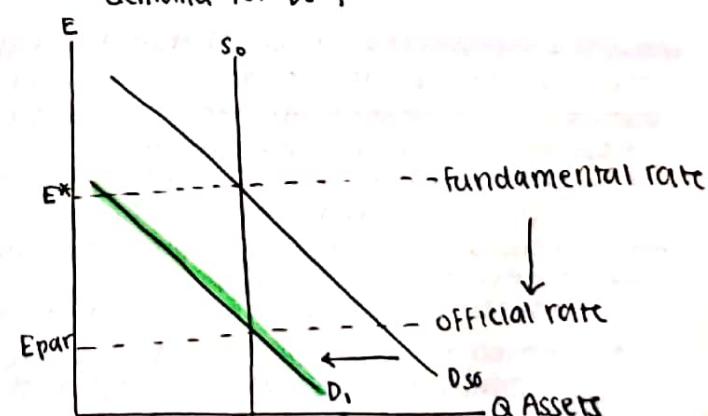
1. Gov't can revalue currency, incr. official to fund. rate
- **revaluation**: cb resets par exchange higher
- generally not happen bc don't want to continually acquire international res. to maintain under valued



2. Gov't can relax capital controls, incr. the money supply of domestic currency-denominated assets  
 → give foreigners access to more supply  
 → reduce fundamental rate to par



3. CB can intervene in the **foreign exchange market** by selling its own currency, reducing fund to official rate  
 → CB sells its domestic currency  
 → CB acquires foreign currency-denom. assets (i.e. international reserves)  
 → domestic money supply  $\uparrow \Rightarrow r^o \downarrow \Rightarrow$  demand for D\_o  $\uparrow$

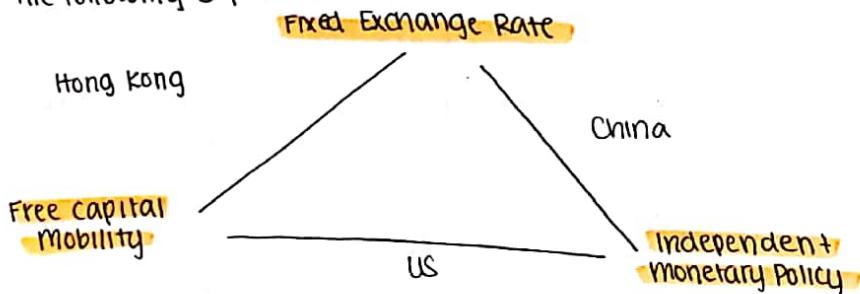


- An **overvalued currency** cannot be maintained forever  
 → country will eventually run out of international reserves + be forced to devalue currency  
 → **speculative runs** occur when investors believe overvalued currency may be devalued  
 ↳ shifts private demand left  
 ↳ sell assets now + buy later at a lower price  
 → liabilities ↑ + NX ↑  
 ↳ leads to larger loss of international reserves from CB + hasten likelihood of devaluation

If real interest rate appreciates in anchor country

1. Anchor country's currency will appreciate
2. Fixing country's currency will depreciate
3. Fixing country's currency will now be overvalued

**Policy trilemma** or **impossible Trinity** describes the situation in which a country can only pursue 2 of the following 3 policies:



### Fixed Exchange Rates

#### Advantages

1. International trade easier + less costly
2. Help discipline monetary policy, making it impossible for a country to engage in independent expansionary policy (control CBs)
3. Non-inflationary MP if anchor country has one
4. If credible, it will help anchor inflationary expectations to inflation in the anchor country

\* An alternative is a **crawling peg**, where currency is allowed to depreciate at a steady rate so inflation rate of pegged country can be > than anchor  
 → adv: inflation control by tying IT rate for internationally traded goods to that in anchor foreign price set by world market whereas domestic price fixed by exch. rate peg  
 adopt MP of anchor reducing inflation quickly in emerging countries  
 → disadv: no independent MP for domestic shocks (see above)

An **undervalued currency** can seemingly be maintained forever as long as the CB is willing to keep acquiring foreign currency-denominated assets

- CB buys domestic currency by selling foreign assets → ↓ international reserves → appreciation of domestic currency
- CB sells domestic currency to purchase foreign assets → ↑ international reserves → depreciation of do. currency

To maintain fixed exchange, fixing country will

1. Sell anchor currency (↓ internat. reserves)
2. Buy domestic currency (↓ liquidity in banking system)
3. Incr. its real interest rate

\* **monetary (or currency) union** is a variant of a fixed exchange rate regime where a group of countries decide to adopt a common currency, fixing their exchange rates relative to another

- adv: trade easier w/ same curr
- disadv: no independent MP to address shortfalls of AD

#### Disadvantages

1. w/ perfect capital mobility, eliminate a country's ability to use MP independently to offset domestic shocks  
 → economic shocks in anchor directly transmit  
 → MP cannot be diff from anchor
2. Open to speculative attacks if overvalued  
 → massive sales of currency → loss of international reserves → devaluation or depreciation of exchange rate

### Flexible Exchange Rates

#### Advantages

1. Allow use of MP for domestic shocks
2. Independent monetary + fiscal policy

\* An alternative is **managed float** where countries attempt to influence value of exchange rate by buying + selling currencies but not to peg it to an anchor currency — also known as the **dirty float**

#### Disadvantages

1. more volatile → more uncertainty → costly international transactions
2. do not provide independent restraint on expansionary MP or FD

**Adaptive expectations** are formed from past experiences only (not on solid economic found.)

→ consequently, Δs in expectations will change slowly over time

**Rational expectations** are formed from past experiences + predictions about the future

→ **optimal forecast**: best guess for the future using all available info.

→ Δs in expectations can occur quickly when new info is available

↳ predictions can be inaccurate

Are households + businesses completely rational in their expectations?

→ accurate forecasts are desirable

↳ strong incentives for households + businesses to make optimal forecasts

→ gathering + processing info is timely + costly

↳ form less than rational expectations

## Implications for Rational Expectations Theory

- Expectations that are rational will use all available info (i.e. govt policies like FP or MP)
- Only new info will cause it to  $\Delta$  (not anticipated info)
- If there is a  $\Delta$  in the way a variable moves, the ways in which expectations of this variable are formed will  $\Delta$  as well

**Discretion** is used when policy-makers make no commitment to future actions, but instead make what they believe in the moment to be the right policy decision for the situation.

### → Disadvantages

- Time-inconsistency problem:** tendency to deviate from good LR plans when making SR decisions (i.e. quantitative/credit easing)
- Political business cycle:** politicians have strong incentives to pursue policies to help them win the next election

### → Advantages

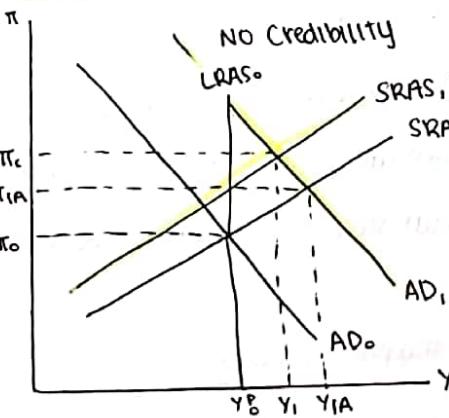
- Acting flexibly can be key to successful MP (esp. in a time of crisis), even if in an unusual environment
- MP is an art as much as a science  
↳ judgment is an essential element for effective MP
- Allows policy maker to  $\Delta$  policy settings when an economy undergoes structural  $\Delta$ s

**Constrained discretion** allows MP to operate within a clearly articulate framework in which the general obj. + tactics of the policy makers are committed to in advance but not their specific actions

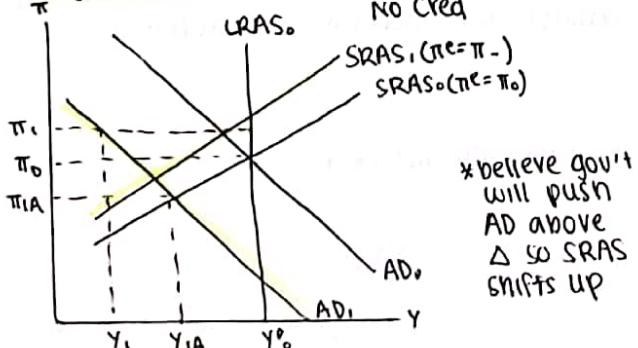
**Nominal anchor** is a nominal variable (inflation, MS, exchange rate) that ties down price level or inflation to achieve price stability

- **Credibility:** one way to achieve constrained discretion; benefits are
- A credible nominal anchor has elements of policy/behavior rule that helps overcome the time-inconsistency problem by providing an expected constraint on discretionary policy  
↳ avoid potential embarrassment + possible punishment
  - Credible commitment will help anchor inflation expectations leading to smaller fluc. in  $\pi$

→ **Positive AD Shock:** MP credibility has benefit of stabilizing  $\pi$  in SR



→ **Negative AD Shock:** MP credibility has benefit of stabilizing  $Y$  in the SR



**Rules** are binding plans that specify how policy will respond to particular economic situation

- **Activist rules:** specify MP should react to level of output + inflation (Taylor Rule)
  - ↳ lags require forecast of future

- **Nonactivist rules** (monetarist): specific variable should behave in a certain way
  - ↳ ex: **constant money growth rate**: MS at a const. growth rate (based on quan. theory of mona.)

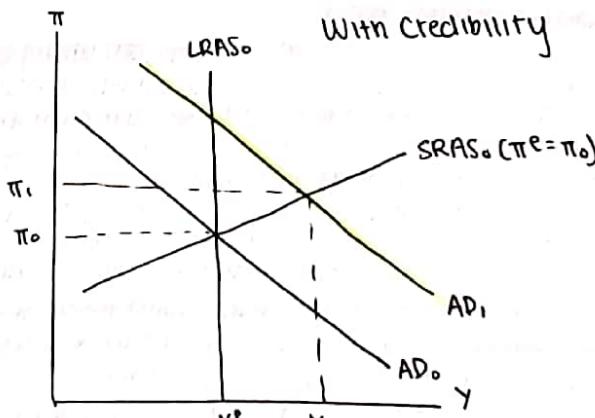
### → Disadvantages

- Rules may be too rigid because they cannot foresee every contingency
  - may exacerbate SR business fluct.
- Does not easily incorp. judgment - esp. of non-quantifiable data
- "True" economic model cannot be known precisely so a policy rule based on a particular model will be wrong if the model is wrong
- If true model was known, structural  $\Delta$ s in economy would lead to sensitivity  $\Delta$ s in the model

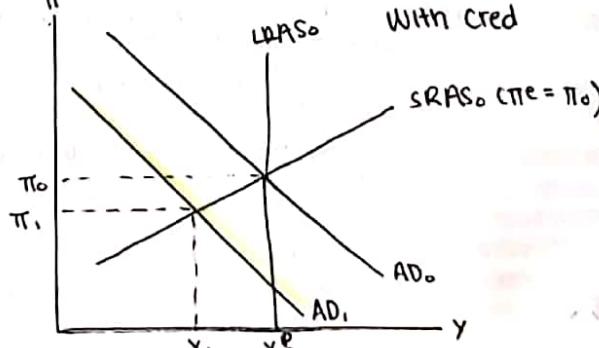
### → Advantages

- Solve time-inconsistency because it forces policy-makers to focus on output + unemployment gap.

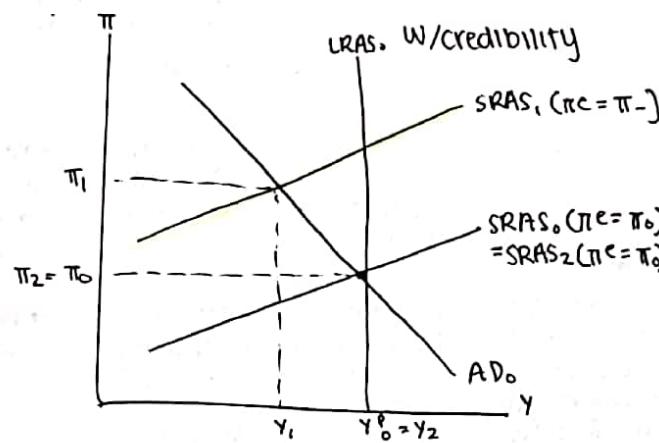
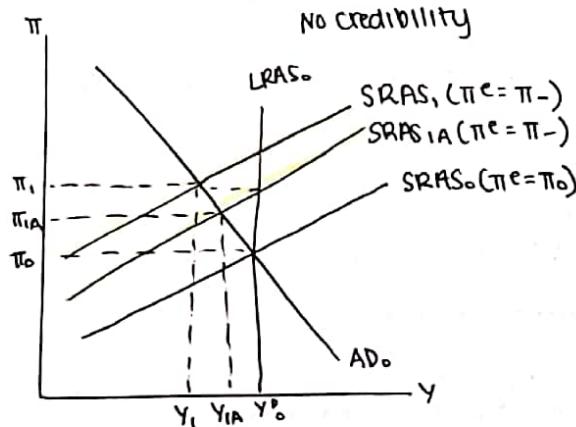
With Credibility



With Cred



**AS shocks:** MP credibility has producing better outcome on both  $\pi + Y$  in SR (temporary AS shock)



### Establishing Central Bank Credibility

#### 1. Inflation Targetting

- public announcement of medium-term numerical targets for  $\pi$
- institutional commitment to price stability as primary LR goal of MP + commitment to achieving  $\pi$
- info-inclusive approach in which policy makers use multiple variables, not just monetary aggregates, in making the decisions about MP
- incr. transparency of MP strategy through comm. w/public + markets about MP plan + obj.
- incr. accountability of cb for attaining its  $\pi$  objectives

#### 2. Nominal GDP Targetting

- reflects chosen numerical  $\pi$  objective
- implies cb will respond to slowdowns in real economy even if  $\pi$  is not falling
- Advantages
  - ↳ explicitly focuses on stabilizing real GDP + not  $\pi$
  - ↳ short falls of GDP < potential or  $\pi^p > \pi^a$  = expansionary MP because GDP < target
  - ↳ expectations of expansionary MP stimulate AD esp. when in ZLB
- Disadvantages
  - ↳ requires accurate est. of potential GDP growth
  - ↳ nominal GDP targetting is more complicated to explain to public than inflation
  - confusion of objectives of cb

#### 3. Appointing inflation-phobic central bankers

- $\pi$  expectations + realize  $\pi$  to be more stable (not certain it will work)

#### 4. Increase central bank independence from political pressures

- politically insulating makes them focus on LR objectives
- inconsistent w/democratic principles (does not always use freedom successfully too)

### Where Macroeconomists Agree

\* LR activity + credibility/faith

1. In the long-run, there is no trade-off between unemployment + inflation
  - in LR, go to natural rate of unemployment (vertical Phillips) or potential output (vertical LRAS)
2. Inflation is always + everywhere a monetary phenomenon
  - Friedman (monetarist): argue growth of money supply was a key determinant of aggregate econ act +  $\pi$
3. There are major benefits to price stability
  - high costs of inflation: high volatility of  $\pi$ , overinvestment in financial sector, uncertainty about future price levels, decr. economic efficiency
  - low + stable  $\pi$ : certainty of  $\pi$  +  $r$  = more economic growth
4. To achieve price stability, central banks must follow the Taylor Principle
5. The more independent a central bank, the more successful it is in achieving price stability
  - insulates from myopia + political pressures
6. Actual execution of monetary + fiscal policy can lead to time-inconsistency problem
  - EX: FP to move negative AD shock right → gov't spending ↑ → less saving + investment → lower steady state
7. Expectations are crucial in economic decisions-making + formulation of monetary + fiscal policy
  - esp. that of the people — which can change!
8. Credibility is crucial for successful policymaking
  - stabilize  $\pi$  + business cycle fluctuations
9. A commitment to a nominal anchor is a crucial element to successfully managing expectations, producing more stable inflation, + lowering economic volatility
  - manipulate econ act. better → policy actions that promote econ effic. + growth
  - counterbalance time-inconsistency problem; encourage fiscally responsible gov't (+ worrisome)
10. Institutions are important in generating rapid long-term economic growth (prop rights, corrupt, etc.)
  - 2/3 difference between successful + unsuccessful countries (but hard to Δ culture w/o deep history)

## Where Macroeconomists Disagree

### 1. Flexibility of Price + Wages

- cannot reject the null because data is not robust enough
  - ↳ main argument: competition (perfect v. imperfect), labor markets, steepness of SRAS
  - Classical (flexible; classical dichotomy) v. Keynesian (SR stickiness)

### 2. How Long it Takes to Get to the Long Run

- Classical (short) v. Keynesian ("in the LR we are all dead")

↳ w/rational expectations + economic modeling, may be faster

### 3. Source of Short Run Business Fluctuations

- Classical: fluctuations solely from shocks to LRAS

↳ Hayek: gov't intervention creates bad incentives; central banks that hold interest rates too low for too long → too much borrowing + too much spending

→ boom + bust: trying to treat w/expansionary MP will not work (i.e. housing boom)

- Keynesian: AD shocks an important source of business fluctuations

↳ liquidity trap: pour more money in economy + people will hold it

→ decline in private investment will not be solved by MP but by ↑ gov't spending

↳ disagreement over how SRAS shifts, timing, + price flexibility

### 4. Effectiveness of Stabilization Policy

- mainly to do w/expectations: private sector may not be responsive to stimulus packages that are temp.
  - ↳ MP: low interest rate → want more investment → too much debt → debt deleveraging
  - ↳ FP: gov't send checks but consumers do not spend

- depends on when you went into recession/recession + economic conditions

↳ time inconsistency less of a problem, but designing policy hard due to rational expectations

- Classical: self-correcting mechanism is rapid

- Keynesian: activist policy can reduce economic fluctuations + severity of business fluctuations

### 5. Cost of Reducing Inflation

- sacrifice ratio: % reduction of real GDP necessary to reduce π rate by 1%

↳ how fast depends on stickiness + expectations / credibility

↳ Classical: low sacrifice ratio

- Keynesian: AS shift slowly over time due to stickiness + adjustment times

### 6. Dangers of Budget Deficits + Debt-to-GDP Ratio

- reduce national savings, lower investment, greater burden on future gen (↑ future taxes + ↑ indebtedness to foreigners; inflationary)

↳ some argue it depends if cb has own MP + issues debt in own currency

→ buy sovereign debt → buy own money → expand domestic MS → π rises → currency depreciates → NX incr. → help economy grow faster

↳ Ricardian equivalence: ↑ deficits = greater savings today (does not crowd)

### 7. Dangers of International Trade Deficits

- trade surplus = insufficient demand

- trade deficit = excess demand

↳ borrow money from rest of world = need to pay interest + principle payments to maturing debt

↳ Total stock + total factor productivity: driving force on how economy will perform

- \* Rational Inattention: adjust price infrequently due to cost of finding new prices  
expectations may be costly to update