CH. 2: Tour of Book

2-1: Aggregate Output

- GDP: Production & Income

1). Value of Final Goods & Services Produced in Econom

2). Σ Value added in Economy

3). Σ Incomes " "

- Nominal & Real GDP

- Nominal GDP = Σ (Quantity of final goods) · Current price

- GDP: Level vs. Growth

1). Output per capita : avg. stnd. of living

2). GDP growth : $g(Y_t) = \Delta Y_t / Y_{t-1}$

* Expansion : $\Delta Y_t > 0 \iff g(Y_t) > 0$
* Recession : $\Delta Y_t < 0 \iff g(Y_t) < 0$

2-2: Unemp. Rate

- $\underbrace{L}_{\text{Labor Force}} = \underbrace{N}_{\text{employment}} + \underbrace{U}_{\text{unemp.}}$ $\qquad \underbrace{u}_{\text{unemp. rate}} = U/L \Rightarrow u = 1 - N/L$

- Unemp. directly affects welfare

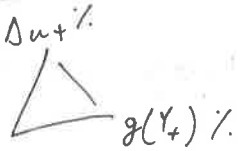
- u is a signal of efficient allocation of resources

2-3: Inflation Rate

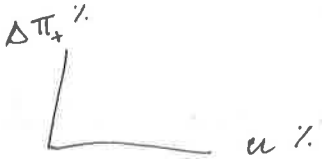
- GDP deflator = $\frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} \iff P_t = \frac{\$Y_t}{Y_t}$
- Inflation Rate $\equiv \pi_t = \Delta P_t / P_{t-1} = g(P_t)$
- CPI - cost in $ of specific list of goods & services
- GDP deflator moves with CPI

2-4: Okun's Law & Phillips Curve

- Okun's Law:



- Phillip's Curve:



CH. 3: The Goods Market

3-1: Composition of GDP

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

* G doesn't include gov. transfers (Medcare, Soc Security, interest payment on debt): G + transfers $\approx$ 39%

* US GDP 2010 data: $C \approx 70.5\%$, $I \approx 12\%$, $G \approx 20.4\%$, $NX \approx -3.$

* Production (Y) = Sales ($C+I+G+NX$) + inventory investment

$\approx 0.5\%$ (US 2010)

3-2: Demand for Goods

- Demand for goods: $Z \equiv C + I + G + X - IM$

* Assump's: 1). All firms produce 1 good.
2). All firms supply any Q @ given P.
3). Economy is closed $\Rightarrow$ $X = IM = 0$.

- Disposable income: $Y_D \equiv Y - T$

- Consumption: $C = c_0 + c_1 Y_D = c_0 + c_1 (Y - T)$

* $c_0 > 0$, $c_1 \equiv$ MPC

- Investment: Exogenous ($\bar{I}$)

- Gov. Spending: Exogenous (G, T)

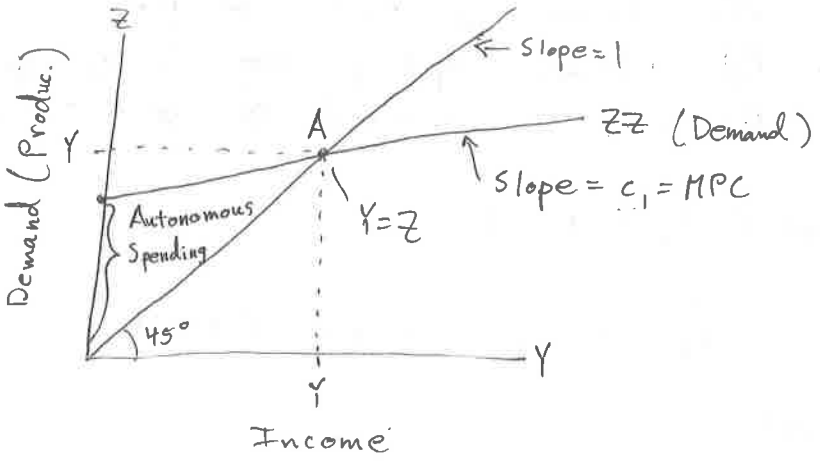
3-3: Determination of Equilibrium Output

- $Z \equiv C + I + G \Rightarrow Z = c_0 + c_1 (Y - T) + \bar{I} + G$
- Assume firms don't hold inventories: $Y = Z$
- $Y = c_0 + c_1 (Y - T) + \bar{I} + G$

- $Y = \underbrace{\frac{1}{1 - c_1}}_{\text{multiplier}} \underbrace{(c_0 + \bar{I} + G - c_1 T)}_{\text{autonomous spending}}$

* $G = T \Rightarrow$ Positive autonomous spending

- Keynsian Cross:



* Shifts in Demand/Produc. take time & result in bigger shift in Y by $1/1 - c_1$

* US MPC ≈ 0.6

3-4: Investment Equals Saving

- Private Saving (S): $S = Y_D - C = Y - T - C$
- Public Saving: $T - G$

* Budget Surplus: $T > G \iff T - G > 0$
* Budget Deficit: $T < G \iff T - G < 0$

- $Y = C + I + G \iff I = S + (T - G)$
  $\iff$ Investment = Private Saving + Public Saving
- Production = Demand $\iff$ Investment = Savings

* $S = -c_0 + (1 - c_1)(Y - T)$, $1 - c_1 \equiv MPS$

	Money	Bonds
Nominal Return	0	i
Real Return	$-E(\pi)$	$i - E(\pi)$

CH. 4 : Financial Markets

4-1 : Demand for Money

- Money : Currency (coins, bills) & Checkable deposits

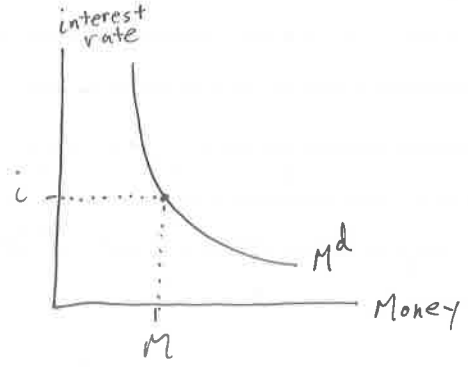
  * M1 = Currency + Checkable deposits

- Bonds : Pay interest rate i, but no transactions

- Ratio of money to bonds depends on level of transactions & interest rate on bonds

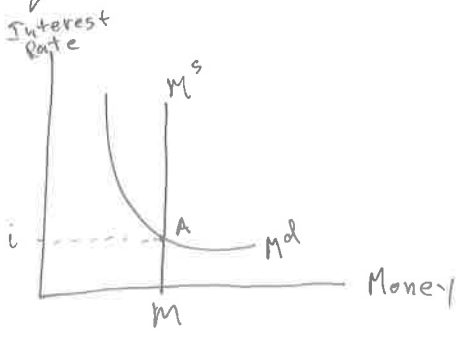
  * Money Market Mutual Funds

- Demand for Money : $M^d = \underbrace{\$Y}_{\text{nominal income}} \cdot f(i)$ ← decreasing function of i



4-2 : Determing Interest Rate (I)

- Equilibrium Condition & Shift effects :



  * ↑(↓) M^s ⇒ ↓(↑) i
  * ↑(↓) $\$Y$ ⇒ ↑(↓) i

- Monetary Policy & Open Market Operations:

1). Expansionary: Buying Bonds ($\uparrow M^s$)
2). Contractionary: Selling Bonds ($\downarrow M^s$)

* T-Bill: Gov. Bond w/ maturity $\leq$ 1 yr.

* $P_B = \frac{c}{1+i}$, $c \equiv$ bond payment

$\Rightarrow$ Inverse relationship between i & P_B

- Fed typically targets an interest rate & changes money supply to achieve this goal

4-3: Determing Interest Rate (II)

Balance Sheets:

1). Central Bank -

Assets	Liabilities
Bonds	Central Bank Money = Reserves + Currency

2). Banks -

↓ required to meet reserve ratio

Assets		Liabilities
Reserves		Checkable Deposits
(≈70%)	Loans	
(≈30%)	Bonds	

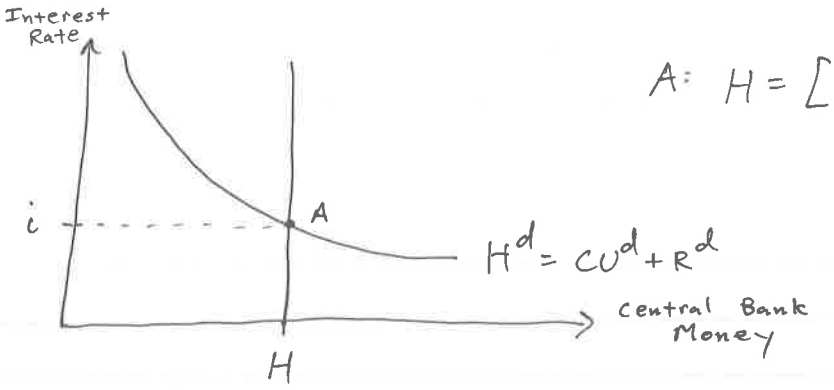
Currency Demand: $CU^d = c\,M^d$, Checkable Deposit Demand: $D^d = (1-c)\,M^d$

$R^d = \theta \cdot D^d$ (θ: reserve ratio; R^d: demand for reserves)

Demand for Central Bank Money: $H^d = CU^d + R^d$

$H^d = [c + \theta(1-c)]\,\$Y \cdot f(i$

Market for Central Bank Money



A: $H = [c + \theta(1-c)]\,\$Y \cdot f(i)$

4-4: 2 Alt. Ways of Equilibrium

Fed. Funds Rate: i^* determined in fed funds market

* $\underbrace{H - CU^d}_{\text{Supply of reserves}} = \underbrace{R^d}_{\text{Demand for reserves}}$

Overall Supply & Demand for Money:

(Supply of Money) (Demand for money)

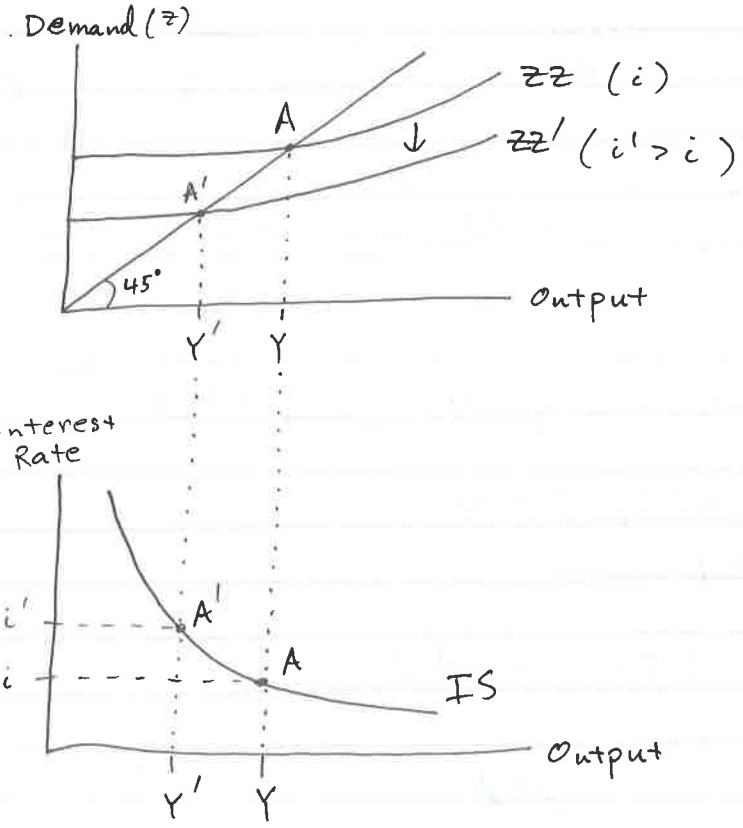
$$\frac{1}{[c + \theta(1-c)]}\,H = \$Y \cdot f(i)$$

$\frac{1}{[c+\theta(1-c)]}$: Money Multiplier; H: High-powered money / Monetary Base

CH.5: Goods & Financial Markets: IS-LM

5-1: Goods Market & IS Relation

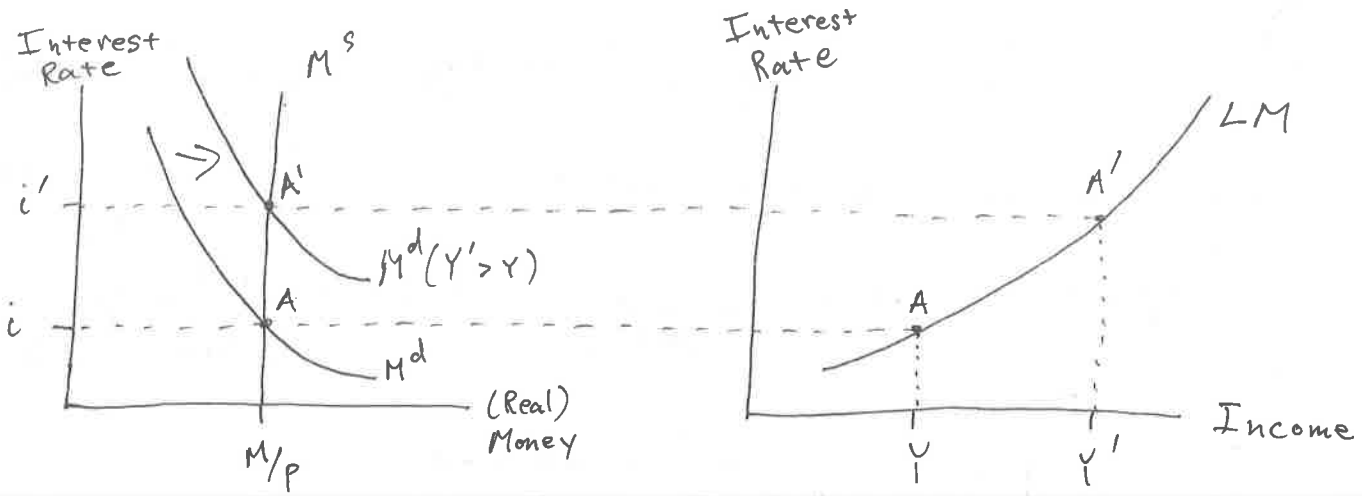
Equilibrium Condition: $\underbrace{Y}_{\text{(produc.)}} = \underbrace{C(Y-T) + I(Y, i) + G}_{\text{(Demand)}}$ (+, −)



* ↑(↓) Y ⇒ < 1 for 1 ↑(↓) Z
* ↑(↓) i ⇒ ↓(↑) Y
* Given i, ↑(↓) T ⇒ ↓(↑) Y
  ↑(↓) G ⇒ ↑(↓) Y

5-2: Financial Markets & LM Relation

$M = \$Y \cdot f(i) \iff \underbrace{M/P}_{\text{real money supply}} = \underbrace{Y \cdot f(i)}_{\text{real money demand}}$



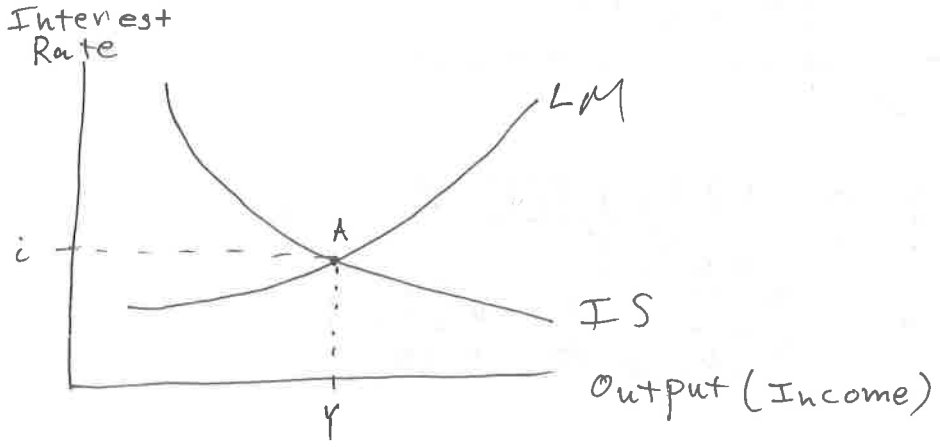
* i is increasing func. of Y
* $\uparrow(\downarrow)\ M^s \Rightarrow \downarrow(\uparrow)\ i \Rightarrow$ LM curve shifts down (up) for given Y

5-3: Putting IS & LM Together

IS: $Y = C(Y-T) + I(Y, i) + G$

LM: $M/p = Y \cdot f(i)$

IS-LM Model



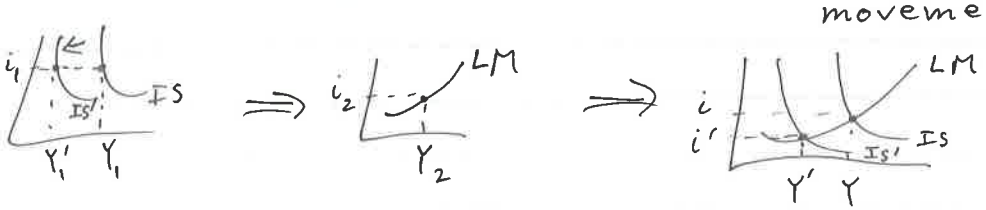
* In S.R., price level is given (empirically true) ↑ Ass. of IS-LM model
* $\exists!$ Interest Rate ↙
  (Short Term = Long Term)

- Fiscal Policy, Activity, & Interest Rate

* Fiscal Contraction (Consolidation): $\downarrow (G-T) \Longleftrightarrow \downarrow G, \uparrow T$
* Fiscal Expansion: $\uparrow (G-T) \Longleftrightarrow \uparrow G, \downarrow T$

Ex: $\uparrow(\downarrow) T \Rightarrow \downarrow(\uparrow) Y_D \Rightarrow \downarrow(\uparrow) C \Rightarrow \underbrace{\downarrow(\uparrow) Y \Rightarrow \downarrow(\uparrow) M^d \Rightarrow}$

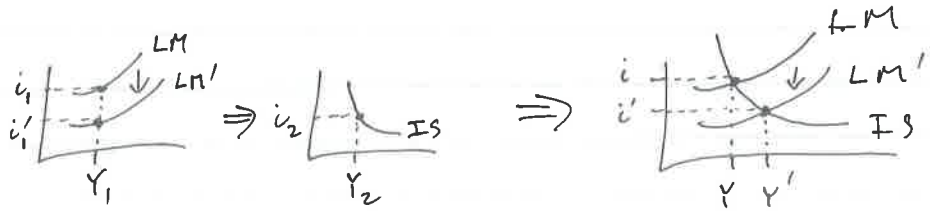
Not a shift, but movement along LM

$\uparrow T$: 

- Monetary Policy, Activity, & Interest Rate

Ex: Monetary Expansion $\rightarrow \uparrow M^s$

$\uparrow(\downarrow) M \Rightarrow \uparrow(\downarrow) \frac{M}{P} \Rightarrow \downarrow(\uparrow) i$, for given $Y \Rightarrow \uparrow(\downarrow) I \Rightarrow \uparrow(\downarrow) Y$

$\uparrow M$: 

- Summary Box:

	Shift of IS	Shift of LM	Movement in Output	Movement in Int. R
↑ Taxes	←	None	↓	↓
↓ Taxes	→	None	↑	↑
↑ Spending	→	None	↑	↑
↓ Spending	←	None	↓	↓
↑ Money	None	↓	↑	↓
↓ Money	None	↑	↓	↑

CH. 6: The Labor Market

6-1: Tour of Labor Market

- US pop. 2010: 308.7 M
- Noninstitutional civilian US pop. 2010: 237.8 M
- Labor force (US 2010): 153.8 M
- Participation Rate (US 2010): $\frac{153.8\text{ M}}{237.8\text{ M}} = 64.7\%$
- Unemployment Rate (US 2010): $U = 14.8$M, $E = 139$M $\Rightarrow u = \frac{14.8\text{M}}{153.8\text{M}} =$
- Flows occur due to separations & hires

6-2: Movements in Unemp.

- annual Δ's in u closely associated with recess./expans.
- effect of movements in agg. u on welfare of indiv. & effect of agg. u on wages determined together
- If u is high, workers are worse in 2 ways:
  1). ↑ P(losing job) for employed workers
  2). ↓ P(getting job) for unemployed " "

6-3: Wage Determination

- Collective Bargaining: bargaining between union & firm
- Reservation wage: wage that would make them indiff. between working or being unemp.
  * wage > reservation wage ⇒ ↓ turnovers, ↑TF
- Bargaining Power: depends on 2 factors
  1). Cost to replace worker
  2). How hard it would be to find another job

- Efficiency Wages: Theories that link productivity of workers to the wage paid
  * wages dependent on nature of job & labor-market conditions

$W \equiv$ agg. nominal wage, $P^e \equiv$ expected price level, $u \equiv$ unemp. rate, $z \equiv$ "all other factors"

$$W = P^e \cdot F(u, z)$$
$$\quad -, +$$

1). Expected Price Level:
   * Workers & Firms care about real wages (W/P)

2). Unemp. Rate: Inverse relationship to wage in both bargaining & efficiency wage theory

3). Other Factors: i.e. unemp. insurance, employment protection

6-4: Price Determination

- $Y = AN \iff$ Labor productivity $= A$ (N: employment)
  * if A constant, then can choose units of output s.t. $A=1$
  * if $A=1 \Rightarrow Y = N \Rightarrow MC = W$
  * Firms operate where $P > MC \Rightarrow P = (1+m)W$, $m > 0$

6-5: Natural Rate of Unemployment

Assume wage is dependent on P ($P^e = P$)

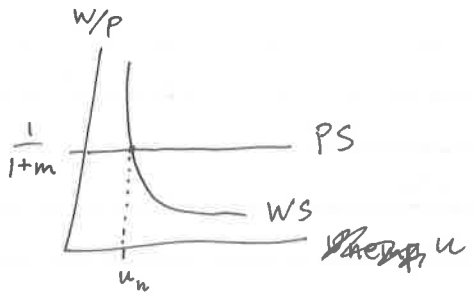
$\Rightarrow W = P \cdot F(u, z)$

$\Rightarrow \frac{W}{P} = F(u, z)$ ($-$, $+$) ← Wage-Setting Relation

Price-Setting Relation: $\frac{W}{P} = \frac{1}{1+m}$

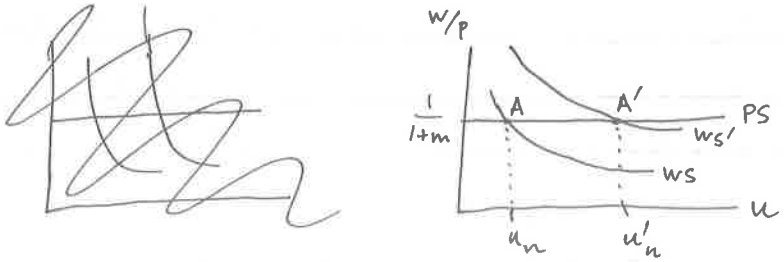
* $\uparrow(\downarrow)\, m \Rightarrow \downarrow(\uparrow)\, W/P$

∴ Equilibrium occurs when $F(u_n, z) = \frac{1}{1+m}$

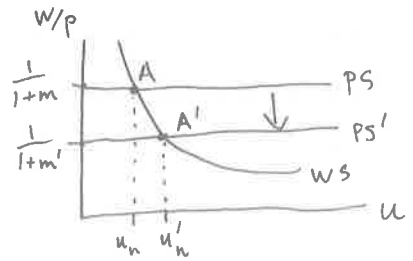


$u_n \equiv$ nat. rate of unemp. (equilib. u in PS-WS model)

1). ↑ unemp. benefits $\Rightarrow \uparrow z \Rightarrow \uparrow WS \Rightarrow \uparrow u_n$



2). ↓ enforcement of antitrust legislation $\Rightarrow$ ↑ market power (due easier collusion) $\Rightarrow \uparrow m \Rightarrow \downarrow PS \Rightarrow \uparrow u_n$

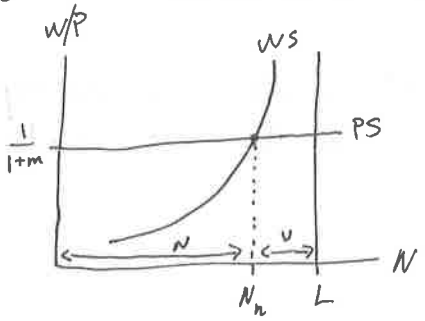


derived from $u = 1 - \frac{N}{L}$

- Natural level of employment: $N_n = L(1 - u_n)$
- Natural level of output: $Y_n = N_n = L(1 - u_n)$
- $F\left(1 - \frac{Y_n}{L}, z\right) = \frac{1}{1+m}$
- Critical assump's: ①. $P^e = P$, ②. $WS = PS$ in medium run

* In S.R. $P^e \neq P$ (usually) $\Rightarrow$ $u \neq u_n$ (usually)

- WS-PS relation to $L^S - L^D$:



WS: $\frac{W}{P} = F\left(1 - \frac{N_n}{L}, z\right)$

PS: $\frac{1}{1+m}$

* L^D (PS) is flat b/c of constant returns to scale ($Y = N$). If decreas. returns to scale, PS would be downward sloping

* Differences: ~~1). WS-PS determined by bargaining power~~ 2). WS-PS model

	WS-PS	$L^S - L^D$
①	w determined through bargaining	w given by willingness to work
②	Firms are price setters	Firms take prices & wages as given
③	involuntary U @ w/p*	voluntary U @ equilib. w/p

CH. 7: The AS-AD Model

7-1: Agg. Supply

- Derivation of AS:

1). $W = P^e F(u, z)$, $P = (1+m) W$

$\Rightarrow P = P^e (1+m) F(u, z)$

2). $u = 1 - \frac{N}{L}$, $Y = N$

$\Rightarrow u = 1 - \frac{Y}{L}$

$\therefore P = P^e (1+m) \cdot F\left(1 - \frac{Y}{L}, z\right)$

- Properties:

1). Given P^e, $\uparrow Y \Rightarrow \uparrow P$

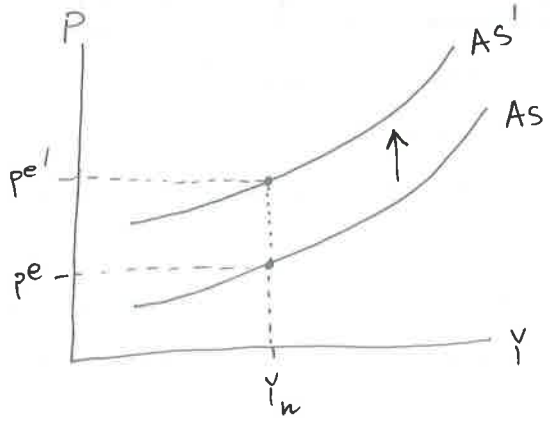
* $\uparrow Y \Rightarrow \uparrow N \Rightarrow \downarrow U \Rightarrow \downarrow u \Rightarrow \uparrow W \Rightarrow \uparrow P$

2). Given U, $\uparrow P^e \Rightarrow \uparrow P$ (one-for-one)

* $\uparrow P^e \Rightarrow \uparrow W \Rightarrow \uparrow$ costs $\Rightarrow \uparrow P$

3). $Y = Y_n \iff u = u_n \iff P = P^e$

4).



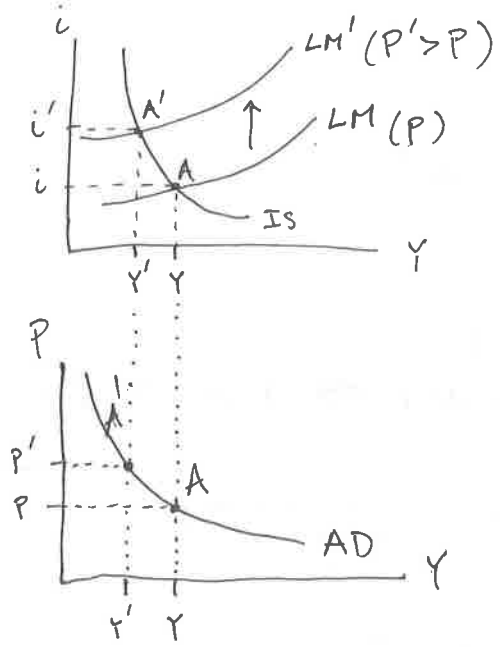
* $Y > Y_n \Rightarrow P > P^e$

* $Y < Y_n \Rightarrow P < P^e$

7-2: Agg. Demand

- Agg Demand Func.: $Y = Y\left(\frac{M}{P}, G, T\right)$ (+, +, −)

- Given M, G, T, $\uparrow(\downarrow) P \Rightarrow \downarrow(\uparrow) Y$
  * $\uparrow(\downarrow) P \Rightarrow \downarrow(\uparrow) M/P \Rightarrow$ LM curve shifts up (down) $\Rightarrow$ $\uparrow(\downarrow) i \Rightarrow \downarrow(\uparrow) Y$



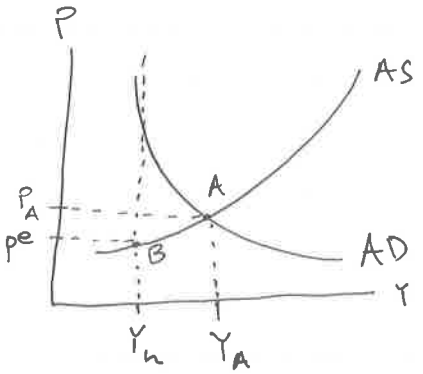
- Any variable (apart from price) that shifts IS and/or LM curves, shifts AD same direction

7-3: Equilibrium in S.R. & M.R.

- AS: $P = P^e(1+m) \cdot F(1 - \frac{Y}{L}, z)$
- AD: $Y = Y(\frac{M}{P}, G, T)$

- Equilibrium in S.R.

*

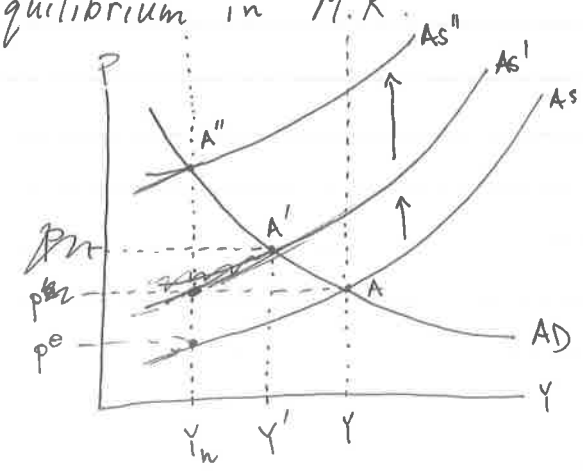


(No reason in S.R. for $Y = Y_n$ in equilibrium)

(If pt. is on AS curve, then Goods Market is in equilibrium) ∴

- Equilibrium in M.R.

*



(Adjustments work through changes in price level)

1). $Y_{\text{something}} > Y_n \Rightarrow \uparrow P^{\text{something}}$ until $P = P^e$

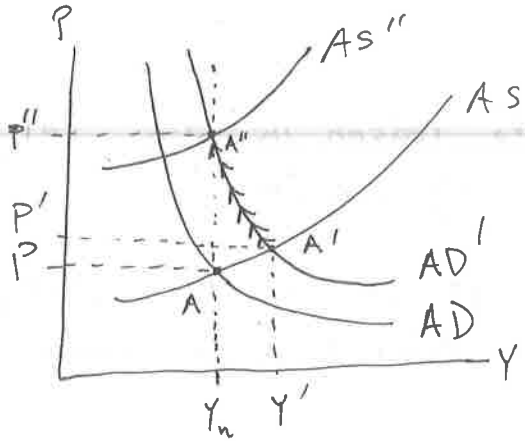
2). $Y < Y_n \Rightarrow \downarrow P$ until $P = P^e$

∴ In M.R., $Y = Y_n$ eventually

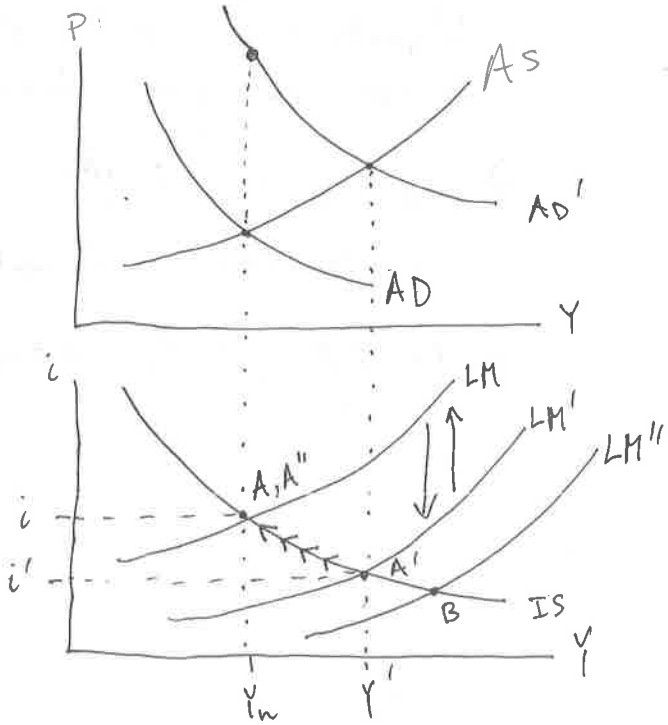
7-4: Effects of Monetary Expansion

In this example, examine effects of $\uparrow M$ to M'

$\uparrow M$ to $M' \Rightarrow \uparrow \frac{M}{P}$ to $\frac{M'}{P} \Rightarrow \uparrow Y \Rightarrow$ Shift out AD



"Behind the Scenes:"



Conclusion: S.R. Monetary Expansion - $\uparrow Y$, $\uparrow P$, $\downarrow i$

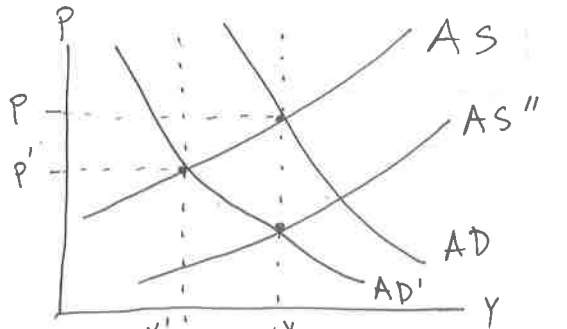
M.R. " " - $\uparrow\uparrow P$ (proportional to $\uparrow M$)

* Neutrality of Money - useful for getting out of recession & reaching Y_n.

7-5: Decrease in Budget Deficit

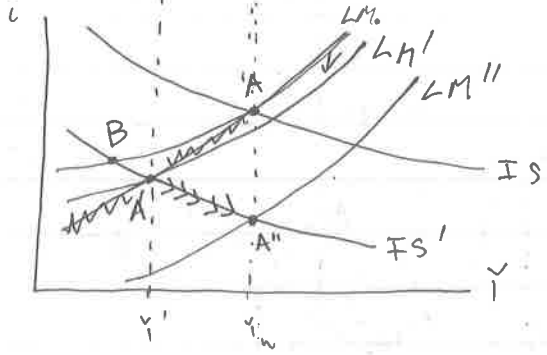
Suppose gov. running a deficit & wants to ↓G, $\Delta T = 0$

* Assume M constant ⇒ growth of $M = 0$



S.R. { 1). ↓G ⇒ AD shifts left ⇒ ↓Y, ↓P ~~S.R.~~

M.R. { 2). Since $Y' < Y_n$, AS shifts down ⇒ $Y = Y_n$, but ↓P (& i) ~~M.R.~~



S.R. { 1). ↓G ⇒ IS shift left ⇒ ↓Y, ↓P S.R.

2). Since ↓P, LM shifts down (If not, then would be @ pt. B)

M.R. { 3). Since $Y' < Y_n$, ↓P ⇒ ↑$\frac{M}{P}$ ⇒ LM shifts down more until $Y = Y_n$ ⇒ ↓P, ↓i

Conclusion: S.R. deficit reduc. ÷ ↓Y, ↓P, ↓i, ΔI?

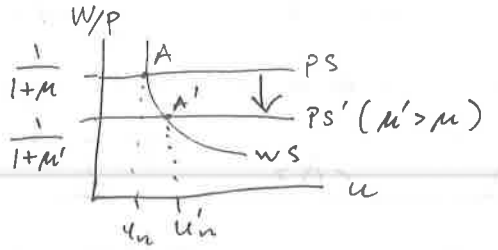
M.R. " " – $Y = Y_n$, ↓P, ↓i, ↑I

* I must ↑ b/c only G ↓ since $Y = Y_n$ & $\Delta T = 0$
* "Composition of GDP changes"

7-6: Increase in Price of Oil

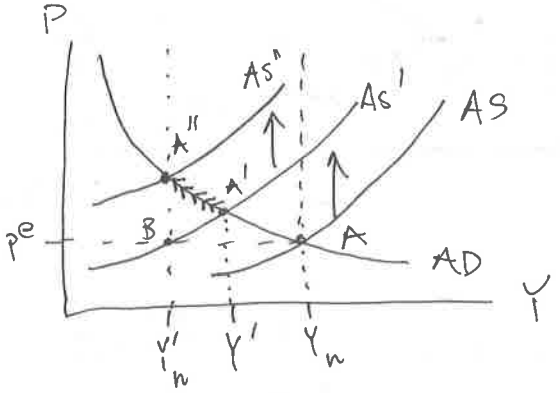
- ↑ Real price of oil ⇒ ↑ costs of production
  ⇒ ↑ μ (markup), given wages

- Effects on u_n:



* Assume ↑price of oil is permanent
Then, ↑ μ ⇒ ↓ real wage (W/P)
⇒ ↑ nat. rate of unemp. (u_n)
⇒ ↓ nat. level of emp. (N_n)
⇒ ↓ nat. rate of output (Y_n)

- Dynamics of Adjustment:



* Given P^e, in S.R., AS shifts to A' (passing thru B)

* if ↑oil price permanent, in M.R., AS shifts to A''

- Why 2000's were diff than '70s?

* In general, ↑oil price ⇒ ↓ Y, ↑ π

* 2 theories: 1). today, workers have less bargaining power, so are willing to accept ↓W (limits ↑shift in AS)

2). monetary policy: P^e not as high due to confidence in Fed

Ch. 8: Phillips Curve, Nat. Rate of Unemp., & π

8-1: π, π^e, & Unemployment

- $F(u,z) = 1 - \alpha u + z \Rightarrow P = P^e(1+m)(1-\alpha u + z)$
  $\Rightarrow \pi = \pi^e + (m+z) - \alpha u$

* $\uparrow \pi^e \Rightarrow \uparrow \pi$
* Given π^e, $\uparrow m$ or $\uparrow z \Rightarrow \uparrow \pi$
* Given π^e, $\uparrow u \Rightarrow \downarrow \pi$

- Time subscripts: $\pi_t = \pi^e_t + (m+z) - \alpha u_t$

8-2: Phillips Curve

- Solow, Samuelson, Phillips early version: $\pi_t = m + z - \alpha u_t$ $(\pi^e_t = 0)$
  * wage-price spiral

- 1970's, Phillips curve broke down: Inflation started to gain momentum & became persistent. Inflation stayed positive & peoples' expectations changed to $\pi^e_t > 0$.

* $\pi^e_t = \theta \pi_{t-1}$ (Samuelson-Solow time: $\theta \approx 0$, mid-1970's: $\theta \approx 1$)

* 1970-2010: $\pi_t - \pi_{t-1} = 3.3\% - 0.55 u_t$ (Expectations-Augmented / Accelerationist Phillips Curve)

- Phillips Curve & Nat. Rate of Unemp.

* Friedman, Phelps argued that neg. relationship between inflation and unemp. exists only if wage setters continuously underpredict inflation

* tradeoff cannot be sustained & eventually economy will achieve u_n.

* $\underline{u_n} \iff P^e = P \iff g(P^e) = g(P) \iff \underline{\pi^e = \pi}$

$\Rightarrow$ So, $0 = (m+z) - \alpha \cdot u_n$

$\Rightarrow u_n = \frac{m+z}{\alpha}$

Also, rewrite Phillips Curve $\rightarrow \pi_t - \pi_t^e = -\alpha\left(u_t - \frac{m+z}{\alpha}\right)$

$\Rightarrow \boxed{\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)}$

* $u_t < u_n \Rightarrow \pi_t > \pi_{t-1}$
* $u_t > u_n \Rightarrow \pi_t < \pi_{t-1}$
* u_n called NAIRU ($\simeq$ 6% from 1970's - 2000's)

· Neutrality of Money

* AD: $Y = Y\left(\frac{M}{P}, G, T\right)$

$\Rightarrow Y_n = Y\left(\frac{M}{P}, G, T\right)$

If Y_n constant, RHS must be constant.
If unchanged fiscal policy, $\frac{M}{P}$ is constant

$\therefore$ In M.R., $\pi = g_M$

* Factors that change price level (unless they affect g_M) have no effect on π in M.R.

8-3: A Summary & Many Warnings

- 1979: Paul Volcker in charge of how fast to reduce inflation ($\approx 10\%$)

$\Rightarrow$ Had to tighten monetary policy, $\downarrow g_Y$, $\uparrow u$

1). Some argued tradeoff would be costly

2). Lucas Critique: argued that wage setters would change expectations admist policy chang No major tradeoff would happen, given "credibility" of monetary policy

- Wage indexation model:

Model where wage contracts $\uparrow$ wages in line w/ π

Assume λ of labor contracts are indexed.

Assume $1-\lambda$ " " " are <u>not</u> indexed.

$$\pi_t = [\lambda \pi_t + (1-\lambda)\pi_t^e] - \alpha(u_t - u_n)$$

$$\pi_t = [\lambda \pi_t + (1-\lambda)\pi_{t-1}] - \alpha(u_t - u_n)$$

* $\lambda = 0 \Rightarrow$ All wages based on $\pi_t^e = \pi_{t-1}$

$\Rightarrow \Delta\pi_t = -\alpha(u_t - u_n)$

* $\lambda > 0 \Rightarrow \Delta\pi_t = -\frac{\alpha}{1-\lambda}(u_t - u_n)$

$\Rightarrow$ Wage indexation $\uparrow$ effect of u_t on π_t

* $\lambda \approx 1 \Rightarrow$ large changes in inflation have little impact on unemp.

- Deflation tends to "break" Phillips Curve relationsh

Ch. 9: The Crisis

9-1: From Housing Problem to Financial Crisis

- Housing Prices & Subprime Mortgages:
  - Housing prices measured by Case-Shiller Index
  - 2000 - 2006: Sharp ↑ price due to...
    1). Low interest rates ⇒ Low Mortgage Rates ⇒ ↑ Demand hous
    2). ↑ Subprime mortgages by 20%
  - 2006 - 2009: Sharp ↓ price
    * Mortgages were underwater (Value of mortg. > Value of house
    * Too many NINJA loans (very risky mortgages)

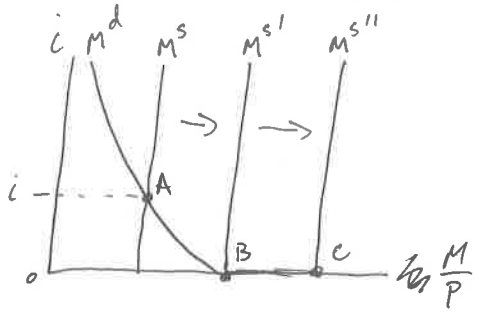
- Role of Banks:
  - Focus on role as financial intermediaries
  - Assets = Liabilities + Capital
    * Insolvency: $A < L$
    * Illiquidity: ↑ liquidity in liabilities or ↓ liquidity in asse
  - Leverage:
    - Capital Ratio = $\frac{C}{A}$
    - Leverage " " = $\frac{A}{C}$
      * High Lev. Ratio ⇒ ↑ Expected profits & ↑ insolvency cha
  - Complexity:
    - Growth of securitization in '90s & 2000s (bundled asset
    - MBS (mortgage-based security): bundles of mortgages
    - CDO (collaterized debt obligations):
      1). Senior Securities - 1st claim on returns from bundle
      2). Junior " " - come after if anything left after
    - Hard to assess value of bundles in a MBS
      * If underlying Mortgage in bundle went bad, MBS labeled toxic asset

- Liquidity:
  - Wholesale Funding - banks borrowing from other banks or investors (via short-term debt) to finance purchase of assets
  - Fire sale price - very low price of asset being sold due to illiquidity
- Amplification Mechanisms:
  - ↓ P of houses, ↑ bad mortgages ⇒ ↑ Lev. Ratio ⇒ ↓ Capital ⇒ ↑ Sale of Assets ⇒ Fire sale prices (due to difficulty in valuation) ⇒ ↓ value of similar assets ⇒ etc...
  - Complexity of securitization made solvency assessment difficult
    - ↓ wholesale funding
    - Ted spread = riskless rate (rate of 3-month US T-bill) − Libor rate (rate of bank-bank loans)
      * Usually between 0 & 1, but spiked mid '07 - 08.

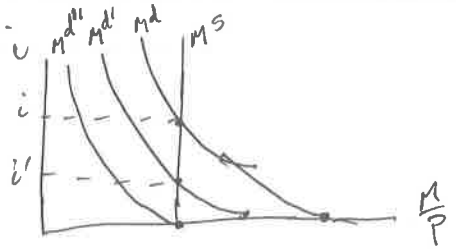
9-2: Use and Limits of Policy

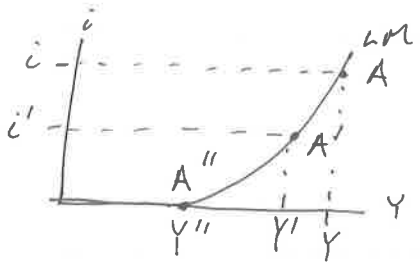
- Interest Rates on AAA/BBB firm borrowing spiked relative to rate ~~of~~ controlled by monetary policy (10-yr. U.S. T-bill)
- Sharp ↓ in confidence, housing/stock price ⇒ ↓ Consump.
- Initial Policy Responses:
  1). F.D.I. ↑ from $100K to $250K, Gov. guaranteed new debt issues
  2). Fed ↑ liquidity of bank assets by setting up liquidity Facilities & ↑ amount of collateral
  3). TARP: tried to assess price of complex assets but failed. Instead gov. ↑ capital ratio
  4). Fed became largest purchaser of MBS
  5). Fed ↓ T-Bill interest rate ≈ 0%.
  6). A.R.R.A.: ↓ T, ↑ G_t ⇒ ↑ demand, ↑ deficit from 1.7% to 9%.

- Limits of Monetary Policy: Liquidity Trap

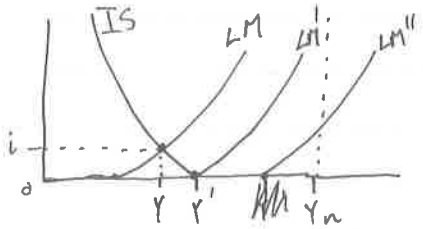


- LM curve derivation under Liquidity trap:



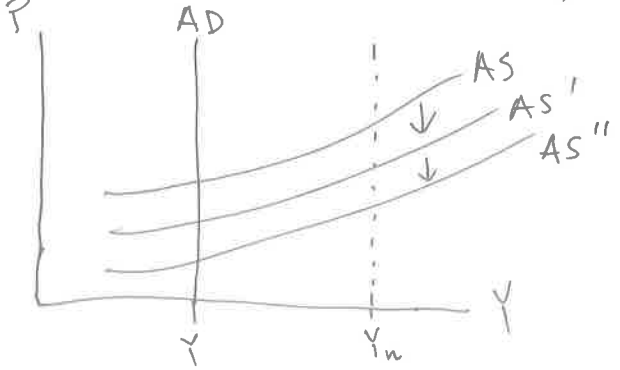


- IS-LM under Liquidity Trap:



- When conventional monetary policy ineffective to ↑ Y, Fed may use credit easing / quantitative easing (only have small overall effect)

- AD-AS under Liquidity Trap:



* AD perfectly inelastic since ↑ $\frac{M}{P}$ doesn't affect i.
⇒ $Y = Y(G, T)$ [not $Y = Y(\frac{M}{P}, G, T$

Ch. 23: Fiscal Policy

23-2: Gov. Budget Constraint

- Arithmetic: $\underbrace{D_t}_{\text{deficit}} = r\underbrace{B_{t-1}}_{\text{gov. debt}} + G_t - T_t$

* r is Real interest rate

* Gov. Budget Constraint: $\Delta B_t = D_t$

$$\Rightarrow \underbrace{\Delta B_t}_{\substack{\text{change} \\ \text{in debt}}} = \underbrace{r B_{t-1}}_{\substack{\text{Interest} \\ \text{Payments}}} + \underbrace{(G_t - T_t)}_{\substack{\text{Primary} \\ \text{Deficits}}}$$

$$\therefore B_t = (1+r) B_{t-1} + (G_t - T_t)$$

- Current vs. Future Taxes:

- Assume $B_0 = 0$, $B_1 = 1$ (i.e. tax cut by \$1 B)
- Full Repayment in $t=2$ ($B_2 = 0$):
  $B_2 = (1+r) B_1 + (G_2 - T_2) \Rightarrow T_2 - G_2 = 1+r$
  * Implies, if ↓T by 1 in yr. 1, ↑T by (1+r) in yr. 2
- Full Repayment in t ($G_k - T_k = 0$, $k = 2, \dots, t-1$), ($B_t = 0$)
  $B_2 = (1+r) \cdot 1 + 0 = 1+r$
  $B_3 = (1+r) \cdot (1+r) \cdot 1 + 0 = (1+r)^2$
  $\vdots$
  $B_{t-1} = (1+r)^{t-2}$

  $B_t = (1+r) \cdot (1+r)^{t-2} + (G_t - T_t) \Rightarrow T_t - G_t = (1+r)^{t-1}$
  * Implies, ↑t, ↑r ⇒ ↑T in future t

- Debt Stabilization in yr. t:
  - * Legacy of past deficits is ~~$\uparrow B_{t+1}$~~ $\uparrow B_t$
  - * To stabilize ~~B_{t+1}~~ B_t, gov. must make $D_t = 0$
  - * To make $D_t = 0$, $T_t - G_t = (1+r)^{t-1} - \uparrow$, where $\uparrow \equiv$ tax cut (in prev. ex., $\uparrow = 1$)

- Evolution of Debt-to-GDP ratio:
  - * Denote $\frac{\Delta Y_t}{Y_{t-1}} = g$, $\frac{(1+r)}{(1+g)} \approx 1 + r - g$

~~Then~~ Then, $B_t = (1+r) B_{t-1} + (G_t - T_t) \Rightarrow$

$$\Delta \frac{B_t}{Y_t} = (r-g) \frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}$$

23-3: Ricardian Equivalence, Cyc. Adj. Deficits, War Finance

- Ricardian Equivalence:
  - * Assumptions: 1). Families act as infinitely lived dynasties & are altruistic
    2). Perfect capital markets (i.e. borrow/lend at single rate)
    3). Path of gov. debt is fixed

$\Rightarrow$ Consumers internalize gov. budget constraint & consequently, timing of taxes doesn't affect spending

$\Leftrightarrow$ Gov. can finance spending by debt OR $\uparrow T$ since level of demand is same

- Deficits, Output Stabilization, & Cyclically Adj. Deficit:
  - Cyc. Adj. Deficit used to measure fiscal policy as a benchmark when $Y = Y_n$. If Cyc. Adj Def. is 0, then deficit is stabilized
- Wars & Deficits
  - Wars lead to large deficits:
    1). Pass on Burden to future gen.
    2). Tax smoothing - LARGE deficits when gov. spending is really high & SMALL surpluses rest of time

23-4: Dangers of High Debt

- Goal must be to not only stabalize $\Delta \frac{B_t}{Y_t}$, but decrease it over time
- Options of default
  - Creditors must take haircut
  - Has severe implications abroad & domestically
- Money Finance:
  - Fiscal dominance: Gov. dominates Fed
  - Debt monetization: Gov. tells Central bank to buy its bonds through money creation, then uses that $$ to finance debt
  - ΔH = money creation (Δ in nominal money stock)
    $\frac{\Delta H}{P}$ = seignorage (revenue from money creation in real terms)

- seignorage = $\underbrace{\frac{\Delta H}{H}}_{\text{rate of nominal \$ growth}} \cdot \underbrace{\frac{H}{P}}_{\text{real money stock}}$

- $\frac{\text{seignorage}}{Y} = \frac{\Delta H}{H} \cdot \left(\frac{H/P}{Y}\right)$

  * Avg. ratio of real central bank $ to GDP ≈ 1

∴ To finance deficit of x% of GDP through seignorage,

$\frac{D_+}{Y_+} = \frac{S_+}{Y_+} = x\% \Rightarrow \frac{S_+}{Y_+} = \frac{\Delta H}{H} \Rightarrow g(H) = x\%$.

  * But, generally, as $\uparrow g(H)$, $\uparrow H/P \Rightarrow$ hyperinflation

CH. 10: Facts of Growth

10-1: Measuring Stnd. of Living

- Want to use country's output/capita
- How to compare across countries?
  - Currency exchange rates not useful ☹
    1). Large fluctuations
    2). ↓ output/capita associated w/ ↓ $P of food/service
  - PPP (Purchasing Power Parity) useful ☺
- useful to measure productivity

- Can also use consumption/capita, since we care about peoples' welfare

10-2: Growth in Rich Countries since 1950

- Does $$ lead to happiness?
  - Happiness is strongly correlated w/ income
  - What might matter is not level of income, but distribution of income

- Large ↑ stnd. of living since 1950

- Convergence of output/person since 1950

10-3: Broader Look across time & space

- Malthusian Trap: Europe had proportional ↑ in output & population from end of Roman Empire to 1500
  $\Rightarrow \Delta Y/N \approx 0$
- 4 Tigers: Singapore, Hong Kong, S. Korea, Taiwan
  * Convergent Y/N asian countries

10-4: A Primer

- Agg. Prod. func.: $Y = F(K, N)$ (+, +)
  - * state of technology determines Y across countries, given same K, N.
- Cons. Returns to Scale: $xY = F(xK, xN)$
  - * $x = \frac{1}{N} \Rightarrow \frac{Y}{N} = F(\frac{K}{N}, 1)$
  - * Decreasing marginal inputs
- Source of Growth:
  1). Capital Accumulation & Tech. Progress
  2). Savings rate - important to ↑ level of output, but cannot sustain permanent ↑ growth of Y

CH. 11: Saving, Capital, Accumulation, & Output

11-1: Interactions between Y & K

Effects of Capital on Output: $\frac{Y_t}{N} = F\left(\frac{K_t}{N}, 1\right) = f\left(\frac{K_t}{N}\right)$

* Assume N is constant $\forall t$

Effects of Output on Capital Accumulation

- Output & Investment: $I = S + (T - G)$
  * Assume closed economy
  * Assume Public Savings are $0 \Rightarrow I = S$
  * " " Private Savings $\propto$ Income $\Rightarrow S = sY$
  $\therefore I_t = sY_t$

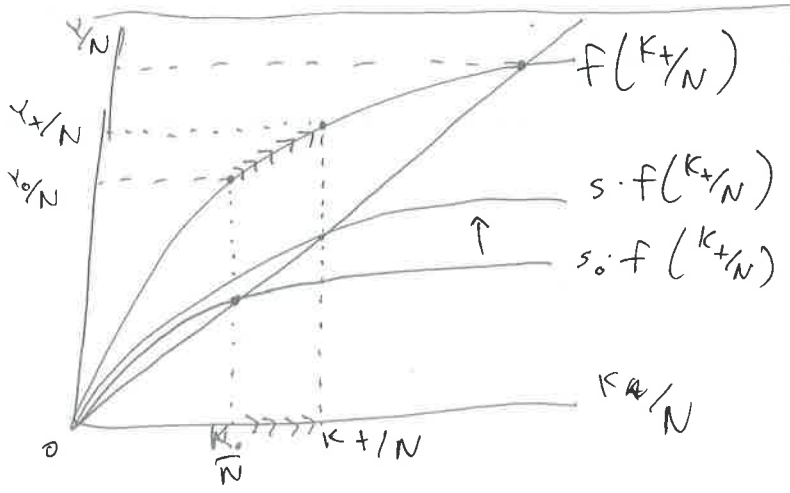
- Investment & Capital Accumulation: $K_{t+1} = (1-\delta)K_t + I$

$\Rightarrow \frac{K_{t+1}}{N} = (1-\delta)\frac{K_t}{N} + s\frac{Y_t}{N}$

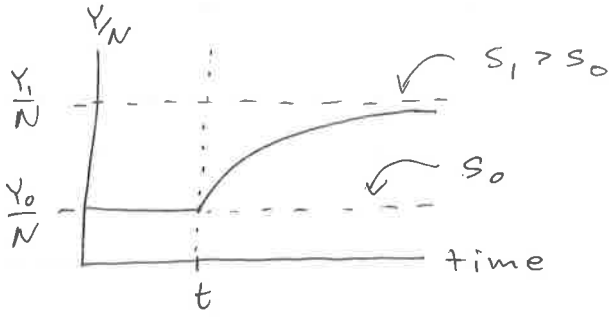
$\Rightarrow \Delta\frac{K_{t+1}}{N} = s\frac{Y_t}{N} - \delta\frac{K_t}{N} = s \cdot f\left(\frac{K_t}{N}\right) - \delta \cdot \frac{K_t}{N}$

$\Rightarrow$ " Change in capital tomorrow = Investment today − Depreciation today "

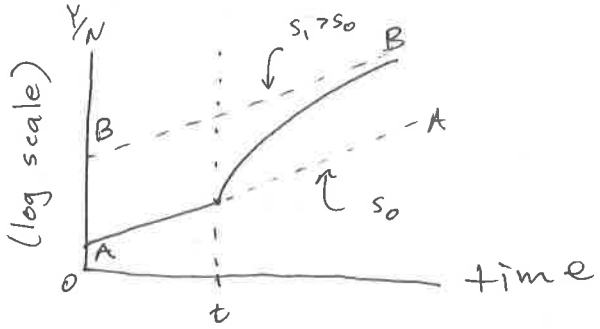
11-2: Alternative Savings Rate



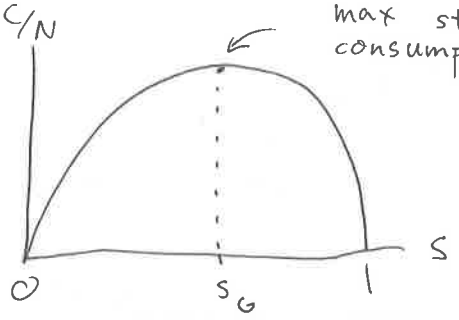
- Effect of ↑ s on Y/N (w/o Tech. Progress)



- Effect of ↑ s on Y/N (w/ Tech. Progress)



- Golden-rule level of capital:



11-3: Magnitudes

- Assume $Y = \sqrt{KN}$

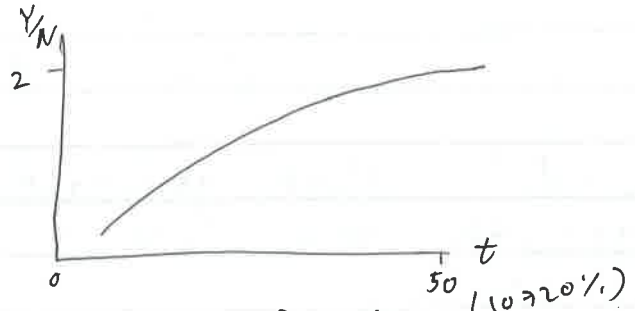
$$\Rightarrow \frac{Y}{N} = \sqrt{\frac{K}{N}} \Rightarrow f\left(\frac{K_t}{N}\right) = \sqrt{\frac{K_t}{N}}$$

$$\therefore \Delta \frac{K_t}{N} = s\sqrt{\frac{K_t}{N}} - \delta \frac{K_t}{N}$$

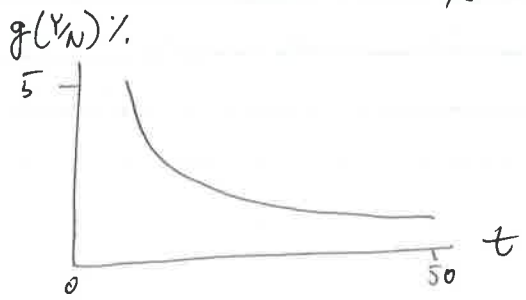
$$\Rightarrow s\sqrt{\frac{K^*}{N}} = \delta \frac{K^*}{N} \Rightarrow s^2 \frac{K^*}{N} = \delta^2 \frac{K^{*2}}{N^2}$$

$$\therefore \frac{K^*}{N} = \left(\frac{s}{\delta}\right)^2, \quad \frac{Y^*}{N} = \frac{s}{\delta}$$

- Effect of $\uparrow s$ ($10 \to 20\%$) on level of Y/N:



- Effect of $\uparrow s$ ($10 \to 20\%$) on growth of Y/N:



- US saving Rate & Golden Rule:
  - In steady state, $\frac{C}{N} = \frac{Y}{N} - \delta \frac{K}{N}$

$$\Rightarrow \frac{C}{N} = \frac{s}{\delta} - \delta\left(\frac{s}{\delta}\right)^2 = \frac{s(1-s)}{\delta}$$

$$\therefore \frac{C}{N} \text{ maximized when } s = \tfrac{1}{2}$$

11-4: Physical vs. Human Capital

H = human capital

$$\frac{Y}{N} = f\left(\frac{K}{N}, \frac{H}{N}\right)$$
$$+ \quad , \quad +$$

* measure H by relative wages ~~i.e.~~
  i.e. $H = \sum_{i=1}^{n} h_i w_i$, $\sum_{i=1}^{n} L_i = N$
  * L_i is laborers of type "i"
  * w_i is wage of laborer of type "i"
    * Controversial to use relative wage since they reflect relative marginal product

Endogenous Growth: models that generate steady growth even w/o technological progress

↑ s &/or ↑ education/training can lead to ↑ level of output/N in L.R., but not permanent ↑ $g\left(Y/N\right)$

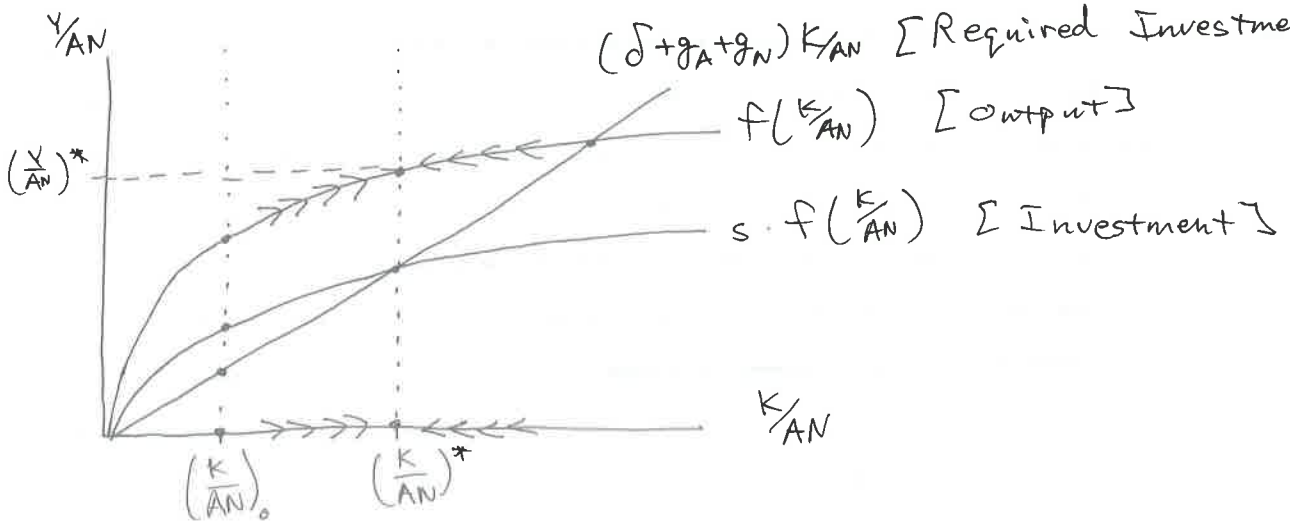
CH. 12: Tech Progress & Growth

12-1: Tech Progress & Rate of Growth

Tech Progress & Produc. Func.:

- A = state of technology
- $Y = F(K, N, A)$
  - $+, +, +$
  - * $Y = F(K, AN)$
    1). Tech progress ↓ workers needed to produce, given output
    2). Tech progress ↑ output, given workers
- Assume c.r.s.
  - * $xY = F(xK, xAN) \Rightarrow \frac{Y}{AN} = F(\frac{K}{AN}, 1) = f(\frac{K}{AN})$
  - * Output/effective worker is func. of capital/ " " " "

- Interactions between Output & Capital



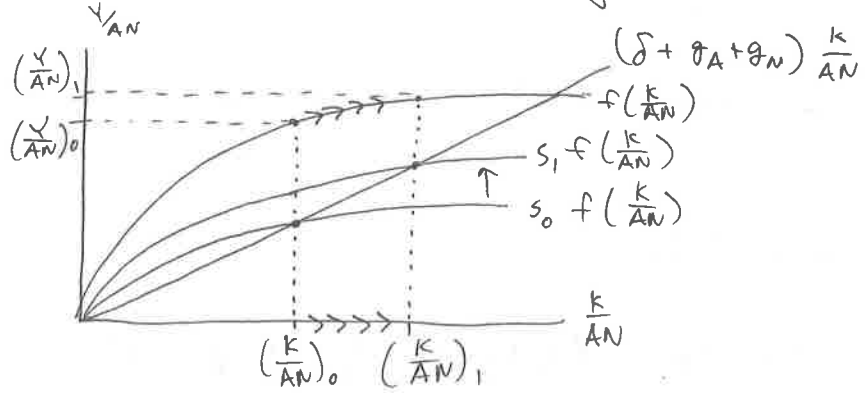
Dynamics of Capital & Output:

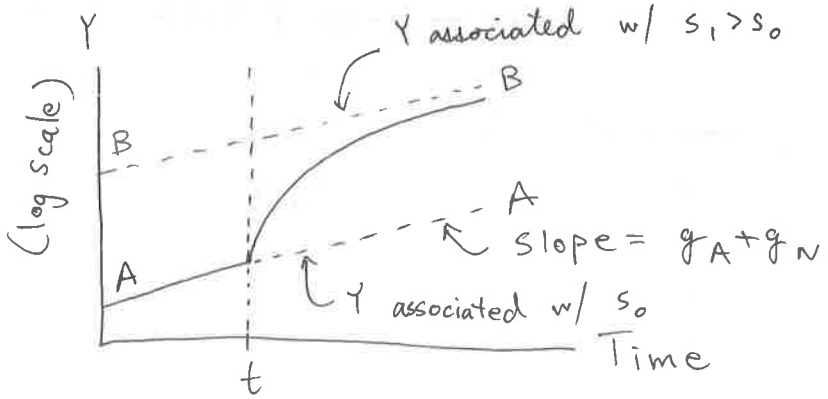
- Steady state of economy in L.R. is where capital/effec. worker is const. $\xi = \left(\frac{K}{AN}\right)^*$,
  output/ " " " " " " " " $= \left(\frac{Y}{AN}\right)^*$

$$\Rightarrow \left(\frac{K}{AN}\right)^* = c_1 \Rightarrow g\left(\frac{K}{AN}\right)^* = 0 \Rightarrow g(K^*) = g(A^*) + g(N^*)$$
$$\Rightarrow \left(\frac{Y}{AN}\right)^* = c_2 \Rightarrow g\left(\frac{Y}{AN}\right)^* = 0 \Rightarrow g(Y^*) = g(A^*) + g(N^*)$$

- Therefore in steady state, $g(K^*) = g(Y^*) = g(AN)^*$
  * $g(Y^*)$ independent of s
  ~~* $g\left(\frac{K}{N}\right)^* = g(A)$, $g\left(\frac{K}{N}\right)^* = g($~~
  * $g\left(\frac{Y}{N}\right)^* = g\left(\frac{K}{N}\right)^* = g(A^*)$

- Effects of Saving Rate





* $g(Y^*)$ indep. of s, but s affects $\left(\frac{Y}{AN}\right)^*$
* ↑ s, for some time ⇒ ↑ $g(Y)^*$

CH. 18: Openness

18-1: Openness in Goods Markets

- Exports & Imports:
  - US economy has grown more open
  - US tends to have $NX < 0$
  - Good index of "openness" is proportion of agg. output composed of tradable goods (Export Ratio)

- Choice between domestic goods & foreign goods:
  - Consumers face 2nd decision (buy domestic or foreign)
  - Real exchange rate: price of domestic goods relative to foreign goods
    - * Newspapers don't report this. They observe nominal

- Nominal Exchange Rates:
  - Can be expressed in 2 ways - i.e. (2011) $\$1 = £0.61$, $£1 = \$1.63$
  - * In this course will use $\$1 = \ldots$ (denoted by E)
  - Appreciation: ↑ domestic currency ⇒ ↑ E
  - Depreciation: ↓ " " " " ⇒ ↓ E
  - Fixed Exchange Rates:
    - Revaluations (↑), Devaluations (↓)

- From Nominal to Real Exchange Rates
  - $P \equiv$ GDP deflator (US), $P^* \equiv$ GDP deflator (other country)
  - ∴ Real Exchange Rate: $\mathcal{E} = \frac{E \cdot P}{P^*}$
    - * index ⇒ not super informative
    - * rate of change is informative
      1). Real Appreciation: ↑ $\mathcal{E}$
      2). Real Depreciation: ↓ $\mathcal{E}$
  - Real & Nominal Exchange Rates tend to move together (but don't ha to

↖ ($\pi = \pi^* \iff \mathcal{E}$ & E move together)

- From Bilateral to Multilateral Exchange Rates:
  - Must consider multiple trading countries
  - Multilateral real exchange rate $\iff$ trade-weighted r.e.r. $\iff$ effective r.e.r.

18-2: Openness in Financial Markets

- Allows 2 things:
  1). Large Volume ($\approx \$4$ T/day) of foreign exchange
  2). Ability to finance trade deficits & have surpluses

- Balance of Payments:
  1). Current Account (above the line)
    a). Trade balance = Exports - Imports
    b). Net income = Income received - Income paid
    c). Net transfers = Foreign aid given - Foreign aid paid
    * Surplus $\Rightarrow$ (a)+(b)+(c) > 0 / Deficit $\Rightarrow$ (a)+(b)+(c) < 0
  2). Capital Account (below the line)
    - Capital Account balance (net capital flows) = ↑ foreign holdings of domestic assets − ↑ domestic " " " foreign " "
    - Surplus $\Rightarrow > 0$, Deficit $\Rightarrow < 0$
    - Statistical discrepancy = Current Acct. − Capital Acct.
- GNP = GDP + NI (net income)
  * Usually NI is small

2/4

Choice between Domestic & Foreign Assets:

· Uncovered interest parity: $(1+i_t) = (1+i_t^*)\cdot\left(\frac{E_t}{E_{t+1}^e}\right)$

* Assume investors only care about highest expected retu

Interest Rates & Exchange Rates:

· $(E_{t+1}^e - E_t)/E_t \equiv$ rate of domestic currency appreci

$$\Rightarrow (1+i_t) = \frac{(1+i_t^*)}{\sum 1 + (E_{t+1}^e - E_t)/E_t \}}$$

$$\Rightarrow i_t \approx i_t^* - (E_{t+1}^e - E_t)/E_t$$

* All due to arbitrage by investors
* $E_{t+1}^e = E_t \Rightarrow i_t = i_t^*$
* Domestic & foreign interest rates tend to move together
  (unless countries will tolerate large movement in exchange rate)

CH. 19: GOODS Market in Open Economy

19-1: IS Relation in Open Economy

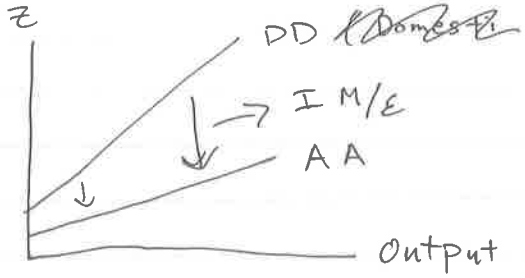
Demand for Domestic Goods:

$$Z \equiv C + I + G - \frac{IM}{\varepsilon} + X$$

$$C + I + G = C(Y - T) + I(Y, r) + G$$
$$\qquad\qquad\quad (+) \qquad\quad (+, -)$$

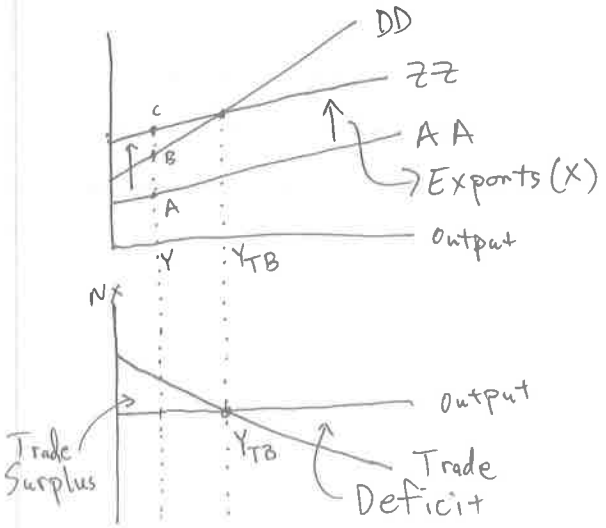
$$IM = IM(Y, \varepsilon)$$
$$\qquad\quad (+, +)$$

$$X = X(Y^*, \varepsilon)$$
$$\qquad\quad (+, -)$$



DD ≡ Domestic Demand ($C+I+G$)
AA ≡ Domestic Demand for domestic Goods ($\frac{IM}{\varepsilon}$ subtracted)

* AA flatter than DD
* Some additional demand falls on domestic goods ⇒ AA has pos. slope



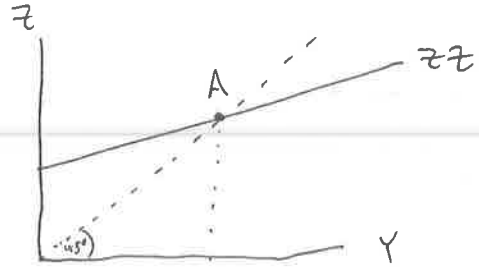
* $AC = X$
* $AB = IM/\varepsilon$

* $Y < Y_{TB} \Rightarrow NX > 0$
  $\Rightarrow X > IM/\varepsilon$
  $\Rightarrow$ Trade surplus
* $Y > Y_{TB} \Rightarrow NX < 0$
  $\Rightarrow X < IM/\varepsilon$
  $\Rightarrow$ Trade deficit
* $Y = Y_{TB} \Rightarrow NX = 0$

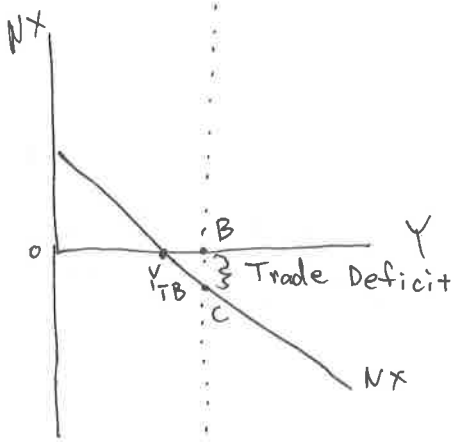
19-2: Equilib. Output & Trade Balance

- $Y = Z$ (equilib. cond'n.)

$$Y = C(Y-T) + I(Y, r) + G - IM(Y, \varepsilon)/\varepsilon + X(Y^*, \varepsilon)$$



* Doesn't have to be case that ~~$Y_{TB} = 0$~~ $Y = Y_{TB}$ ($NX = 0$) at equilibrium

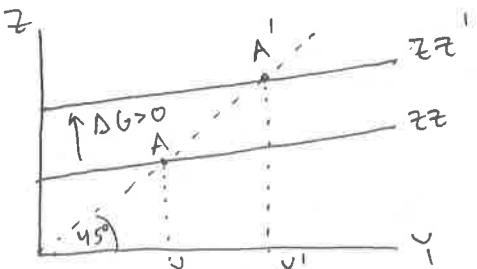


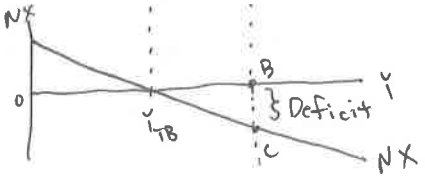
19-3: Increased Demand, Domestic / Foreign

- Increase in Domestic Demand:

Assume $Y_1 = Y_{TB}$.

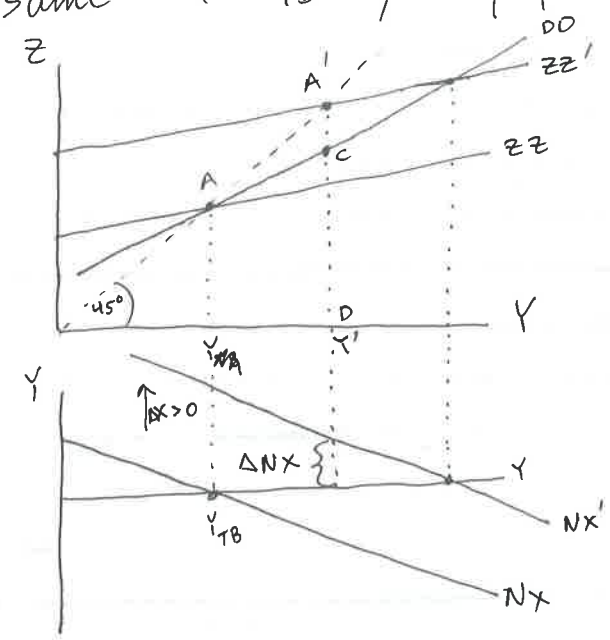
* ↑ G ⇒ ↑ Y
* ↑ G ⇒ trade deficit
* ZZ is flatter than DD, so multiplier is smaller





Increases in Foreign Demand:

Assume $Y = Y_{TB}$, $\uparrow Y^*$ (can be from anything)



DC ≡ Domestic Demand

DA' ≡ Demand for domestic goods

$\therefore CA' \equiv \Delta NX$

19-4: Depreciation, Trade Balance, & Output

Marshall-Lerner Condition:

Assume $Y = Y_{TB} \Rightarrow NX = 0$.

Then, $NX = X - IM/\varepsilon \Rightarrow \frac{\Delta NX}{X} = \frac{\Delta \varepsilon}{\varepsilon} + \frac{\Delta X}{X} - \frac{\Delta IM}{IM}$

M.L.C: If $\frac{\Delta \varepsilon}{\varepsilon} + \frac{\Delta X}{X} - \frac{\Delta IM}{IM} > 0$, then $\Delta NX > 0$

Effects of Depreciation:

* $\downarrow \varepsilon \Rightarrow$ Shift in (foreign & domestic) demand towards domestic goods

  $\Rightarrow \uparrow Y$, $\uparrow$ trade balance

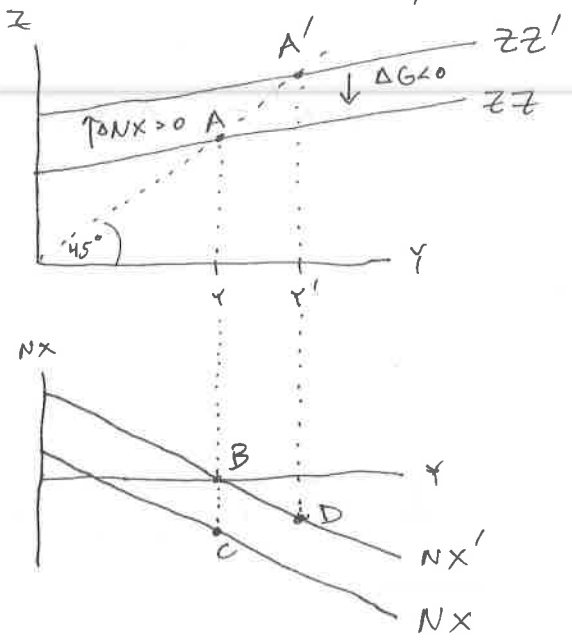
* Almost same as $\uparrow Y^*$, but now given income people are worse off since foreign goods are more expensive

Combining Exchange Rate & Fiscal Policies:

* Gov. must use both:

  Assume $Y > Y_{TB}$ (Trade Deficit = BC)

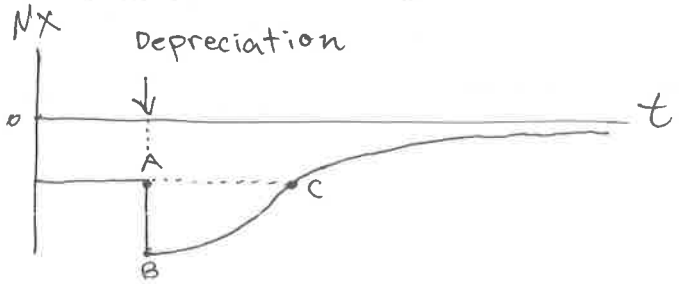
  * Want $Y = Y_{TB}$, but $\Delta Y = 0$.



* Moves from C → D → B

Initial Conditions	Trade surplus	Trade Deficit
Low Y	ε ? G↑	ε↓ G ?
High Y	ε↑ G ?	ε ? G↓

19-5: Dynamics: J-Curve:



$\downarrow \varepsilon \Rightarrow \downarrow \left(X - \frac{IM}{\varepsilon}\right)$

Assume M.L.C. holds

$\Rightarrow \uparrow \left(X - \frac{IM}{\varepsilon}\right)$ over time

19-6: Savings, Investment, Current Accounts

* Open economy: $Y = C + I + G + NX \Rightarrow CA = S + (T - G) - I$

  * Usually $NX = CA - NI - NT$, but NI, NT are small

CH. 20: Output, Interest, Exchange Rate

20-1: Equilibrium in Goods Market

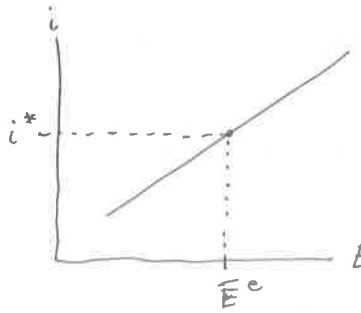
- Assume in S.R., P is given.
  Assume in S.R., P^* is given s.t. $P = P^*$.
  Then, $\pi^e = 0 \Rightarrow r = i$
  Then, $Y = C(Y-T) + I(Y, i) + G + NX(Y, Y^*, E)$
  $\qquad\qquad\qquad\quad +\qquad\quad +, -\qquad\qquad\quad -, +, -$

20-2: Equilibrium in Financial Markets

- Money vs. Bonds: No difference! $\frac{M}{P} = Y \cdot L(i)$

- Domestic vs. Foreign Bonds:
  Assume expected future exchange rate given ($\bar{E}^e$)
  $\Rightarrow E = \frac{1+i}{1+i^*}\bar{E}^e$

* $\uparrow i$ relative to $i^* \Rightarrow \uparrow E$



Interest parity relation (given i^*, $\bar{E}^e$)

* $i = i^* \Rightarrow E = \bar{E}^e$

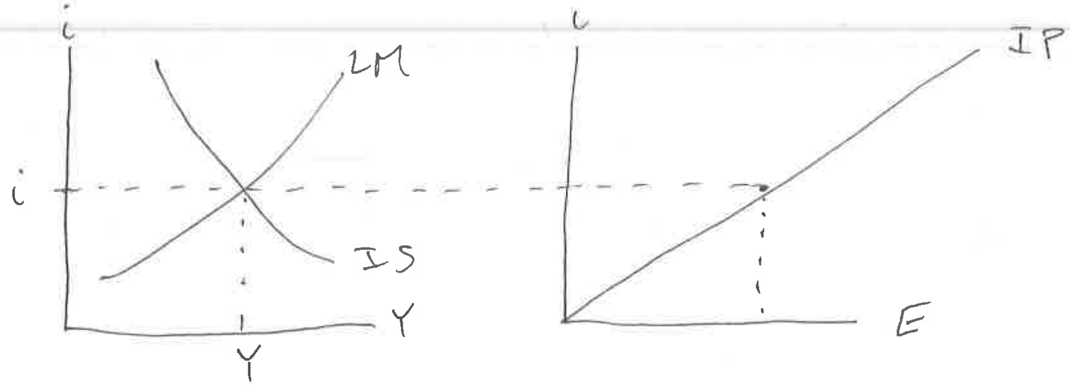
20-3: Goods + Financial Markets Together

- IS: $Y = C(Y-T) + I(Y, i) + G + NX\left(Y, Y^*, \frac{1+i}{1+i^*}\bar{E}^e\right)$

  (signs: C: +; I: +, −; NX: −, +, −)

LM: $\frac{M}{P} = Y \cdot L(i)$

Mundell-Fleming Model

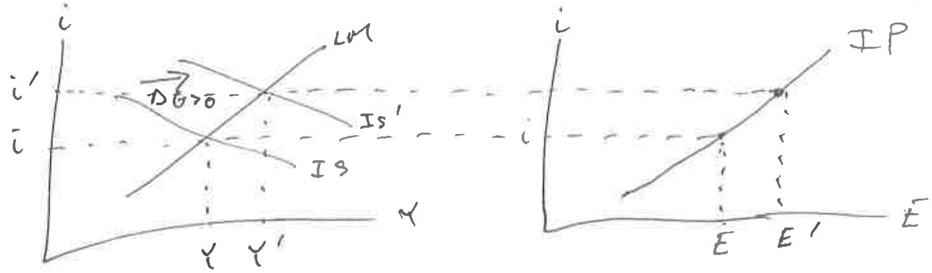


* IS: ↑(↓) i ⇒ ↓(↑) directly & inderectly to demand
⇒ ↓(↑) Y

* LM: ↑(↓) Y ⇒ ↑(↓) M^d
⇒ ↑(↓) i

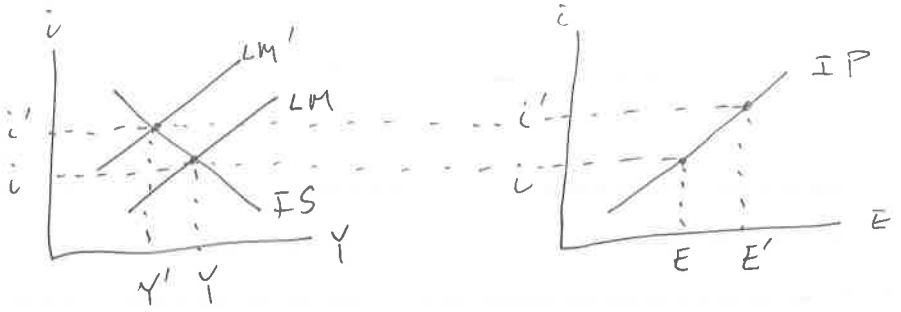
20-4: Effects of Policy in Open Economy

- Fiscal Policy: Fiscal Expansion



* G↑, Y↑, i↑, C↑, E↑, I?, NX↓

Monetary Policy: Contraction



* M^s↓, ↓Y, ↑i, ↓I, ↓C, NX ?

~~20-5 Fixed Exchange Rates~~

20-5: Fixed Exchange Rates:

- Peg: "attach" currency to some foreign currency
- Crawling Peg: predetermined rate of depreciat against dollar
- EMS: determined movement of exchange rates within EU ('78-'79)

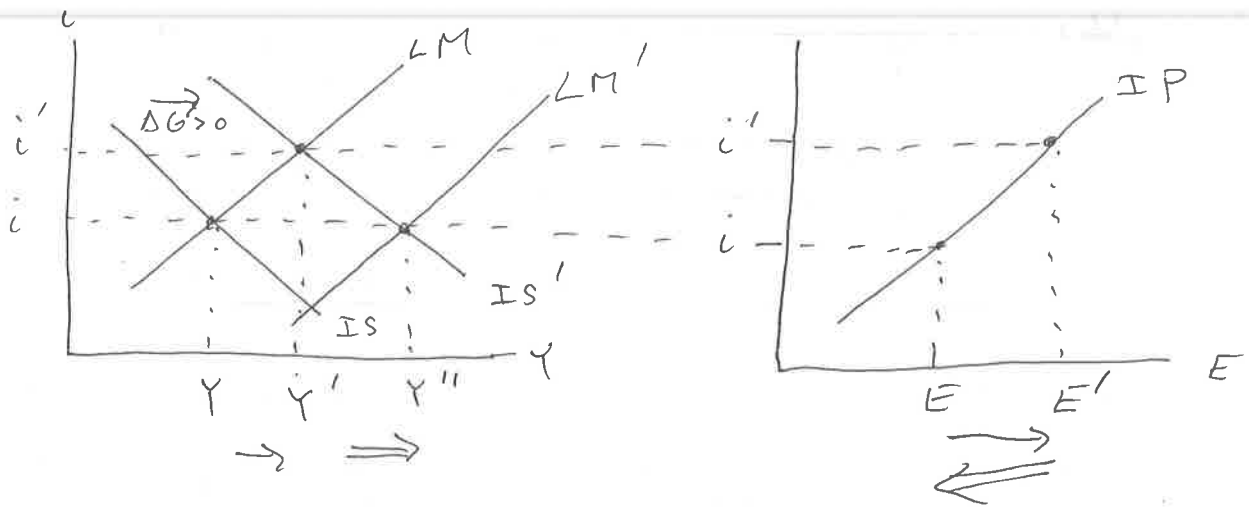
* Can maintain E relative to some foreign currency within a band around central parity (given value for E)
* Crisis in 1992 led to fall of EMS & usage of Euro

- Pegging Exchange Rate, and Monetary Control:

$$E_t = E^e_{t+1} = \bar{E} \Rightarrow i_t = i_t^* \Rightarrow \frac{M}{P} = Y \cdot L(i^*)$$

* Central bank <u>can't</u> use monetary policy

- Fiscal Policy:



CH.21: Exchange Rate Regimes

21-1: The Medium Run

Aggregate Demand under Fixed Exchange Rate

$$Y = Y\left(\frac{\bar{E}P}{P^*}, G, T\right)$$
$$\quad -, +, -$$

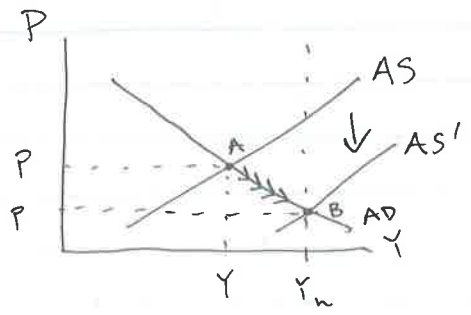
* Given i, $\bar{E}$, P^*, $\uparrow P \Rightarrow \uparrow \varepsilon \Rightarrow \downarrow ZZ \rightarrow \downarrow$

Equilibrium in S.R. & M.R.

Agg Supply: $P = P^e(1+\mu)\cdot F\left(1-\frac{Y}{L}, z\right)$

* Upwarding Sloping ($\Delta Y > 0 \Rightarrow \Delta P > 0$)

Assume in S.R. $Y \neq Y_n$ (i.e. $Y < Y_n$)



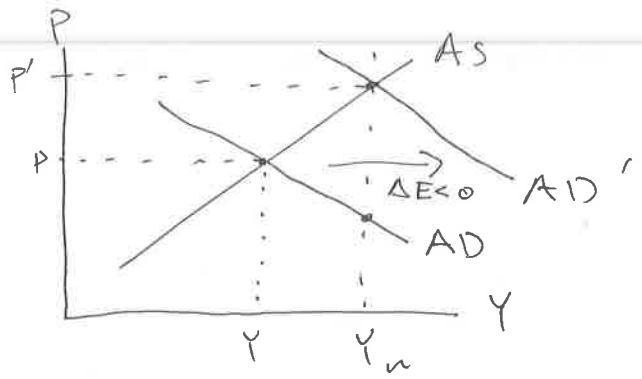
$Y < Y_n \Rightarrow$ wage setters revise price expectations
$\Rightarrow \downarrow P^e$
$\Rightarrow$ Shift out AS
$\Rightarrow \downarrow \varepsilon$
$\Rightarrow \uparrow Y$ until $Y = Y_n$ (M.R

* A - S.R. equilib., B - M.R. equilib.

* Despite $E = \bar{E}$, in M.R. there is $\Delta \varepsilon$

- Case For & Against Devaluation:

* Faster ways to return $Y = Y_n$.
* Can $\downarrow E$. (devalue currency)
  $\Rightarrow \downarrow \mathcal{E}$
  $\Rightarrow \uparrow Y$
  $\Rightarrow$ AD shifts out



* Does not happen immediately (J-curve)

21-2: Exchange Rate Crises under Fixed Rates

- Float: Allow move from fixed to flexible
- $i_t = i_t^* - \dfrac{(E^e_{t+1} - E_t)}{E_t}$
- Under Fixed Exchange Rate: $E_t = E^e_{t+1} = \bar{E} \Rightarrow i_t = i_t^*$
- Under Anticipation of Devaluation ~~(w/ probability p)~~:

P = Probability interest parity maintained

$$\Rightarrow i_t = i_t^* - \left[p \cdot 0 + q \cdot \frac{E^e_{t+1} - E_t}{E_t} \right]$$

$$i_t = i_t^* - (1-p)\frac{(E^e_{t+1} - E_t)}{E_t}$$

1). Gov will try to reassure there will be no devaluation
2). Central Bank can increase i (but less than new parity value)
3). After some time (more perfect capital mobility means shorter time), Central bank
   a). Raises i to satisfy UIP OR
   b). devalues currency

21-3: Flexible Exchange Rate Movements

$$(1+i_t) = (1+i_t^*)\left(\frac{E_t}{E_{t+1}^e}\right) \Rightarrow E_t = \frac{1+i_t}{1+i_t^*} E_{t+1}^e$$

$$\Rightarrow E_{t+1} = \frac{1+i_{t+1}}{1+i_{t+1}^*} E_{t+2}^e$$

$$\vdots$$

$$\Rightarrow E_t = \frac{\prod_{k=0}^{n}(1+i_{t+k})}{\prod_{k=0}^{n}(1+i_{t+k}^*)}$$

$$\Rightarrow E_t = \frac{(1+i_t)\cdot\prod_{k=1}^{n-1}(1+i_{t+k}^e)}{(1+i_t^*)\cdot\prod_{k=1}^{n-1}(1+i_{t+k}^{*e})} E_{t+n}^e$$

* level of E_t will move 1-1 with E_{t+n}^e
* Δi_{t+k}^e, $\Delta i_{t+k}^{*e} \Rightarrow \Delta E_t$
* E_t is volatile

$n \geq 20 \Rightarrow E_{t+n}^e$ is exchange rate required for CA=0 in M.R./L.R.