Closed econ = savings = investment

Wages + Profits = GDP

$GDP = \sum_j a_j \times P_j$

Real = adj. for inflation - use base year prices

$Y = C + I + G + NX$ (exports)

$C = C(Y_D) = C(Y - T)$

$= C_0 + C_1(Y - T) + \bar{I} + \bar{G}$

hedonic pricing - take advances in value not just price drop

$GDP = \frac{\text{Nominal GDP}}{\text{Real GDP}} = \frac{\$Y_t}{Y_t}$

CPI - measures inflation

inflation - generally rising prices

$Y = Z$ output = income

$Y = \frac{1}{1-C_1}[C_0 + \bar{I} + \bar{G} - C_1 T]$

multiplier $= 1 + C_1 + C_1^2 + C_1^3 + \dots$

Private savings $= S = Y_D - C$

$= Y - T - C$

public savings $= T - G$

$Md = \$Y\, L(i)$ (−)

M^s = set by central bank

higher income shifts curve out

Bonds - alt to currency $\$P_B = \frac{100}{1+i}$

Central gov buys/sells

when buys prices ↑ i ↓

Checkable deposits

LM

Liabilities - Money

Demand for Money

$Md = \$Y\, L(i)$ (−)

$CUd = c\, Md$ (currency; c = proportion held in CU)

$Dd = (1-c)\, Md$ checkable deposits

Demand Reserves

θ reserve ratio

$R = \theta D$

R demand for reserves

$Rd = \theta(1-c)\, Md$

14.02 Quiz 1

Demand Central Bank Money

$HR = CU^d + Rd$

$= c\,Md + \theta(1-c)\,Md$

$= [c + \theta(1-c)]\,Md$

$= [c + \theta(1-c)]\,\$Y\,L(i)$

Determination

$H^s = H^d$

$= [c + \theta(1-c)]\,\$Y\,L(i)$

Wealth < Currency, Bonds < Money, Deposits — His

$Y\,L(i)$ ↓

Money (MD) ⇄ Currency (C) → (central bank Money)

Deposits (1−c) → Reserves (θ) → (central bank Money)

Demand = Z or Zz

$Y - T - C = S = \bar{I} + \bar{G} - T$ ① IS

$SP + SG = \bar{I}$ savings = investment

$C = C(Y-T)$? Can be any function — LS

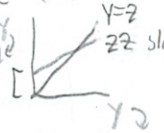
$I = I(Y, r)$ ⊃ assume inflation = 0

$Y = C(Y-T) + I(\overset{\ominus}{Y}, \overset{\ominus}{i}) + \bar{G}$ ②

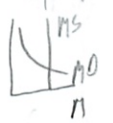
$\frac{Md}{P} = Y \cdot L(\overset{\ominus}{i})$ ③

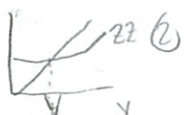
2 eq 2 unknowns

$Z = [C_0 + \bar{I} + \bar{G} - C_1 T] + C_1 Y$ Z = demand



①





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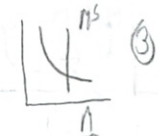
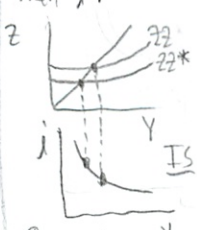


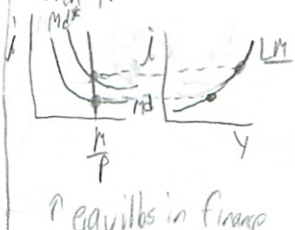
③

When i ↑

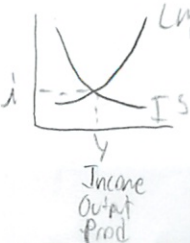


↑ equilibs in good markets

When Y ↑



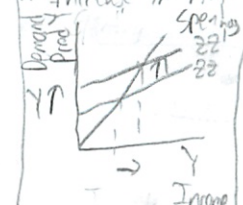
↑ equilibs in finance markets



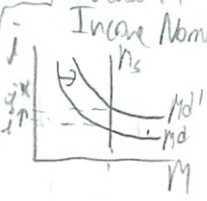
Shifts when Exog. Changes

3/16

↑ Increase in Autonomous Spending



↑ Increase in Income Nominal



Exog I, G, T

End C, Y, Z, Yd

Exog $\$Y^D, M$

End M^s, M^d, i

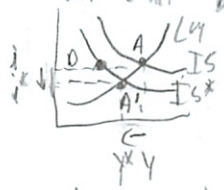
Fiscal Contraction (Gov ↑ Taxes)

lower output/sales = ↓ investment

but ↑ i = ↑ investment

IS curve shifts - since Exog to that

LM does not shift - but shift along



↑ increase in taxes → lower disposable income

lower consumption → so output ↓ →

so income ↓ (through multiplier) to D

Also ↓ in income → ↓ demand for money

↓ i rate

offsets effects of higher taxes on demand

shifts to A'

Monetary Expansion Gov ↑ M^s by buying bonds

So lower i → I ↑ So demand + output ↑

income ↑ w/ taxes unchanged, so ↓I, C ↑ so I ↑

What	IS	LM	Output	i
↑T	←	—	↓	↓
↓T	→	—	↑	↑
↑G	→	—	↑	↑
↓G	←	—	↓	↓
↑M	—	↓	↑	↓
↓M	—	↑	↓	↑

Labor

Pop - Non Inst. Civilian < In Labor Force < Emp, Unemp

Out LF

$U = \frac{U}{L}$ ∈ Unemp, ∈ Labor Force

$W = P^e F(u, z)$

nominal

$Y = A \cdot E^{\alpha} \cdot k^{1-\alpha} \rightarrow Y = A \cdot E \rightarrow Y = E$

prod. $\alpha = \frac{1}{2}$

$P = W(1+\mu)$

$\frac{W}{P} = F(u, z)$ Wage setting

$\frac{W}{P} = \frac{1}{1+\mu}$ Price setting

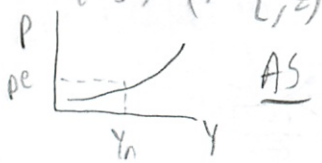
Set = to Find u_n

Then translate for $N_n = L(1-u_n)$

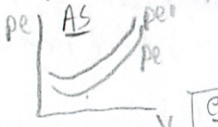
AS don't assume $P = P^e$ take WS, PS above

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

$= P^e(1+\mu)F(1-\frac{Y}{L}, z)$ ∈



Expected price becomes actual - wage Setters set expected, compar, must raise prices to meet, comes true



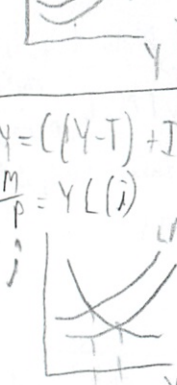
$P^{e'} > P^e$

exog P^e, z, μ, u
end w, P, Y

AD take IS, LM inputs

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

LM $\frac{M}{P} = YL(i)$

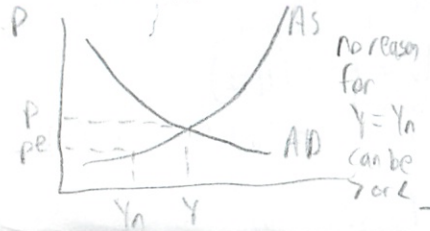


So adds another layer

$Y = Y(\frac{M}{P}, G, T)$ ∈

SR take P^e as given

for given P^e (AS), M, G, T (AD) find Y, P

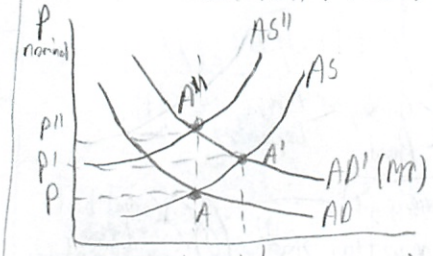


no reason for $Y = Y_n$ can be ↑ or ↓

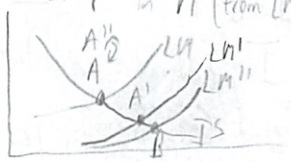
MR Price expectations start to come into play

Say gov ↑MS for given P, MP so $\frac{M}{P}$ ↑, so Y↑ AD shifts right AD' (SR, Econ A → A') Y↑ from Y_n to Y' so P↑ from P to P'

Over time P^e into play, when $Y > Y_n$, the $P > P^e$, so wage setters ↑P^e, so AS shifts ↑ (Econ moves along AD' to A'') Stops when $Y = Y_n$ Arrived at medium run, P now P''



Behind Scenes In SR the ↑P partially offsets effect of ↑ in M (from LM'' to LM') from B



lefts match

Don't know I since ↓Y: I↓ but ↓i: ↑I

Diamond Labor u: unemp v: vac h: hires s: seps

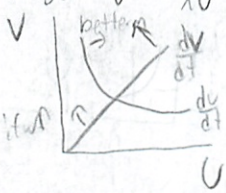
$h = m\sqrt{vu}$ matching

$w = \beta b(1-\beta)y + \frac{V}{U}$ $\frac{V}{U}$ = market tightness

wage ↑ who controls surplus

$x = w - \beta b + (1-\beta)y$

to get $V^{ss} = xU^{ss}$



$u_{t+1} - u_t = s(1-u_t) - h_t$

$u_t h^{ss} = s^{ss}(1-u^{ss})$

$V_{t+1} - V_t = \frac{u_t}{u_t} - \frac{1}{x}$

$u_{V^{ss}} = xU^{ss}$

Phillips Curve Start w/ AS, adds expectation π^e

$\pi = \pi^e + (\mu + z) - \alpha u$

early version $\pi^e = 0$

so $\pi_t = (\mu + z) - \alpha u_t$

wage-price spiral up to 1960s

	exog	end
AS	P^e, μ, Y, N, z	P
AD	M, P, G, T	Y
AS/AD	μ, N, z, G, T	P, Y

M

But then in 1970s: $\pi^e_t = \theta\pi_{t-1}$

$\pi_t = \theta\pi_{t-1} + (\mu + z) - \alpha u_t$

AS $\theta \to 1$ then Phillips Curve about $\Delta\pi$

Natural rate of unemp: so that $P = P^e$, $\pi = \pi^e$

so $u_n = \frac{\mu + z}{\alpha}$

AS'' So $\pi_t - \pi_{t-1} = -\alpha(u_t - u_n)$

Now some have COLAs λ = proportion with

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

Assume $\pi_t^e = \pi_{t-1}$

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

when $\lambda \uparrow$ ⇒ Small change unemp → large change unemp

---

Okun's Law Production Function

$u_t - u_{t-1} = -g_{yt}$

In USA $u_t - u_{t-1} = -.4(g_{yt} - .03)$

In General $u_t - u_{t-1} = -\beta(g_{yt} - \bar{g}_y)$ ∈

Phillips Curve

$\pi_t = \pi^e_t - \alpha(u_t - u_n)$

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

AD

$Y_t = Y(\frac{M_t}{P_t}, G, T)$

$g_{yt} = g_{mt} - \pi_t$ ∈

Solve Simultaneously

MR $g_y = \bar{g}_y$

$\pi = \bar{g}_m - g_y$ $\pi_t - \pi_{t-1} = 0$

$u = u_n$

Lucas Critique on credibility

Autonomous spending $C_0 - C_1 T + \bar{I} + G$

67/100

14.02 Exam 1

March 15, 2011

Professor: Francesco Giavazzi.

TAs: Joaquin Blaum, Fernando Duarte, Maya Eden, Camilo García, Anna Zabai

Time Available: 90 minutes

Student Name: Michael Plasnoie Section: MWF 10

1 Multiple Choice Questions (5 points each) 50% of test

1. The Chain index method is the most appropriate way to compute real GDP because:

- a. It takes into account the depreciation of capital.
- b. It takes into account inflation.
- c. It avoids double counting by considering only final goods.
- d. It takes into account changes in relative prices.
- e. It takes into account the discrepancy between the GDP deflator and the Consumer Price Index (CPI).

2. The price of bonds is inversely related to the nominal interest rate because

- a. Investment, which depends on how many bonds the FED sells, is decreasing in the interest rate.
- b. In recessions, the price of bonds increases while the interest rate decreases.
- c. The FED can increase the money supply by selling bonds through open market operations, and a larger money supply lowers the interest rate.
- d. The nominal interest rate always adjusts to make savings qual to investment.
- e. For a given promised payment at maturity, a higher bond price reduces the return on each dollar paid for the bond.

3. Fiscal policy has a multiplier effect because

- a. For each dollar spent by the government, consumers spend an extra dollar.
- b. The increase in income induced by the increased government spending in turn increases disposable income and hence consumption.
- c. The increase in government spending always has to be accompanied by a corresponding change in monetary policy.
- d. The increase in government spending also increases consumer confidence.
- e. An increase in government spending reduces savings, increasing consumption.

4. An increase in the banks' required reserve ratio θ tends to increase the nominal interest rate because

- a. It reduces the price of bonds.
- b. It is a symptom that a financial crisis is likely, so consumers reduce their bank deposits.
- c. It increases the demand for central bank money.
- d. It increases the demand for currency.
- e. It increases the loans issued by financial institutions.

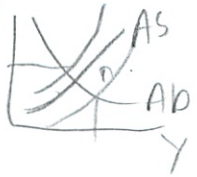
concurrent w/ ans in back

5. Liquidity traps can happen when

- a. Consumer confidence is at very low levels, so that reductions in the nominal interest rate don't make consumers increase spending.
- b. The nominal interest rate is zero, so that increases in the money supply don't generate increases in investment.
- c. Prices are flexible, so that increases in the money supply translate into higher inflation and not into higher income.
- d. The LM curve is downward sloping.
- e. The reserve ratio is high, so that increases in the money supply do not translate into increased bank lending.

6. In the AS-AD model, when output is above its natural level it decreases until it reaches its natural level because

- a. Unemployment increases because wages are too high when output is above its natural level.
- b. The central bank reduces the money supply when output is above its natural level, shifting the AD curve to the left.
- c. Wage setters revise their price expectations upwards, shifting the AS curve up.



- d. In the short run prices are fixed, so that only output can change.
- e. Contractionary fiscal policy is used to shift the AD curve to the left.

7. If the number of discouraged workers increases

- a. The economy will enter a recession.
- b. The unemployment rate and the participation rate increase.
- c. The unemployment rate increases and the participation rate falls.
- d. The unemployment rate falls and the participation rate increases.
- e. The unemployment rate and the participation rate fall.

8. Unemployment will respond less to changes in inflation if there is

- a. An expansionary monetary policy.
- b. A change in the natural rate of unemployment.
- c. A long period of recession.
- d. Wage indexation.
- e. An increase in the rate of separations.

9. A reason why employment does not respond one-for-one to output is

- a. Labor hoarding by firms.
- b. The number of discouraged workers increases.
- c. Realized and expected inflation differ.
- d. Monetary policy can affect output but not employment.
- e. Separations increase as much as hires during expansions.

10. According to the theory of rational expectations, a disinflation policy should be able to reduce inflation without increasing unemployment because

- a. In the medium run monetary policy is neutral, and hence has no effect on unemployment.
- b. The AD curve becomes vertical.
- c. In developed nations the sacrifice ratio is small.
- d. Monetary policy does not affect separation or hiring rates.
- e. If the policy is credible, expected inflation should match the target inflation rate.

2 Short Long Question: Financial Reform (15 points)

After the financial crisis, Congress decided to pass legislation making banking activities less risky. Imagine that one such measure was an increase in the banks required reserve ratio θ. Assume that people hold a proportion τ of their money requirements in cash, and the rest as deposits in bank accounts. Aggregate money demand is given by

Or This have to rem formulas

$$M^d = YL(i)$$

where $L(i)$ is a decreasing function of i.

a. Write an expression for reserves R.

$R = \theta(1-\tau) M^d$

$= \theta(1-\tau) YL(i)$ ✓

3

b. Write an expression for central bank money H^d.

– Cash + reserves

$H_D = CU^d + R^d$ $= \tau YL(i) + \theta(1-\tau) YL(i)$

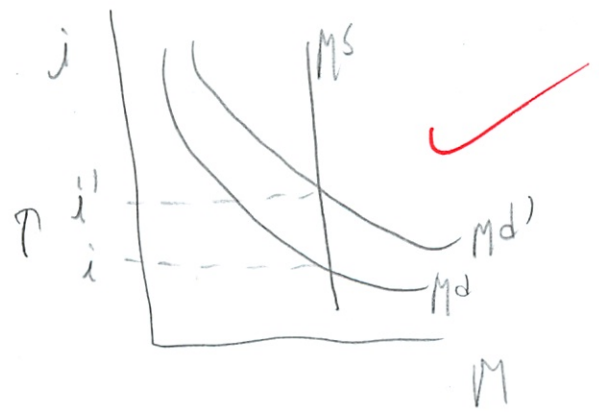
$= \tau M^d + \theta(1-\tau) M^d$ ✓

3

c. Now assume that the required reserve ratio increases to $\theta' > \theta$. Graphically show what happens in the money market.

For 1-θ MC wrong for this

The demand for money increases



✓

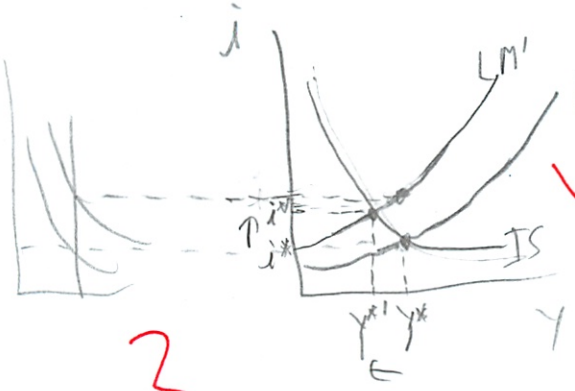
3

i increases

should have looked more

d. Graphically show how the change in θ affects the equilibrium in the IS-LM diagram (i.e. show what happens to i and Y).

At a given income, there is a higher interest rate



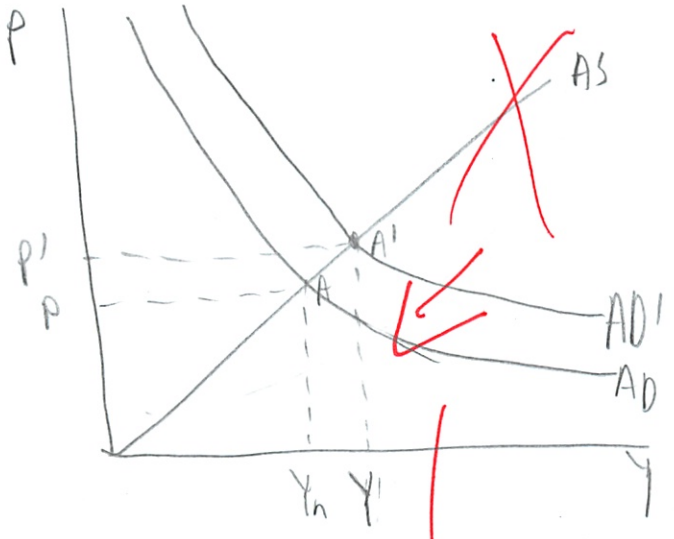
So i ↑ and Y ↓

Also investment unclear - higher interest rate but lower potential to sell

3

e. Assume the Aggregate Suppy relation is given by $P = P^e \alpha Y$, and that initially output was at its natural level Y_n. Graphically show how the change in θ affects the equilibrium in the AS-AD diagram (i.e. show what happens to P and Y), both in the short run and in the long run. wage-price = medium run

SR



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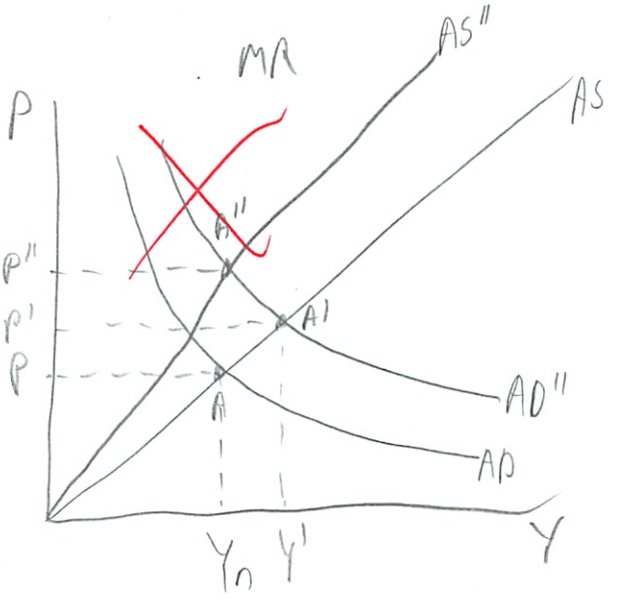


the other way around

3 Long Long Question (35 points)

In this problem, we are going to use the Diamond-Mortensen-Pissarides (DMP) model to derive a relationship between output and prices that comes from equilibrium in the labor market. Then, we are going to combine it with an aggregate demand curve (coming from equilibrium for goods and services and the money markets) and see how the equilibrium behaves.

A quick reminder. For variables that are changing over time, we define the "steady state"' as a situation where the variable is constant, i.e. $x_{t+1} = x_t$.

Consider the following unemployment and vacancies dynamics

firing rate hiring

$$u_{t+1} - u_t = s(1 - u_t) - h_t$$

$$v_{t+1} - v_t = \frac{u_t}{v_t} - \frac{1}{w_t^2}$$

level of

where u_t is unemployment at time t, v_t are vacancies at time t, h_t are hires at time t, w_t is wage at time t and $s > 0$ is a parameter.

1. Interpret the economic meaning of s.

The separation rate - % of workers who leave job each t period

"r, but that changes over time

4

2. Find the steady-state levels of u and v as a function of s and the steady state levels of h and w. Denote the steady state levels u^{ss}, v^{ss}, h^{ss} and w^{ss}.

$$u_{t+1} - u_t = 0 = s(1 - u_{ss}) - h_{ss}$$

$$0 = s - s u_{ss} - h_{ss}$$

$$s u_{ss} = s - h_{ss}$$

$$u_{ss} = \frac{s}{s} - \frac{h_{ss}}{s}$$

$$u_{ss} = 1 - \frac{h_{ss}}{s}$$

$$v_{t+1} - v_t = 0 = \frac{u_{ss}}{v_{ss}} - \frac{1}{w_{ss}^2}$$

$$\frac{1}{w_{ss}^2} = \frac{u_{ss}}{v_{ss}}$$

$$v_{ss} = w_{ss}^2 u_{ss}$$

$$v_{ss} = w_{ss}^2 \left(1 - \frac{h_{ss}}{s}\right)$$

$$v_{ss} = w_{ss}^2 - \frac{w_{ss}^2 h_{ss}}{s}$$

4

gar did not feel closely

3. Assume that the number of hires at a given point in time is given by a "matching" function:

$$h_t = m\sqrt{u_t v_t}$$

where $m > 0$ is a parameter that describes how good the matching is in the economy. Write an expression for the steady-state levels of u^{ss}, v^{ss} and h^{ss} as a function of s, m and w^{ss}.

$h_{ss} = m\sqrt{u_{ss} v_{ss}}$

$u_{ss} = 1 - \frac{h_{ss}}{s}$

$u_{ss} = 1 - \frac{m\sqrt{u_{ss} v_{ss}}}{s}$

$u_{ss}^2 = 1^2 - \frac{m^2 u_{ss} v_{ss}}{s^2}$

$s^2 u_{ss}^2 = s^2 - m^2 u_{ss} v_{ss}$

$s^2 u_{ss}^2 + m u_{ss} v_{ss} = s^2$

$u_{ss} = \frac{s^2}{s^2 u_{ss} + m v_{ss}}$

$v_{ss} = w_{ss}^2 - \frac{w_{ss}^2 h_{ss}}{s}$

$v_{ss} = w_{ss} - \frac{w_{ss} m\sqrt{u_{ss} v_{ss}}}{s}$

$v_{ss}^2 = w_{ss}^2 - \frac{w_{ss}^2 m^2 u_{ss} v_{ss}}{s^2}$

$\frac{v_{ss}^2}{s^2} = \frac{w_{ss}^2}{s^2} - w_{ss}^2 m^2 u_{ss} v_{ss}$

$\frac{v_{ss}^2}{s^2} + w_{ss}^2 m^2 u_{ss} v_{ss} = \frac{w_{ss}^2}{s^2}$

$v_{ss} = \frac{\frac{w_{ss}^2}{s^2}}{\frac{v_{ss}}{s^2} + w_{ss}^2 m^2 u_{ss}}$ ← s correction

→ over

4. Describe in words how the steady state values of u, v and s (u^{SS}, v^{SS}, s^{SS}) change when m increases. Explain the intuition behind it.

When m increases, the percentage of people unemployed (u) ↓ since better matching means people are out of a job for less time

There are also less vacancies (v) since the jobs are filled faster.

The seperation rate does not change since it is independent of m. This also makes sense because getting fired does not depend on how good you can find a new job - but an argument could be made that people may be more likely to leave since they know there will be less time unemployed.

we said this was a typo. you didn't pay attention!

Then plug in for the other

$$U_{ss} = \frac{S^2}{S^2 U_{ss} + m\left(\frac{\frac{W_{ss}^2}{S^2}}{\frac{U_{ss}}{S^2} + W_{ss}^2 m^2 U_{ss}}\right)}$$

Solve for U_{ss} again

$$U_{ss} = \frac{S^2}{S^2 U_{ss} + \frac{m W_{ss}}{\cancel{S^2}} \cdot \frac{\cancel{S^2}}{U_{ss}} + \frac{1}{W_{ss}^2 m^2 U_{ss}}}$$

$$= \frac{S^2}{S^2 U_{ss} + \frac{m W_{ss}}{U_{ss}} + \frac{1}{W_{ss}^2 m^2 U_{ss}}}$$

must have gone wrong somewhere. yes.

must be doing something wrong

5. Assume that the wage w_t is determined by the following equation:

$$w_t = p_t + \beta b + (1-\beta)\, y_t$$

where y_t is output (GDP) at time t, p_t is the price level at time t, and $b > 0$ is the reservtion wage. Describe what the parameter β, such that $1 \geq \beta \geq 0$ represents. What does it mean when$\beta = 1$?

Amount of say workers have in determining their wages. When $\beta = 1$ workers have total say in determining their wage So it is soly based on their reservation wage (what they want) - not on how the economy is doing.

exactly the opposite!

6. Now suppose that output y is produced only using labor, but that keeping vacancies open is costly. The production function is given by:

$$y_t = (1-u_t) - \frac{v_t}{w_t}$$

Use your results from part 3 and the production function to write an expression for the steady state value of the wage w^{ss} as a function of the steady-state level of output y^{ss}. Your answer should be an expression that depends only on ~~w^{ss}~~, y^{ss} and the parameters m and s. β, b

mistake p^{ss}

keep → $Y_{ss} = (1-U_{ss}) - \frac{V_{ss}}{W_{ss}}$ keep as fn Y_{ss}

$W_{ss} = P_{ss} + \beta b + (1-\beta) Y_{ss}$

keep → ~~$= P_{ss} + \beta b + (1-\beta)(1-U_{ss})$~~ $- \frac{V_{ss}}{W_{ss}}$ ← plug in from 3

$W_{ss} + \frac{V_{ss}}{W_{ss}} = P_{ss} + \beta b + (1-b)(1-V_{ss})$

$W_{ss} = \frac{P_{ss} + \beta b + (1-b)(1-V_{ss})}{1 + \frac{1}{V_{ss}}}$

Now plug in results from 3, assuming I found them

??

Now assume that $\beta = 1$. $W_t = p_t + b$

7. Using parts 5 and 6, find a relationship between the steady-state level of output y^{SS} and the steady-state level of prices p^{SS}. This is a relationship between output and prices that represents equilibrium in the labor market. It is the "analogue" of the aggregate supply relation that you have seen in class.

$W^{SS} = p^{SS} + b$ ← but when $\beta = 1$ then wage does not depend on output (TA correct)

$p^{SS} = W^{SS} - b$

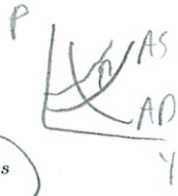
So in this case there is no relation between output and wages so there is no relation between prices and output since prices are tied to wages as employees will demand the same real incomes

8. Consider the relationship that you have just derived. Is this relationship increasing or decreasing?

Normally When prices increase, the wages will increase as workers demand the same real income. These higher wages cause firms to raise prices - leading to the wage-price spiral.

Here there is no relation

9. There exists a second relationship between steady state output and prices, representing equilibrium in the good and money markets. This aggregate demand (AD) relation is given by:



$$y^{ss} = G - p^{ss}$$

where G is government spending. Describe in words how the equilibrium changes (i.e., how y^{ss} and p^{ss} change) in the following cases (no need to use any formulas).

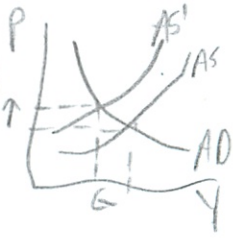
(a) Suppose there is an increase in unemployment benefits and you wanted to capture this by changing some parameter in the model. What parameter would you change?

5 - people are more likely to quit if they know that more of their income will be covered

$Y_t = (1-U_t)\frac{V_t}{W_t}$

P_t is in U_{ss}, V_{ss} (complicated effects)

Y_{ss} would ↓ as employment ↓ p^{ss} would ?



(b) The economy becomes more efficient at matching workers with jobs (m goes up).

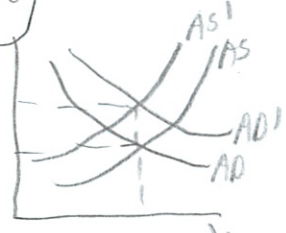
Less people are unemp - more output, AS↑

And more people have jobs - so AD↑?

But then output shrinks back to natural levels as wages fall

Y = same

P_{ss} increases



(c) There is fiscal consolidation (G goes down).

AD ↓ meaning less income, meaning companies fire people ASL

Y^{ss} = same

P_{ss} falls

9 correction

10. Contrast your answer to part (a) of question 10 to the results of the same experiment in the AS/AD model.

I used AS/AD above

2 would increase, which increases wages. This increases prices, which by the above AD decreases output

contrast...

Y_{ss} ↓

P_{ss} ↑

11. (OPTIONAL: up to 5 extra points) Describe in words (no formulas needed) how the economy converges to the steady state if it starts from a point in which v_t and u_t are both above its steady state levels.

Wages go up in order to attract workers and over time they find jobs

14.02 Exam 1

Solutions

March 14, 2011

Professor: Francesco Giavazzi.

TAs: Joaquin Blaum, Fernando Duarte, Maya Eden, Camilo García, Anna Zabai

Student Name:_____Section:_____

1 Multiple Choice Questions (5 points each)

1. The Chain index method is the most appropriate way to compute real GDP because:

   - a. It takes into account the depreciation of capital.
   - b. It takes into account inflation.
   - c. It avoids double counting by considering only final goods.
   - D. It takes into account changes in relative prices.
   - e. It takes into account the discrepancy between the GDP deflator and the Consumer Price Index (CPI).

2. The price of bonds is inversely related to the nominal interest rate because

   - a. Investment, which depends on how many bonds the FED sells, is decreasing in the interest rate.
   - b. In recessions, the price of bonds increases while the interest rate decreases.
   - c. The FED can increase the money supply by selling bonds through open market operations, and a larger money supply lowers the interest rate.
   - d. The nominal interest rate always adjusts to make savings qual to investment.
   - E. For a given promised payment at maturity, a higher bond price reduces the return on each dollar paid for the bond.

3. Fiscal policy has a multiplier effect because

   - a. For each dollar spent by the government, consumers spend an extra dollar.

- B. The increase in income induced by the increased government spending in turn increases disposable income and hence consumption.
- c. The increase in government spending always has to be accompanied by a corresponding change in monetary policy.
- d. The increase in government spending also increases consumer confidence.
- e. An increase in government spending reduces savings, increasing consumption.

4. An increase in the banks' required reserve ratio θ tends to increase the nominal interest rate because

- a. It reduces the price of bonds.
- b. It is a symptom that a financial crisis is likely, so consumers reduce their bank deposits.
- C. It increases the demand for central bank money.
- d. It increases the demand for currency.
- e. It increases the loans issued by financial institutions.

5. Liquidity traps can happen when

- a. Consumer confidence is at very low levels, so that reductions in the nominal interest rate don't make consumers increase spending.
- B. The nominal interest rate is zero, so that increases in the money supply don't generate increases in investment.
- c. Prices are flexible, so that increases in the money supply translate into higher inflation and not into higher income.
- d. The LM curve is downward sloping.
- e. The reserve ratio is high, so that increases in the money supply do not translate into increased bank lending.

6. In the AS-AD model, when output is above its natural level it decreases until it reaches its natural level because

- a. Unemployment increases because wages are too high when output is above its natural level.
- b. The central bank reduces the money supply when output is above its natural level, shifting the AD curve to the left.
- C. Wage setters revise their price expectations upwards, shifting the AS curve up.
- d. In the short run prices are fixed, so that only output can change.
- e. Contractionary fiscal policy is used to shift the AD curve to the left.

7. If the number of discouraged workers increases

- a. The economy will enter a recession.
- b. The unemployment rate and the participation rate increase.
- c. The unemployment rate increases and the participation rate falls.
- d. The unemployment rate falls and the participation rate increases.
- E. The unemployment rate and the participation rate fall.

8. Unemployment will respond less to changes in inflation if there is

- a. An expansionary monetary policy.
- b. A change in the natural rate of unemployment.
- c. A long period of recession.
- D. Wage indexation.
- e. An increase in the rate of separations.

9. A reason why employment does not respond one-for-one to output is

- A. Labor hoarding by firms.
- b. The number of discouraged workers increases.
- c. Realized and expected inflation differ.
- d. Monetary policy can affect output but not employment.
- e. Separations increase as much as hires during expansions.

10. According to the theory of rational expectations, a disinflation policy should be able to reduce inflation without increasing unemployment because

- a. In the medium run monetary policy is neutral, and hence has no effect on unemployment.
- b. The AD curve becomes vertical.
- c. In developed nations the sacrifice ratio is small.
- d. Monetary policy does not affect separation or hiring rates.
- E. If the policy is credible, expected inflation should match the target inflation rate.

2 Short Long Question: Financial Reform (15 points)

After the financial crisis, Congress decided to pass legislation making banking activities less risky. Imagine that one such measure was an increase in the banks required reserve ratio θ. Assume that people hold a proportion τ of their money requirements in cash, and the rest as deposits in bank accounts. Aggregate money demand is given by

$$M^d = YL(i)$$

where $L(i)$ is a decreasing function of i.

a. Write an expression for reserves R.

A/ $R = \theta(1-\tau)YL(i)$

b. Write an expression for central bank money H^d.

A/ $H^d = \tau YL(i) + \theta(1-\tau)YL(i)$

c. Now assume that the required reserve ratio increases to $\theta' > \theta$. Graphically show what happens in the money market.

A/ Money demand shifts up, increasing interest rate.

d. Graphically show how the change in θ affects the equilibrium in the IS-LM diagram (i.e. show what happens to i and Y).

A/ LM shifts up, increasing the interest rate and reducing income.

e. Assume the Aggregate Suppy relation is given by $P = P^e \alpha Y$, and that initially output was at its natural level Y_n. Graphically show how the change in θ affects the equilibrium in the AS-AD diagram (i.e. show what happens to P and Y), both in the short run and in the long run.

A/ In the short run, AD shifts to the left, reducing output and the price level. In the long run, AS shifts down as prices remain above the expected future prices, until output reaches its natural level again.

3 Long Long Question (35 points)

In this problem, we are going to use the Diamond-Mortensen-Pissarides (DMP) model to derive a relationship between output and prices that comes from equilibrium in the labor market. Then, we are going to combine it with an aggregate demand curve (coming from equilibrium for goods and services and the money markets) and see how the equilibrium behaves.

A quick reminder. For variables that are changing over time, we define the "steady state"' as a situation where the variable is constant, i.e. $x_{t+1} = x_t$.

Consider the following unemployment and vacancies dynamics

$$u_{t+1} - u_t = s\,(1 - u_t) - h_t$$

$$v_{t+1} - v_t = \frac{u_t}{v_t} - \frac{1}{w_t^2}$$

where u_t is unemployment at time t, v_t are vacancies at time t, h_t are hires at time t, w_t is wage at time t and $s > 0$ is a parameter.

1. Interpret the economic meaning of s.

The parameter s is the separation rate. It denotes the number of people who moved from having a job to being unemployed.

2. Find the steady-state levels of u and v as a function of s and the steady state levels of h and w. Denote the steady state levels u^{ss}, v^{ss}, h^{ss} and w^{ss}.

We have

$$u^{ss} = 1 - \frac{h^{ss}}{s}$$

$$v^{ss} = u^{ss}\left(w^{ss}\right)^2 = \left(1 - \frac{h^{ss}}{s}\right)\left(w^{ss}\right)^2$$

3. Assume that the number of hires at a given point in time is given by a "matching" function:

$$h_t = m\sqrt{u_t v_t}$$

where $m > 0$ is a parameter that describes how good the matching is in the economy. Write an expression for the steady-state levels of u^{ss}, v^{ss} and h^{ss} as a function of s, m and w^{ss}.

The steady state level of hires is

$$h^{ss} = m\sqrt{u^{ss} v^{ss}}$$

Using the results (1) and (2) from part 2, we find

$$h^{ss} = m u^{ss} v^{ss}$$

$$h^{ss} = \frac{w^{ss} s}{s/m + w^{ss}}$$

For vacancies and unemployement, we have

$$u^{ss} = 1 - \frac{h^{ss}}{s}$$

$$= \frac{s}{s + m w^{ss}}$$

$$v^{ss} = u^{ss}\left(w^{ss}\right)^2$$

$$= \frac{\left(w^{ss}\right)^2 s}{s + m w^{ss}}$$

4. Describe in words how the steady state values of u, v and s (u^{SS},v^{SS},h^{SS}) change when m increases. Explain the intuition behind it.

When m increses, h^{ss} increases, u^{ss} decreases and v^{ss} decreases. When the "matching technology" improves (m increases), (3) shows that the number of hires increases for a given level of unemployment and vacancies. That is, for a given level of "market tightness" (see the notes on stellar for a discussion of market tightness), there are more matches. But if there are more matches occurring in steady-state, more jobs are being filled up, which means that the number of vacancies decreases. The people filling in those vacancies are exiting unemployment, therefore unemployment also decreases.

5. Assume that the wage w_t is determined by the following equation:

$$w_t = p_t + \beta b + (1 - \beta)\, y_t$$

where y_t is output (GDP) at time t, p_t is the price level at time t, and $b > 0$ is the reservtion wage. Describe what the parameter β, such that $1 \geq \beta \geq 0$ represents. What does it mean when$\beta = 1$?

The parameter β denotes the bargaining power that workers have vis-a-vis firms. When $\beta = 1$, workers get paid their reservation wage b and the firms keep all the output y for themselves. In this case, the firms have all the bargaining power. When $\beta = 0$, workers get all the output -they have all the bargaining power-.

6. Now suppose that output y is produced only using labor, but that keeping vacancies open is costly. The production function is given by:

$$y_t = (1 - u_t) - \frac{v_t}{w_t}$$

Use your results from part 3 and the production function to write an expression for the steady state value of the wage w^{ss} as a function of the steady-state level of output y^{ss}. Your answer should be an expression that depends only on w^{ss}, y^{ss} and the parameters m and s.

We have

$$y^{ss} = 1 - u^{ss} - \frac{v^{ss}}{w^{ss}}$$

$$y^{ss} = 1 - \frac{s}{s + mw^{ss}} - \frac{w^{ss}s}{s + mw^{ss}}$$

where the first line follows by the definition of the production function and the second line follows from the results in part 3. Solving for w^{ss} gives

$$w^{ss} = \frac{y^{ss}s}{(m - s - y^{ss}m)}$$

Now assume that $\beta = 1$.

7. Using parts 5 and 6, find a relationship between the steady-state level of output y^{SS} and the steady-state level of prices p^{SS}. This is a relationship between output and prices that represents equilibrium in the labor market. It is the "analogue" of the aggregate supply relation that you have seen in class.

We combine the wage equation from part 5 with the wage equation from part 6 to get

$$\frac{y^{ss}s}{(m - s - y^{ss}m)} = p^{ss} + b$$

Solving gives

$$p^{ss} = \frac{y^{ss}s}{m - s - y^{ss}m} - b$$

$$= \frac{s}{\frac{m-s}{y^{ss}} - m} - b$$

8. Consider the relationship that you have just derived. Is this relationship increasing or decreasing?

This relation is upward sloping, just like in the regular AS.

9. There exists a second relationship between steady state output and prices, representing equilibrium in the good and money markets. This aggregate demand (AD) relation is given by:

$$y^{ss} = G - p^{ss}$$

where G is government spending. Describe in words how the equilibrium changes (i.e., how y^{ss} and p^{ss} change) in the following cases (no need to use any formulas)

(a) Suppose there is an increase in unemployment benefits and you wanted to capture this by changing some parameter in the model. What parameter would you change?

The reservation wage b increases. The AS shifts down, prices go down and output goes up.

(b) The economy becomes more efficient at matching workers with jobs (m goes up)

The AS shifts up if $1 < y_t$ and down if $y_t < 1$. There is no change when $y_t = 1$. When the AS shifts up, prices go up and output goes down. When the AS shifts down, prices go down and output goes up.

(c) There is fiscal consolidation (G goes down).

The AD shifts to the right, output and prices go down.

10. Contrast your answer to part (a) of question 10 to the results of the same experiment in the AS/AD model.

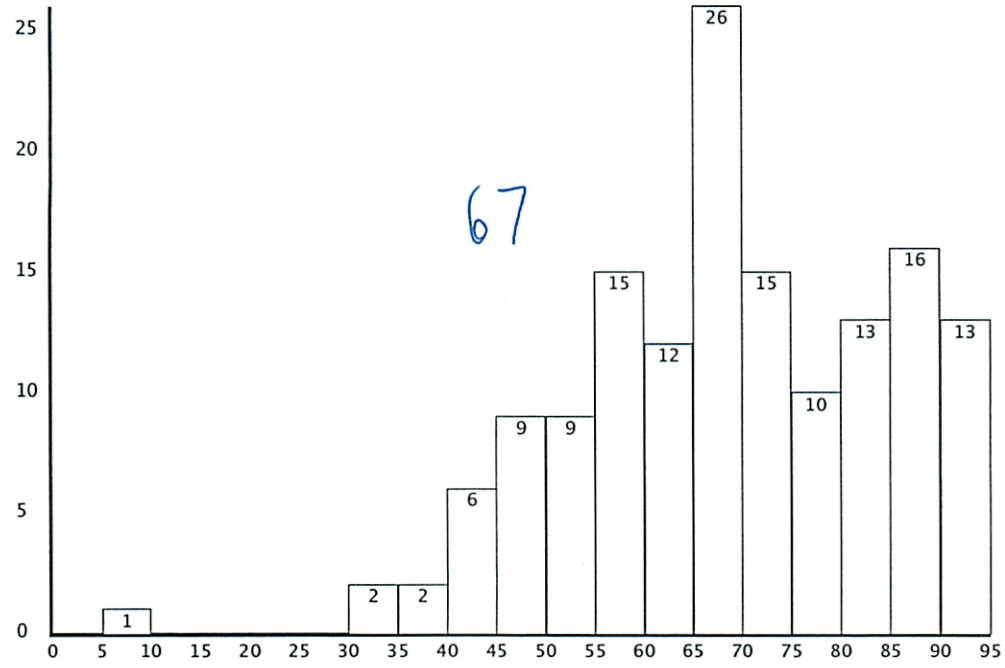
In the usual model, an increase in the reservation wage would imply an increase in the "catchall" variable z, which would shift the AS up, prices would go up and output would go down.

11. (OPTIONAL: up to 5 extra points) Describe in words (no formulas needed) how the economy converges to the steady state if it starts from a point in which v_t and u_t are both above its steady state levels.

14.02 Principles of Macroeconomics

Dashboard | Students | Assignments

Grading Summary for Quiz 1



67

Number of Scores:	149
Average:	68.03
Standard Deviation:	16.06

Chap 10 Growth Reading

3/26
At home

Start of section on Long Run

Growth is the main part of long-term picture
- outshines day to day fluctiations (which are short + medium run)

output per capita grew steadly in advanced countries
- leads to standard of living
- hard w/ exchange rates
  - fluctiation
  - and cost of l'ving differs
- so correct for above issues → purchasing power parity (PPP)
  - use one countries' prices
  (still kinda confused - exactly how this works)
  - no use avg of price "international dollar prices"
  - Penn World Tables"
- growth compounds
- growth rates high 1950-1973
  middling/low 1970s-on
  (high again 1990s-on?)
- countries have converged recently
  - those that started low have had higher growth
    - but we looked at OCED countries who were in w/ high growth!
  - some, on the other hand, fell behind

(2)

10.2 but long history more like leap frogging
fast growth only really in recent years

Some African countries actually fell in standard of living!

why does growth exist? and not in some areas? and why so fast post-WW2?

the % people "happy" in US has not changed since 1975

but people in poor countries far less happier

So income only leads to happiness up to a point, since it is relative

---

- look at aggregate production function
  - before we assumed no growth - constant output per worker

$Y = F(k, N)$

↑ employment (assuming all the same)
Capital stock

- state of technology - how much output for $\bar{k}, \bar{N}$
  - for how narrow view on technology: just list of available machines

returns to scale - if k, N doubled, output will double

$$2Y = F(2k, 2N)$$
$$xY = F(xk, xN)$$

but what if only add more Y, at $\bar{N}$

- decreasing marginal ~~th~~ return - decreasing returns to capital

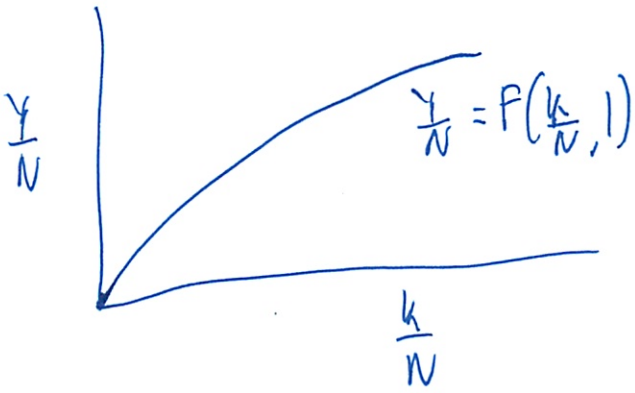
labor as well

(3)

$\frac{Y}{N}$ = output per worker

$\frac{k}{N}$ = capital per worker

$\frac{Y}{N} = F\left(\frac{k}{N}, \frac{N}{N}\right) = F\left(\frac{k}{N}, 1\right)$



(think abstractly about graphs - what are they trying to show? why show it like that?)

Sources of Growth

- $\frac{Y}{N}\uparrow$ when $\frac{k}{N}\uparrow$ capital accumulation
- Or better state of tech technological progress

(4)

Capital itself does not sustain growth

- at some point society will stop investing in k
  - since decreasing returns to scale

Higher savings rate leads to higher level of output

- but not higher growth of output

chap 11

Sustained growth only through tech progress

- key to growth

chap 12

Chap 11 Savings + Output Reading

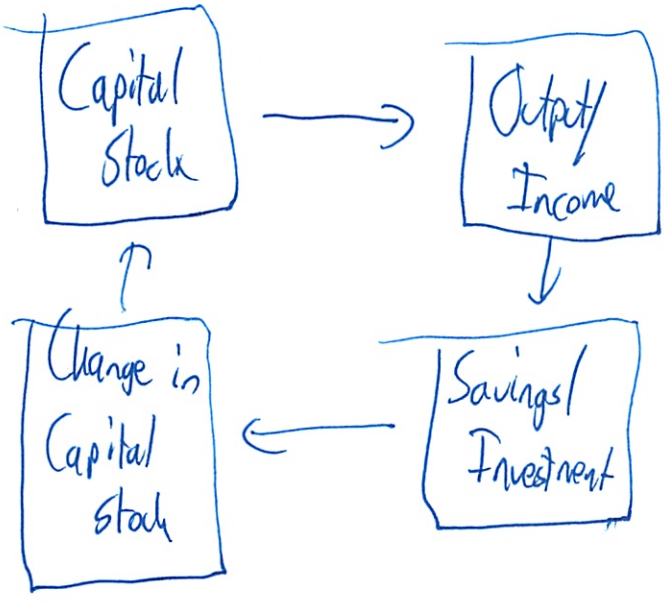
3/26

US has low savings rate - but higher growth rates

Over long periods - savings rate does not matter for growth

but matters for level of output and standard of living

- amt of capital controls amt of output
- amt of output determins amt of saving and thus amt of capital



Capital on Output

$$\frac{Y}{N} = F\left(\frac{k}{N}, 1\right)$$

- remember decreasing return on capital of output

$$\frac{Y}{N} = f\left(\frac{k}{N}\right)$$

↑ same function, but now lowercase (why?)

- assume employment is constant, so only k changes
- " no tech progress - so F, f constant over time

(2)

$$\frac{Y_t}{N} = f\left(\frac{k_t}{N}\right) = F\left(\frac{k_t}{N}, 1\right)$$ - added time indexes (11.1)

Solow

Output on Capital Accumulation

Output + Investment

- assume econ closed ($I = S + (T-G)$)
- and $T-G = 0$
- So $I = S$
- Savings is proportional to income

$$S = s Y$$

↑ savings rate

- does not appear to change as country becomes richer
- not correlated w/ if country is rich or poor

So $I_t = s Y_t$

↑ investment is proportional to output

Investment + Capital Accumulation

Remember - investment = flow
- Capital = stock

δ = capital depreciation rate $(1-\delta)$ = capital that remains from year to year

$t \Rightarrow$ begining of the year matters

$$k_{t+1} = (1-\delta)k_t + I_t$$

- k_{t+1}: capital stock in next year
- $(1-\delta)k_t$: still around
- I_t: new

Now put in I_t

$$k_{t+1} = (1-\delta)k_t + s Y_t$$

And divide by N

$$\frac{k_{t+1}}{N} = (1-\delta)\frac{k_t}{N} + s\frac{Y_t}{N}$$

Expand and Reorg

$$\frac{k_{t+1}}{N} - \frac{k_t}{N} = s\frac{Y_t}{N} - \delta\frac{k_t}{N} \qquad (11.2)$$

- from the saving side - level of output per worker determins change in level of capital per worker over time

Dynamics of Capital + Output

- Replace $\frac{Y_t}{N}$ w/ aapa $\frac{k}{N}$ from 11.1

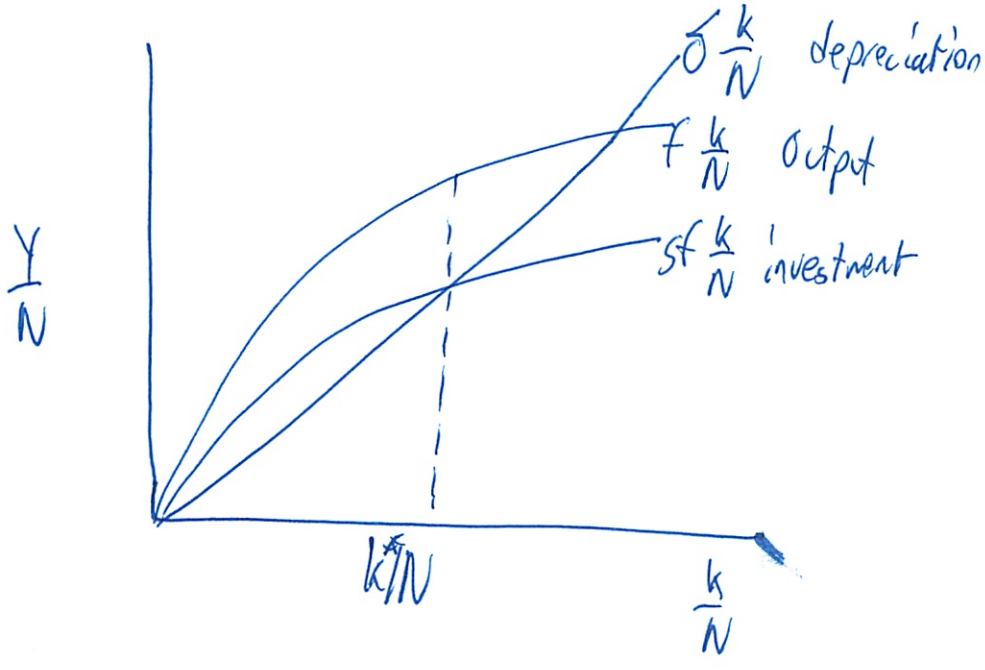
$$\frac{k_{t+1}}{N} - \frac{k_t}{N} = sf\left(\frac{k_t}{N}\right) - \delta\frac{k_t}{N} \qquad (11.3)$$

Change in k = investment − depreciation

(9)

if investment > depreciation, change in $\frac{k}{N}$ is (+)

So $\frac{Y_t}{N} = f\left(\frac{k_t}{N}\right)$



At $\frac{k^*}{N}$ the $\frac{Y}{N}$ is 0 - does not change - steady state

but

→ → → . ← ← ←

$\frac{k}{N}$

deprec < invest
so $\frac{Y}{N} \uparrow$

depreciation > investment
so $\frac{Y}{N} \downarrow$

So always hits $\frac{k^*}{N}$ "converges"

if a lot of capital disappears (bombed) then will be on left
- can grow back up

(5)

Steady State Capital + Output

$$sf\left(\frac{k^*}{N}\right) = \delta \frac{k^*}{N}$$

investment = depreciation

$$\frac{Y^*}{N} = f\left(\frac{k^*}{N}\right)$$

↑ steady state output per worker

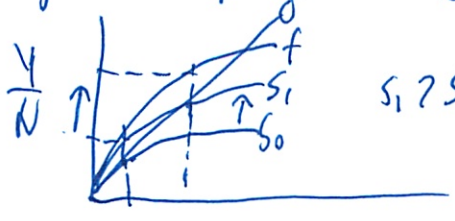
Savings Rate + Output

1. Savings rate has no effect on long term growth of $\frac{Y}{N}$, which = 0
   - Since it converges to steady state

For growth to have happened - would need $\frac{k}{N}$ to ↑
- but decreasing returns, it would have to ↑ faster than $\frac{Y}{N}$

So econ would have to save larger + larger fraction of output
But at one point this would be impossible
Soviet Union tried
(go back + understand!)
[Ah so s is ↑ over time - to keep up with push to 0 ↑ fight back]

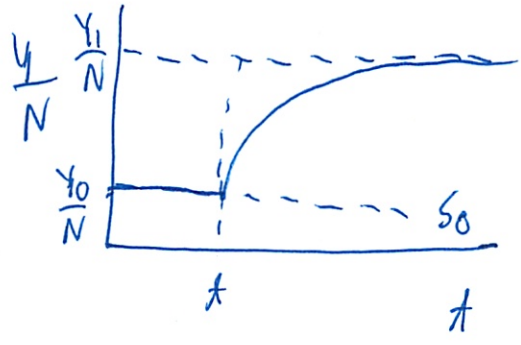
2. Savings rate determins level of output in long run
   - Countries w/ higher savings rate have higher output per worker in long run



3. ↑ in s will lead to higher $\frac{Y}{N}$ for some time

- since we know long-run growth rate $\frac{Y}{N}$ → 0
- and ↑s will ↑$\frac{Y}{N}$

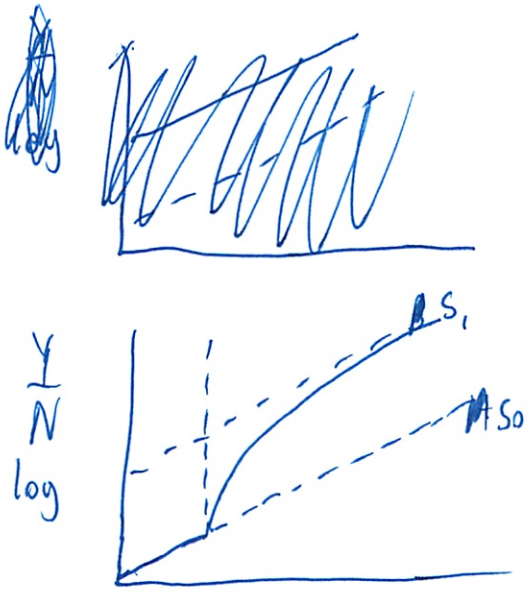
So as s ↑, econ will grow
But will soon reach new steady state
And stop growing



w/o tech progress

$s_1 > s_0$

But also applys w/ tech progress



w/ tech progress

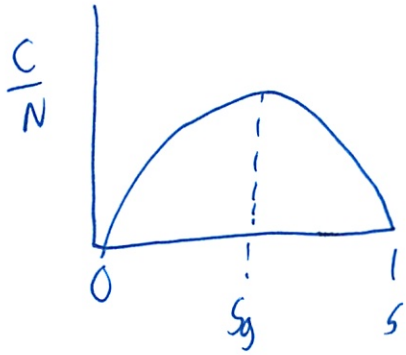
$s_1 > s_0$

⑦ Savings Rate + Consumption

Gov can affect ~~private~~ savings
- can vary public savings
- tax breaks for private savings

But look at <u>consumption</u> not <u>output</u>

Consumption = 0 when savings rate is either 0 or 1
- 0: no output
- 1: all saved
  - but need to continue this to match depreciation!



↑ <u>golden rule level of capital</u> comes from this
- increasing capital past this ↓ consumption
  - not only now, but also later

- Most OECD countries are far below s_g
  - so gov faces tradeoff
  - ↑s means lower consumption now, but higher in future
  - politics means pander to current voters
- Social Security in US has ↓ savings rate
  - So ~34% smaller capital stock

11.3 Sense of Magnitudes

Assume $Y = \sqrt{k}\sqrt{N}$
- constant returns to scale
- decreasing returns to capital or labor

(8)

$$\frac{Y}{N} = \frac{\sqrt{K}\sqrt{N}}{N} = \frac{\sqrt{K}}{\sqrt{N}} = \sqrt{\frac{K}{N}}$$

since $\frac{\sqrt{N}}{N} = \frac{\sqrt{N}}{(\sqrt{N}\sqrt{N})} = \frac{1}{\sqrt{N}}$

(oh cool - would not have noticed!)

So $f\left(\frac{K_t}{N}\right) = \sqrt{\frac{K_t}{N}}$

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = s\sqrt{\frac{K_t}{N}} - \delta\frac{K_t}{N}$$

Evolution of capital per worker over time

Effect of Savings Rate on Steady State Output

- in steady state $\frac{K}{N}$ is constant, left = 0, so

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

Square both sides

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

Divide both sides $\frac{K}{N}$, reorg

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

Steady state $\frac{K}{N}$ is = to 2 of each savings ratio to depreciation rate

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

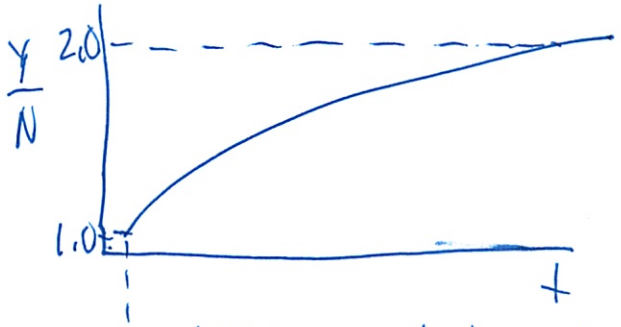
Higher savings rate or lower depreciation leads to more $\frac{K^*}{N}$ & steady state

(9)

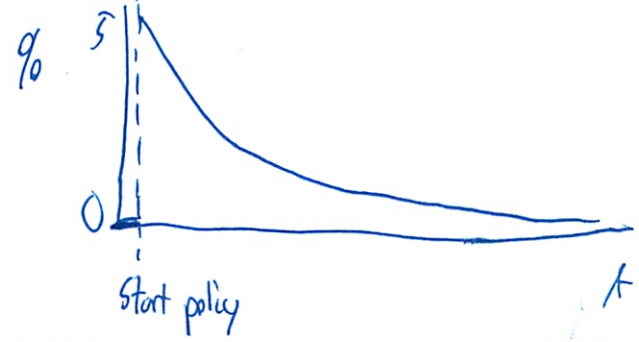
Dynamic Effect of ↑ in Saving Rate

- how long does adjustment take?
- Can solve eq each year
(Glad spent time learning this on P-set)
- Adjustment can take a long time
40% done after 10 years

Effect on $\frac{Y}{N}$



Effect on output growth



USA

- remember consumption is what is left after req. investment to offset depreciation

$$\frac{C}{N} = \frac{Y}{N} - \delta \frac{k}{n}$$

(10)

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

So C is largest when $s = \frac{1}{2}$

* ↑ steady state *

11.4 Physical vs Human Capital

human capital - people

much higher today than any time in the past

$$\frac{Y}{N} = f\left(\frac{k}{N}, \frac{H}{N}\right)$$

(+) (+)

↑ human capital per worker
- avg level of skill

- also decreasing returns
- use relative wages to calculate
  - since it should be their marginal product

treat it much the same as physical capital accumulation

in US ~6.5% of GDP

- but need to subtract out part for people's enjoyment
- add in opp. cost of edu
- plus on-the-job training
- some depreciation on skills

- studies showed both matter

(11) Exogenous Growth Models

Remember more saves/spends on edu leads to higher output
- not higher output growth

But some have wondered if ↑k ? ↑H together does not lead to ↓ rate of return

Jury still out on these models

Also no word yet on wether higher edu-ed workforce leads to faster tech progress

Chap 12 Tech Progress + Growth

3/26

Sustained growth requires tech progress

add tech progress to aggregate production function

- can lead to ↑Y with $\bar{k}, \bar{N}$
- Can lead to better products
- " " " new "
- " " " more variety of products

) in each case consumer gets greater utility

∴ So look at state of technology A

$$Y = F(k, N, A)$$

(+) (+) (+)

Rewrite to make ealser

$$Y = F(k, AN)$$

defining tech progress as

- reducing # of workers for same output
- or ↑ Y for given N

So basically AN = effective labor

Constant returns to scale

$$2Y = f(2k, *2AN)$$

$$xY = f(xk, xAN)$$

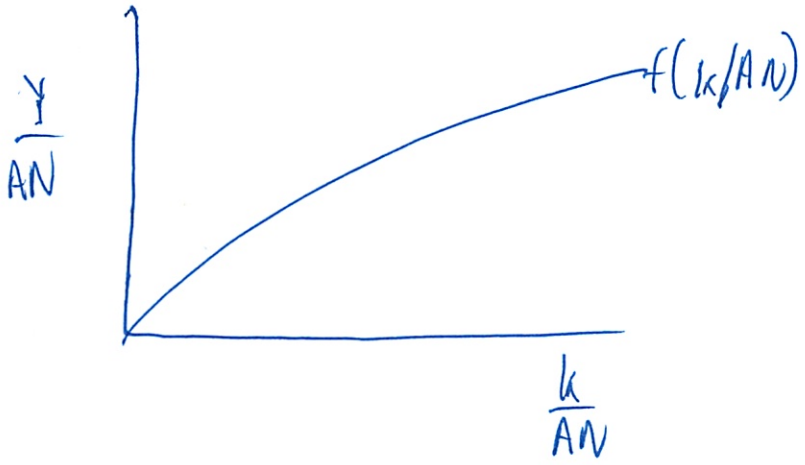
but with one fixed, get decreasing rate of return if just ↑ one

(2)

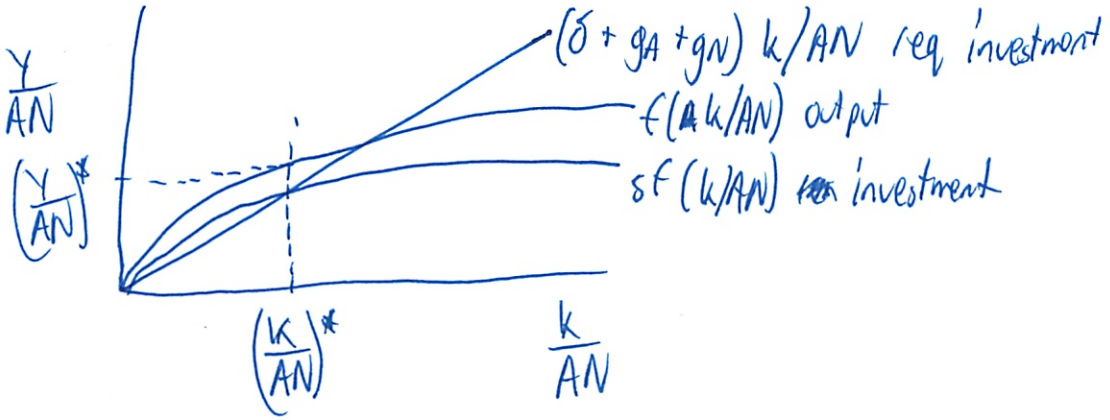
$$\frac{Y}{AN} = F\left(\frac{k}{AN}, 1\right)$$

$$\frac{Y}{AN} = f\left(\frac{k}{AN}\right)$$

Interactions b/w Output + Capital



So basically now just effective workers?



$$I = S = sY$$

$$\frac{I}{AN} = s\frac{Y}{AN}$$

$$= sf\left(\frac{k}{AN}\right)$$

(3)

but A ↑ w/ time

So maintaining same $\frac{k}{AN}$ requires more k

g_A = rate tech progress

g_N = growth rate of labor force

So growth $AN = g_A + g_N$

So level of investment to keep $\frac{k}{AN}$ constant =

$$\delta k + (g_A + g_N) k$$

$$(\delta + g_A + g_N) k$$

So amt of capital needed per worker =

$$(\delta + g_A + g_N) \frac{k}{AN}$$

Dynamics of Capital + Output

* So settles again on steady state $\left(\frac{k}{AN}\right)^*$ $\left(\frac{Y}{AN}\right)^*$

So Y is growing at same rate as AN

So growth must = $g_A + g_N$

- Output and capital
- savings rate has nothing to do here!

Econ can't grow faster than $g_A + g_s$ since then capital > output

- econ would be dedicating larger + larger share output to investment
- and have to replace the depreciation!

(4)

To look at standard of living

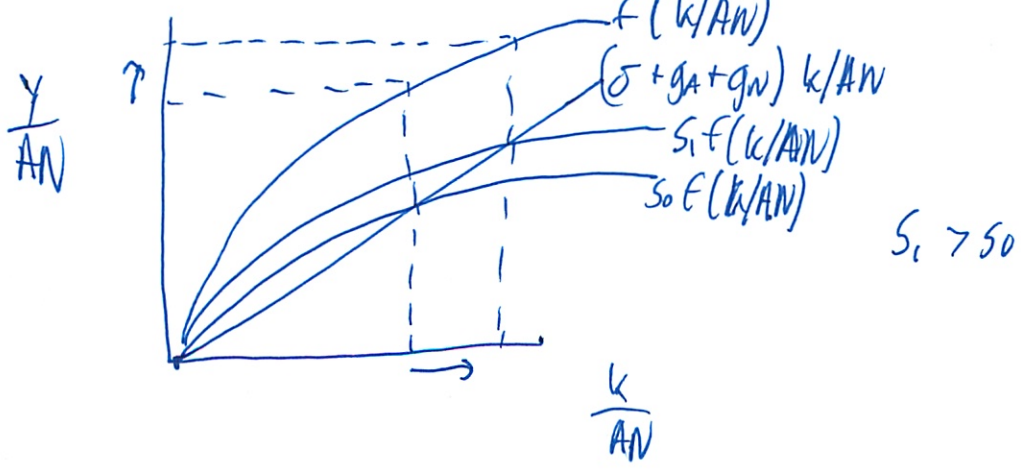
look at output per worker not output per effective worker!

this is called balanced growth

	Rate of growth of
1. Capital / effective worker	0
2. Output / " "	0
3. Capital / worker	g_A
4. Output / "	g_A
5. Labor	g_N
6. Capital	$g_A + g_N$
7. Output	$g_A + g_N$

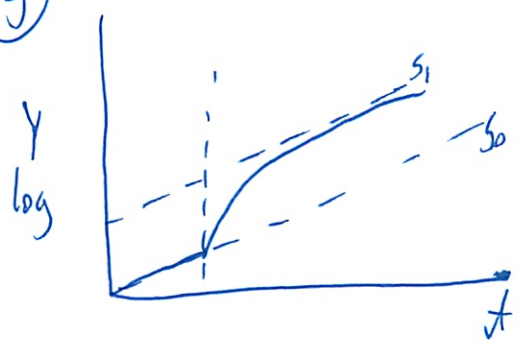
Effect of Savings Rate

= does not affect steady-state growth rate



$s_1 > s_0$

(5)



$s_1 > s_0$

(same chart as before!)

12.2 Determinants of Tech Progress

R+D activities

~2-3% of GDP

Generates ideas to make higher profits

depends on both fertility + appropriability of results

No evidence that fertility is decreasing

Need to balance access to new drugs vs. incentives for R+D

12.3 Facts of Growth Revisited

Remember econ can grow fast for 2 reasons

1. Higher rate of tech progress → output growth → balanced growth
2. Or more capital per effective worker
   - temp
   - perm.

1. So 1950-1973 was #1
   - not since France all bombed out
2. But not as much tech progress mid 1970s-on
   - not disappearance of thrift

3. Convergence b/c new tech in poorer countries

Fluctiations in Tech Progress

- still a mystery
- R+D spending increasing or constant
- or major invention implemented
  - steam engine
  - telegraph
  - computer

12.4 Institutions

- weaker in African nations
  - like property rights, etc
- strong correlation on graph
- hard to implement - somewhat of a cycle
- Asia is doing it

14.02 Open Economy

Maya's teaching ....

Real exchange rate - price of domestic goods relative to foreign car

if ~~people buy more foreign cars~~ foreign cars cheaper - People will buy more

Generally price is **not observable**
- more complex/abstract idea
- need to calculate

real exchange rate tells us about relative prices
↑ | domestic goods more expensive

Nominal exchange rate two differences
1. # of shekels for a dollar ← common
2. or the inverse: # of dollars for a shekel ← book uses "E"

nominal exchange rate **NOT** informative about real exchange rate
- just different denomination

ie car $25,000 USD
100,000 isreli shekel
if exchange rate (def 2) < .25 car is cheaper in Isreal
> .25 " " more expensive " "

(2)

But changes in nominal rate is interesting

Appreciation - ↑ exchange rate (shekel becomes more valuable)
Depreciation - ↓ " " (" " less ")

- using def. 2 - remember!

Constructing Real Exchange Rate

1. Use nominal ex. rate to find how much an Israeli car costs in USD
2. $\epsilon = \frac{E P_{car}}{P^*_{car}}$

* = foreign
ϵ = real ex rate
E = nominal ex rate def 2 (dollars for shekels)
P_{car} = price Isreali car in shekels
P_{car}^* = Price US car in US dollars

So defining domestic as Isreal
foreign as US

But often exchange rate is in terms of US
- So why she is making Isreal "domestic"

(4) - continued p(3)

So if this is .25

$$\frac{.25 \cdot 100{,}000}{25{,}000} = 1$$

GDP deflator - price of all goods produced domestically
often used

GDP deflator $_{Ereal}$
GDP deflator US

But its an index
- good at price over time

So changes in real exchange rate important
- appreciation or depreciation

Puzzle: change in real exchange rate often driven by changes in nominal rate

* Relative purchasing power matters *

Difference GDP / GNP

- in open econ - people can own factor of productions that are foreign

GDP - value added domestically

GNP - value added by domestically owned factors of production

(5)

Most countries - values are similar GDP, GNP

- Both: domestically-owned factors ≈ foreign owned domestic factors

[What's in the book is what counts in this class]

Except Kuwait

GNP > GDP

- used oil revenues to buy financial assets
- income generated ~~for~~ from foreign assets

Current Account

People can save through domestic + foreign investment

$CA = S - I_{domestic}$

↑ how much we save abroad at this time period

3 components

NX - if we export > import - foreigners "owe us" so it is like saving abroad
- buy foreign assets w/ excess export revenues

Net return on assets - profits of US owned foreign factories - profits of foreign owned factories in US

Net transfers - foreign aid, etc

(6)

Basically we are looking at <u>net capital flows</u>

- We can count how many foreign assets (stocks + bonds) were bought by Americans + subtract amt of US assets bought by foreigners

But in real life the #s don't add up perfectly

- US up to 20%!
- Since a lot of hidden income

(I need to look at this closer - read book)

Chap 18

In US 2009

$NX = X - IM = -374$ bill

$+ r^* A^* = 350$ bil - rev from foreign assets from US res A^*

$- r A = -230$ bill rev paid to US res on US assets to foreign

$- 124$ bil = grants to foreign countries

$= -378$ bil

So $r = 1\%$ $r^* = 1.8\%$

$r < r^*$ = US privilege - US has higher return

(7)

Financing

↑ foreign assets owned by US $\Delta A^* = +1{,}222$ bil

↑ US assets owned by foreigners $\Delta A = -1600$ bil

So change $\Delta A^* - \Delta A = CA = -378$ bill

14.02 Goods Market Open Econ

Chap 19 + 20

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

- Z: domestic demand
- $-\frac{IM}{\varepsilon}$: subtract goods imported
  - divided by real exchange rate ε
  - Since IM is in foreign currency - by convention
  - Need to convert to domestic currency
  - Not really currency
    - Say econ #1 apples
      - #2 oranges
    - 1 imports oranges
    - Needs to denote in apples
- X: exports

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

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

- remember foreign values *

So can derive domestic demand curve

$$DD = C + G + I = C(Y_d) + I(Y, r) + G$$

↳ domestic agents for all goods

(2)

Slope of demand to output is 0 but < 1
↑ income ↑ demand but less than 1 for 1

$AA = DD - \frac{IM}{e}$

↑ domestic demand for domestic goods

AA will always be less than DD
- imports will always be +
- also flatter
  - when demand ↑ some goes to domestic foreign
- has a pos slope

$ZZ = AA + X$

↑ demand for domestic goods from all agents

Note $X \neq f(Y)$

Distance b/w AA, ZZ constant since X is constant

(3)

Equalibcim Output + Trade Balance

$Y = Z$

Output must = demand

Some demand might be foreign

Could have trade deficit/surplus

Depreciation, Trade Balance, Output

$$NX = X(Y^*, \varepsilon) - \underbrace{IM(Y, \varepsilon)}_{\varepsilon}$$

assume gov can choose ε

- bit of a stretch

A real depreciation

$X \uparrow$

$Im \downarrow$

$\frac{1}{\varepsilon} \uparrow$

In theory ambigias

Condition under which depreciation leads to $\uparrow NX$ is called Marshall-Lerner condition.

$$\frac{\partial NX}{\partial \varepsilon} < 0$$

We will assume it

9)

What are effects depreciation on output?

NX ↑

Y ↑

Income ↑

Demand ↑ (Consumption)

Output ↑ further!

(Bit confused - should look at book)

Gov see this as good deal

- depreciate exchange rate
- many govs tried Great Depression

But if everyone does it - it has no effect!

- "currency war"
- Today people think Chineese are doing it

Revisit Investment + Savings

Domestic agents can also save by ↑ net exports

foreigners owe them something in return at a future date

(5)

$$Y = C + I + G - \frac{IM}{\epsilon} + X$$

$$S = Y - C - T$$

$$S = I + G - T - \frac{IM}{\epsilon} + X$$

$$\downarrow$$

$$NX = S + (T - G) + I$$

$$\uparrow NX = X - \frac{IM}{\epsilon}$$

$S \neq I$ because can also save w/ $\oplus NX$

- giving away goods + promise to repay in future

Chap 20 Intest Rates in Open Econ

Domestic Bonds vs Foreign Bonds

interest rate parity condition

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

usually IS depends on i

$i \uparrow$ $I \downarrow$

but adding another IS dependence on i through ϵ

- depends on relative exchange rates foreign + domestic bonds

(6)

To buy foreign bonds

- Convert domestic currency for foreign currency
- buy foreign bonds in foreign currency
- Convert foreign currency to domestic currency

If one would deliver a high rate of return — every one would rush there, that rate would ↓ back to be in line.

Large risk of loss
- arbitrage opportunity
- would not last

$(1+i_t)$ = domestic rate of return on bond

$(1+i_t^*)$ = foreign " " " " "

$i_t \overset{may}{\neq} i_t^*$ ~ can get an arbitrage opportunity

E_t = exchange rate, actual, this period

E^e_{t+1} = expected exchange rate next period

$i \uparrow \rightarrow E_t \uparrow$

$i^* \uparrow E_t \downarrow$

Changes in E^e_{t+1} lead to changes in E_t

We will assume $E^e_{t+1} = \bar{E}^e$

? some constant - won't think about how this adjusts

(1)

Use nominal rate since we are not talking about flow of goods

Net exports depend on real interest rates

First 2 simplifications

1. P and P^* are constant so $\boxed{\varepsilon = \frac{EP}{P^*}}$

   - real exchange rate moves 1 for 1 w/ nominal exchange rate

2. No inflation / expected inflation

   $i = r$

Notation

E = nominal exchange rate
ε = real " "

So IS is writen as

$$Y = C(Y^d) + I(Y, i) + G + NX(Y, Y^*, E)$$

Substitute in interest rate parity condition

$$Y = C(Y^d) + I(Y, i) + G + NX(Y, Y^*, \frac{1+i}{1+i^*} E^e)$$

When i^* ↑, foreigners richer, want to export more

(8)

When $\epsilon \uparrow$, IM ?

- our domestic goods relatively more expensive

X ↓

Assume NX ↓ in E

- b/c simplifying assumption ϵ, E moves 1 for 1

So ? in i has two effects

- investment (was)
- net exports (new)

14.02 4/1

Fernando now teaching Friday

Going over exam 1

Mean = 67.8 ← right on target!

3. Point: depending on which part of labor market you do changes #
   - outcome diff from AS-AD #s

Unemp dynamics $u_{t+1} - u_t = s(1-u_t) - h_t$

Vac " $V_{t+1} - V_t = \frac{u_t}{V_t} - \underbrace{\frac{1}{w_t^2}}_{\text{↑ was x in class}}$

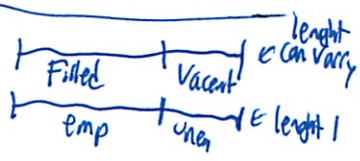
1. economic meaning of s
   - ~~how much~~ sepeation rate

2. Steady state - where variable is constant $X_{t+1} = X_t = X^{ss}$

ind $0 = s(1-u^{ss}) - h^{ss} \rightarrow u^{ss} = 1 - \frac{h^{ss}}{s}$ ← hiring rate, ← sep rate

firms $0 = \frac{u^{ss}}{V^{ss}} - \frac{1}{(w^{ss})^2} \rightarrow V^{ss} = \left(1 - \frac{h^{ss}}{s}\right)(w^{ss})^2$

think about makes sense



↑ if more unemp, more vacancies, for given wage

(3)

Now plug into #2 ans

$$u^{ss} = \frac{s}{s + m w^{ss}}$$

$$v^{ss} = \frac{(w_{ss})^2 s}{s + m w^{ss}}$$

Think about h^{ss}

- rewrite so see clearly

$$- h_{ss} = \frac{s}{\frac{s}{m w_{ss}} + 1}$$

~~when w_{ss} goes~~

when $w_{ss} \uparrow$ $\frac{s}{m w_{ss}} \downarrow$ $h_{ss} \uparrow$

if more empty spots, easier to find empty spots

~~$h^{ss} = m \sqrt{u^{ss} v^{ss}}$~~

$$h^{ss} = m \sqrt{u^{ss} v^{ss}}$$

$$V_{ss} = u_{ss} (w_{ss})^2$$

$$u^{ss} \left(1 - \frac{h^{ss}}{s}\right)$$

from 2 opposing effects

hire less - more open spot

but then easier to find jobs

lots of feedbacks in here

(2)

When w↑, vacancies ?

- Since more expensive for firms to hire
- marginal product no longer > Marginal cost

3. $h_t = m\sqrt{u_t v_t}$

- When more people at there, more people to fill Vacancies
- But takes time to find right job
  - m = how good matching goes
- Had 2 eq 2 unknowns
- Now add 1 eq, 1 unknown
- Solve

$$h^{ss} = m\sqrt{u^{ss} v^{ss}}$$

$$= m\sqrt{(u^{ss})^2 (v^{ss})^2}$$

$$= m\, u^{ss} v^{ss}$$

$$= m\, u^{ss} \left(1 - \frac{h^{ss}}{s}\right)$$

$$= \frac{w^{ss} \cdot s}{s/m + w^{ss}}$$

← oh I simplified too much in previous problem!

(4)

4. Describe in words how ^{ss} changes when m ↑

Step 1 Look at eqns

u^{ss} ↓

V^{ss} ↓

h^{ss} ↑

Idea of market tightness $\theta = \frac{V}{u}$

- wage completly determing market tightness

$$h^{ss} = m w^{ss} \frac{u^{ss}}{V^{ss}}$$

$$= m \frac{1}{w^{ss}} V^{ss}$$

← hires + vacancies directly related

They wrote wrong correction, wanted h^{ss}

- email Anna

(5)

5. Have eq for wage $W_t = P_t + \beta b + (1-\beta) Y_t$

b is reservation wage
- wage below which people in different b/w working + not

$\beta = 1 \rightarrow W_t = P_t + b$

$\underbrace{W_t - P_t}_{\text{real wage kinda} \rightarrow \log(\text{real wage})} = b$

firms have all bargining power

(I got it backwards - kinda guessed/from mem)
(should have looked at formulas)

$\beta = 0$ workers have all power

6. Given production function $Y = L = N(1-U)$ $\longrightarrow$ $Y_t = \underbrace{(1-U_t)}_{\text{get if } L=1} - \underbrace{\frac{V_t}{W_t}}_{\text{new term/twist to Prod Function}}$

Keep vacancies open wastes output

(6)

Had 3 eq, unknows

Add 2 more eq, unknowns W, Y "endogenized"

Rewrite as steady state

$$Y^{ss} = (1 - U^{ss}) - \frac{V^{ss}}{W^{ss}}$$

- Plug in previous results U_{ss}, V_{ss} from part 3

$$W^{ss} = p^{ss} + \beta b + \underbrace{(1-\beta) y^{ss}}_{\text{assume } \beta = 1}$$

$$W_{ss} = p^{ss} + b$$

$$Y^{ss} = 1 - \frac{s}{s + m w^{ss}} - \frac{W^{ss} \cdot s}{s + m w^{ss}}$$

Want relationship Y, p. Get $w(p)$

Get like an AS relation

- upward sloping
- but when change parameters its not the same

$b \uparrow$

$Y \uparrow$ previous model $Y \downarrow$

$p \downarrow$ $p \uparrow$

Chap 18 The Open Econ

4/2

Openness can be looked at in diff markets
- goods
- financial
- factor

Means open between cantries

18.1 Openness in Goods Market

Us exports = exports from USA

- exports + imports going ↑, but diverging
- US much more open now
- look at tradable goods
  - since even if firms sell largly domestically - cald lose biz to foreign competition
- geography + size are important in cantries' trade balance
- remember GDP is value added
- Consumers decide to buy foreign or domestic goods
  - real exchange rate = relative prices domestic rel. to foreign goods
- Nominal exchange rate - price of domestic currency in terms of foreign currency ← this bode uses
  - Or foriegn in terms of domestic ← many people use
  - Nominal appreciation = ↑ price domestic in terms foreign
    - ↑ ex rate
  - Nominal depreciation = ↓ price domestic in terms foreign = ↓ ex rate

(2)

Some countries have fixed their exchange rates

- when ex rate ↑ revaluation (not appreciations)
- " " " ↓ devaluations (not depreciations)

When you go on vacation to Uk don't just care how many pands to a dollar - but also how expensive stuff is.

From Nominal to Real Ex Rate

Want price of domestic goods in terms of foreign goods
if US Cadallac in terms of British Jags

1. Convert Cadillac from USD to GBP

$40{,}000 \cdot .55 = 22{,}000$

2. Compute ration $\frac{\text{Us Good in foreign currency}}{\text{foreign good " " "}} = \frac{22{,}000 \text{ GBP}}{30{,}000 \text{ GBP}} = .73$

- (but what does this mean - you could buy a Cadillac in Britian for $22,000 GBP?)

In real life use price index of goods - like GDP deflator

P = US Price levels
P* = Uk " "
E = dollars in terms of pands

ϵ = real exchange rate = price US in terms of British goods = $\frac{EP}{P^*}$

- (So above ϵ was .73)

(3)

Its an index #

- so only changes in are interesting

If $\epsilon \uparrow 10\%$ then US goods are now 10% more expensive relative to UK goods

(; Does $\epsilon < 1$ mean goods are cheaper in US?)

<u>real appreciation</u> = ↑ rel prices domestic rel to foreign
= ↑ real exchange rate

The ϵ w/ UK has pretty much converged.

E has ↑ (nominal ex rate)

$\frac{P}{P^*}$ grew slower (inflation) in US than UK

Trip would actually be more expensive relatively now vs 1970

<u>Multilateral Rates</u>

- compute above for each country
- weight by US share of trade w/ that country for ex + imp
- average together the ex- and imports rate
- this = <u>multilateral real US exchange rate</u>

Very volitile "dance of the dollar"

18.2 Openness in Fin Markets

- hold foreign assets to diversify portfolio
- Speculate on foreign interest rates + exchange rates
- dollar is on 1 side of transaction 90% of the time
- allows countries to run trade surpluses + deficits
- balance of payments = statement of trade + financial flows

Current Account = "above the line" - payments to + from rest of world

- goods + services
- investment income
- net transfers recieved (int. aid)
- sum = current account balance

US
deficit
surplus
deficit
deficit

Capital Account - "below the line"

Since US had $541 bill current account deficit
net foreign holdings of US assets had to ↑ by $541 bill

↑ in foreign holdings of US assets − US holdings foreign assets = net capital flows = capital account balance

⊕ net flows = surplus ← US
⊖ " " = deficit

In principle current acc + capital acc should = 0
but 7% statistical discrepancy

(5)

Also if you add up all countries - you have a large current account deficit

Choice b/w Domestic + Foreign Assets

- should hold money vs foreign money
  domestic assets vs foreign assets ← what matters

	$t=1$	$t=2$
US	\$1	$1+i_1$

UK: 1 USD → E_1 GBP → $E_1(1+i_1^*)$ GBP → $E_1(1+i_1^*)(1/E_2^e)$ USD

(i_1^*: British rate)

So if you invest depends on E_2^e, i_1, i_1^*

(Just did this in 14.02!)

Because of no arbitrage:

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

Or, reorg

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

← uncovered interest parity / interest parity condition

- plus more trans costs (2 extra currency exchange), rel. risks of countries

(6) Interest + Exchange Rates

Rewrite again

$$(1+i_t) = \frac{(1+i_t^*)}{\left[1+(E_{t+1}^e - E_t)/E_t\right]}$$

If interest rates or expected rate of depreciation $\sim$ < 20%, can approximate

$$i_t \approx i_t^* \underbrace{\frac{E_{t+1}^e - E_t}{E_t}}$$

expected appreciation rate domestic currency = expected depreciation rate foreign currency

Since govs limit ~~interest~~ exchange rate fluctuations
- interest rates converge in UK

19: Goods Market in Open Econ

4/2

A strong expansion in US helps countries around the globe

19.1 The IS relation in the Open Econ

- Now must distinguish
  - demand for domestic goods
  - domestic demand for goods

$$Z = C + I + G - \underbrace{IM}_{\varepsilon} + X$$

ε: value of imports in domestic terms

$C + I + G$ is still the same
- C: total consumption
- I: total investment

make up will still change

Imports

- depend on domestic income
- real exchange rate

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

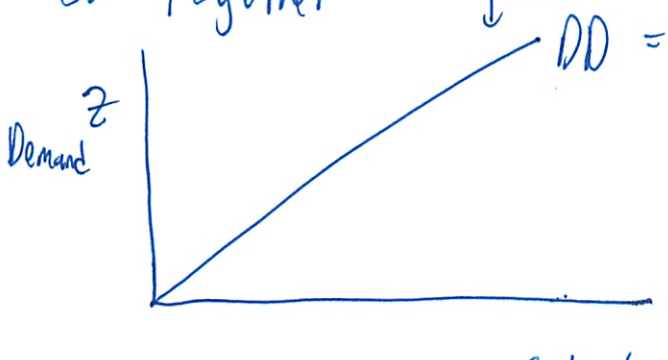
- Income still = output

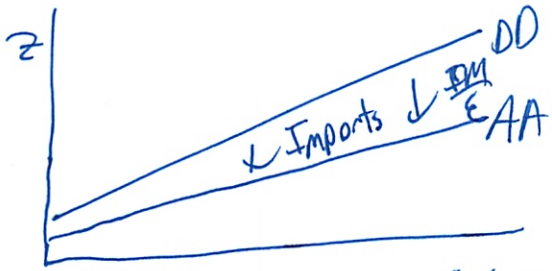
Exports

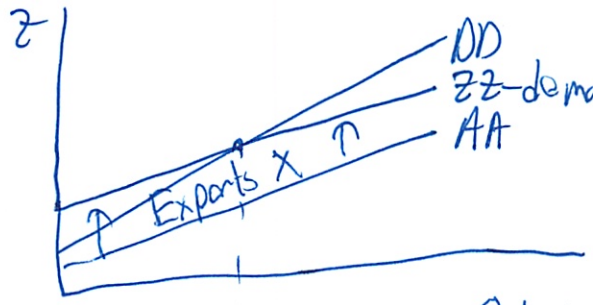
- foreign income
- real exchange rate

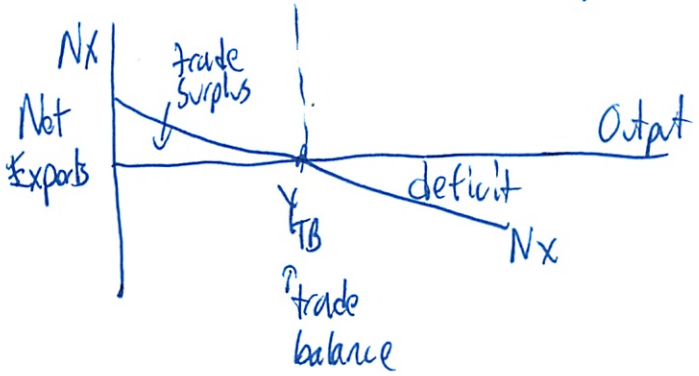
$$X = X(Y^*, \varepsilon)$$
$$(+)\quad(-)$$

(2) So together









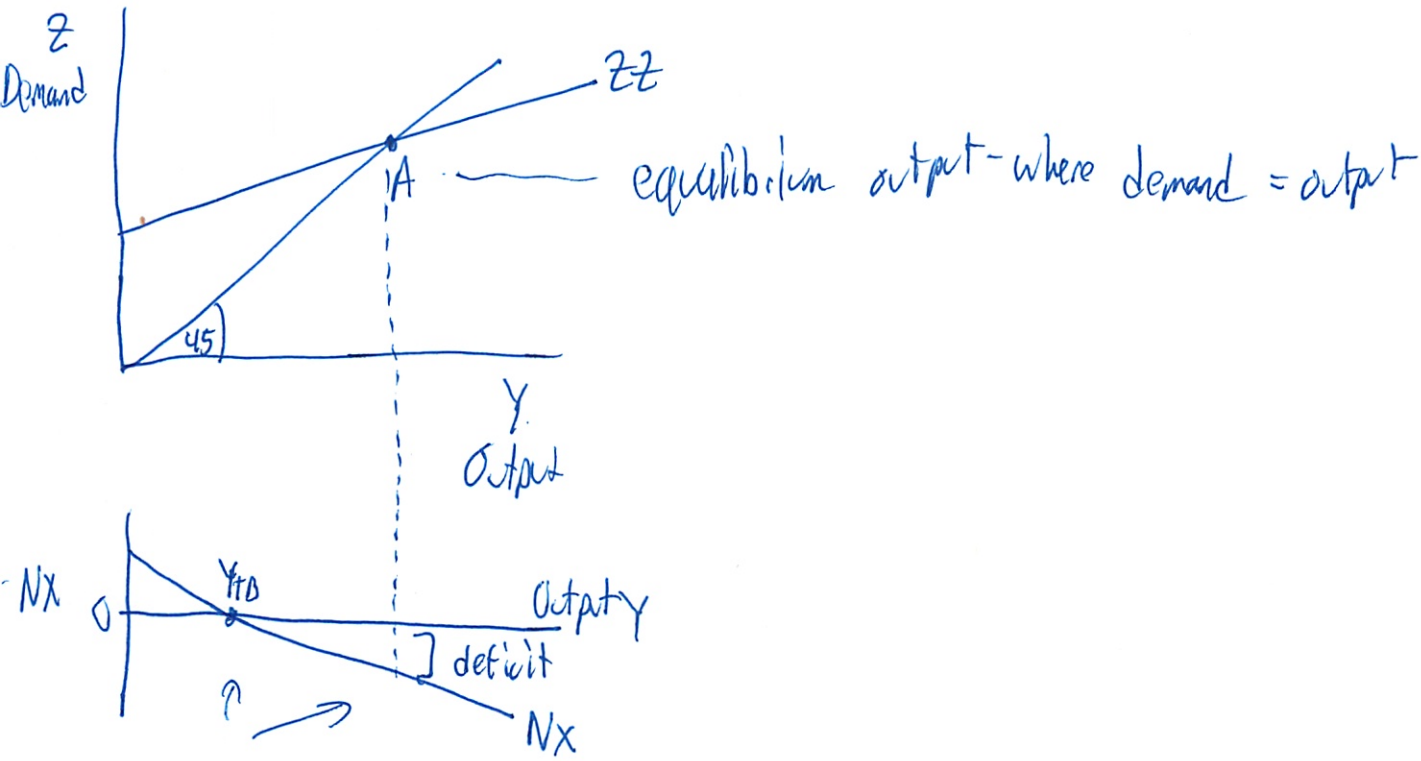
19.2 Equilibrium Output + Trade Balance

$Y = Z$

Y: domestic output; Z: domestic + foreign demand

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

(3)



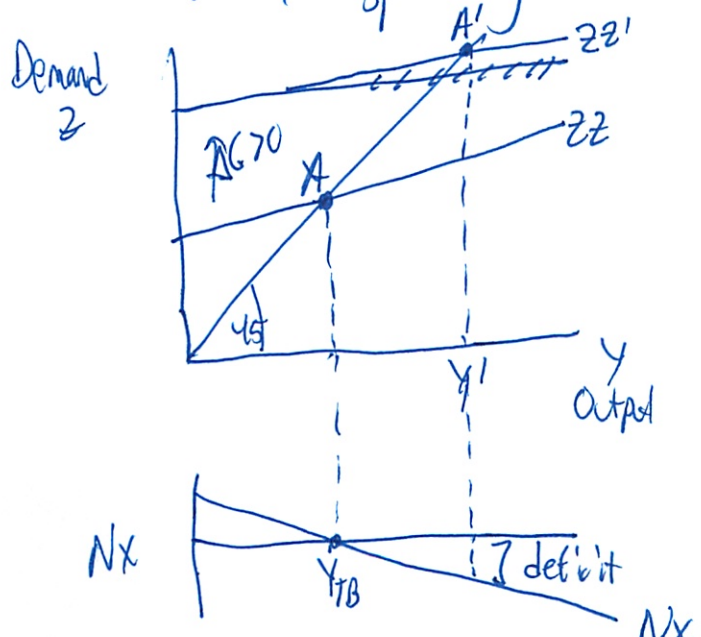
equilibrium output - where demand = output

no reason for these to be at same point
could have drawn at surplus

19.3 Increase in Demand, Domestic or Foreign?

↑ Domestic Demand

- Gov ↑ spending



- multiplier effect still around
- but does not go into IM, X - does not change
- but imports go up

- creates trade deficit
- effect is less than would be in Closed econ
  - multiplier is smaller

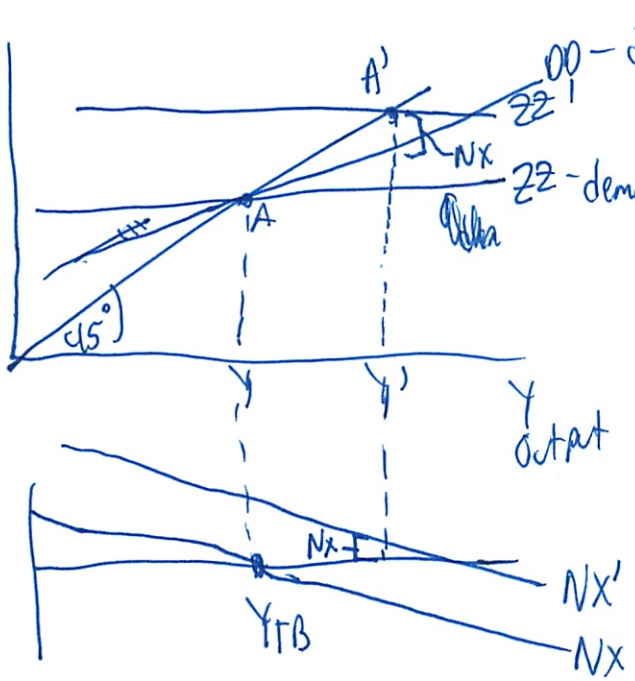
(4)

(but by how much - book never said!)

Increases in Foreign Demand

$Y^* \uparrow$

- could be $G^* \uparrow$, but we don't care



Higher foreign ~~output~~ demand leads to higher exports of domestic goods, which ↑ domestic output and the domestic demand for goods through the multiplier.

Trade balance improves

~~Shocks~~ shocks to 1 country - affect all

Countries don't like trade deficits - means higher interest rates in future

everyone tries to push exports

5

if countries balances and 1 tries to ↑ demand
- then it goes largly to other countries!

So if countries coordinate - won't be a problem

G7

- but countries not in recession don't care
- the countries w/ large deficits don't want to do more
- it pays to say you will cooperate and don't

19.4 Depreciation, the Trade Balance, and Output

Remember $\epsilon = \frac{EP}{P^*}$ Assume Gov sets exchange rate

$$NX = X - \frac{IM}{\epsilon}$$

$$= X(Y^*, \epsilon) - \frac{IM(Y, \epsilon)}{\epsilon}$$

- real depreciation
  - ↑ X
  - ↓ IM
  - ↑ foreign prices rel. domestic prices
  - aims towards trade balance
  - = Marshall-Lerner condition

* Condition = real depreciation ($\mathcal{E}\downarrow$) → NX↑

We looked at direct effects

* but ↓NX also changes domestic output, further changing NX
  - like an ↑ in foreign output - depreciation → ↑NX
  - both demand (ZZ), NX shift up
  - trade balance improves

depreciation means people who need to pay more for foreign goods - often leading to riots

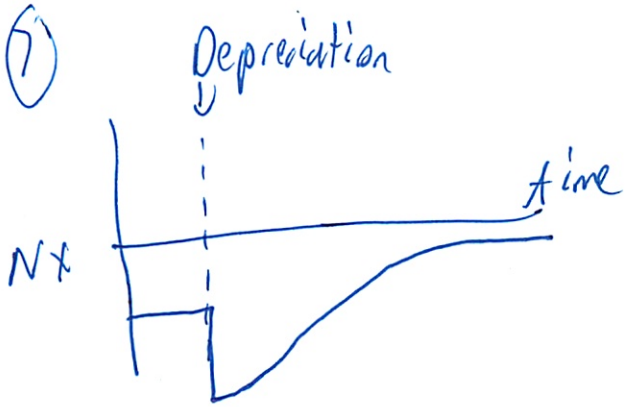
Combining Exchange Rate + Fiscal Policies

- Suppose gov wants to ↓ trade deficit w/o Δ output
- depreciation would ↑ output
- fiscal contraction would ↓ output
- So do both!

19.5 Dynamics → The J Curve

- Same old dynamic effects + some new ones
- movement not instantly

(7)



- 6 months and a year
- effects go "wrong" way for awhile

19.6 Savings, Investment, and Trade Balance

So starting from

$$Y = C + I + G - \frac{IM}{\epsilon} + X$$

Gets you

$$NX = S + T - G - I$$

- trade surplus must be savings > investment
  deficit " < "

↑ I is either ↑ private savings, ↑ public savings or worse trade surplus/deficit

↑ G-T = ↑ private savings ↓ I, or worse trade balance

Chap 20: Output, Interest Rate, Exchange Rate

Exchange rates are not set by govs
- set by markets
- Mundell - Flemming model
  - based on ISLM

20.1 Equilibrium in Goods Market

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

(+) (+)(−) (+)(+) (+)(−)

Alias

$$NX(Y, Y^*, \epsilon) = X(Y^*, \epsilon) - \frac{IM(Y, \epsilon)}{\epsilon}$$

so could use that instead

- real interest rate and real exchange rate affect demand
- ↑ real i ↓ I ↓ domestic good demand
  multiplier, ↓ output
- ↑ ϵ, shifts demand to foreign goods ↓ NX
  ↓ NX, ↓ domestic good demand, multiplier, ↓ output
- assuming real + nominal ex rate move together $E = \epsilon$
- assuming no inflation so $r = i$
  (real ↑, nominal ↑ interest rates)

so $Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, E)$

(2)

20.2 Equalibium in Financial Markets

people now have choice b/w money, domestic bonds, foreign bonds

Money vs Bonds

$\frac{M}{P} = YL(i)$ still applies when econ open

- $\frac{M}{P}$: real supply of M, given
- $YL(i)$: real demand for M
- interest rate must be such that demand = supply

Money held for convenience
- easy to spend

no reason to hold foreign currency

Domestic Bonds vs Foreign Bonds

- investors want highest return
- must have same rate of return in domestic terms
- otherwise arbitrage

$$(1 + i_t) = (1 + i^*_t)\left(\frac{E_t}{E^e_{t+1}}\right)$$

rearrange

$$E_t = \frac{1 + i_t}{1 + i^*_t} E^e_{t+1}$$

assume E^e_{t+1} is given $\bar{E}^e$

$$E = \frac{1 + i}{1 + i^*} \bar{E}^e$$

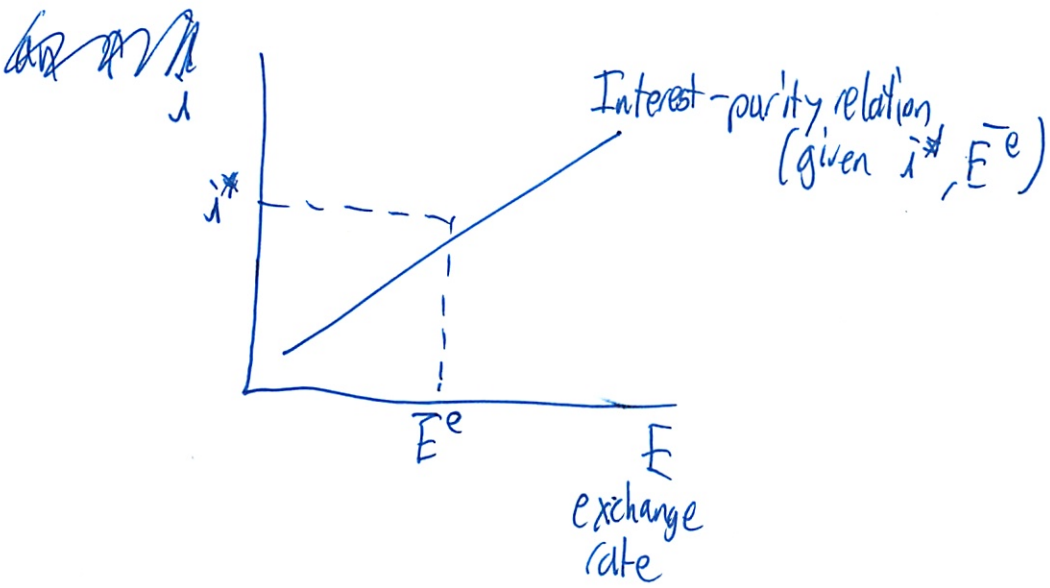
(3)

↑ i = ↑ ex rate – appreciation

↑ i^* = ↓ ex rate

↑ $\bar{E}^*$ = ↑ ex rate

So currency ex rate changes till expected returns are = again



20.3 Putting Together Goods + Financial Markets

$$Y = C(Y-T) + I(Y,i) + G + NX(Y, Y^*, E)$$

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

$$E = \frac{1+i}{1+i^*}\bar{E}^e$$

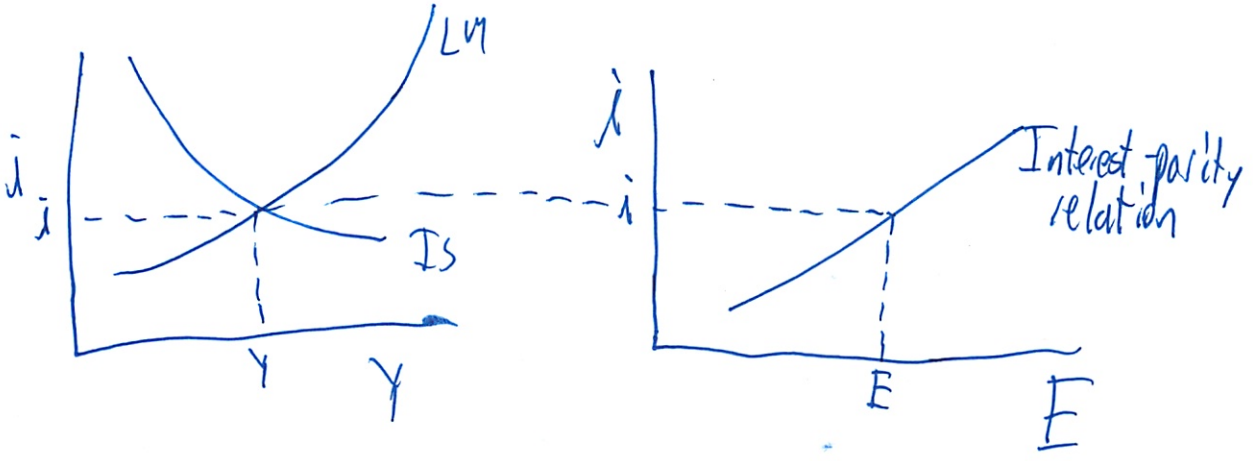
Simplify to get IS-LM

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

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

So when $i \uparrow$

- $I \downarrow$ like before $\downarrow$ domestic demand, $\downarrow$ output
- but also $\uparrow E$ (appreciation), $\downarrow NX$, $\downarrow$ demand for domestic goods, $\downarrow$ output

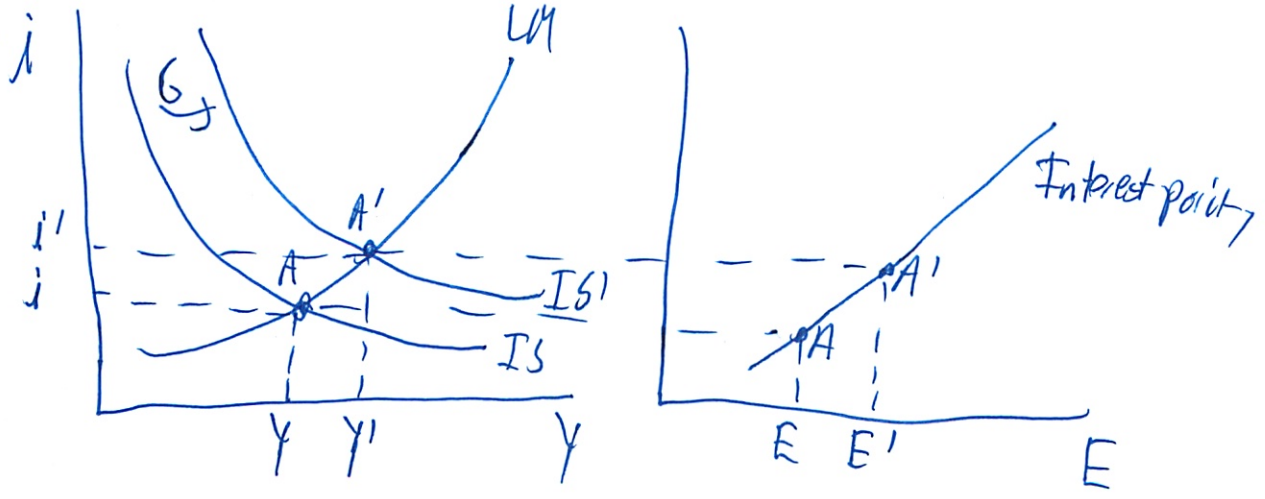


IS holds both relations now

20.4 Effects of Policies in Open Econ

Effects of Fiscal Policy in Open Econ

$G \uparrow$



(5)

↑G = ↑ output, ↑ i, appreciation,

↑ - from the extra demand for money

= domestic bonds more attractive

So ↑ i, appreciation both offset ↑ spending effect on I still ambigias

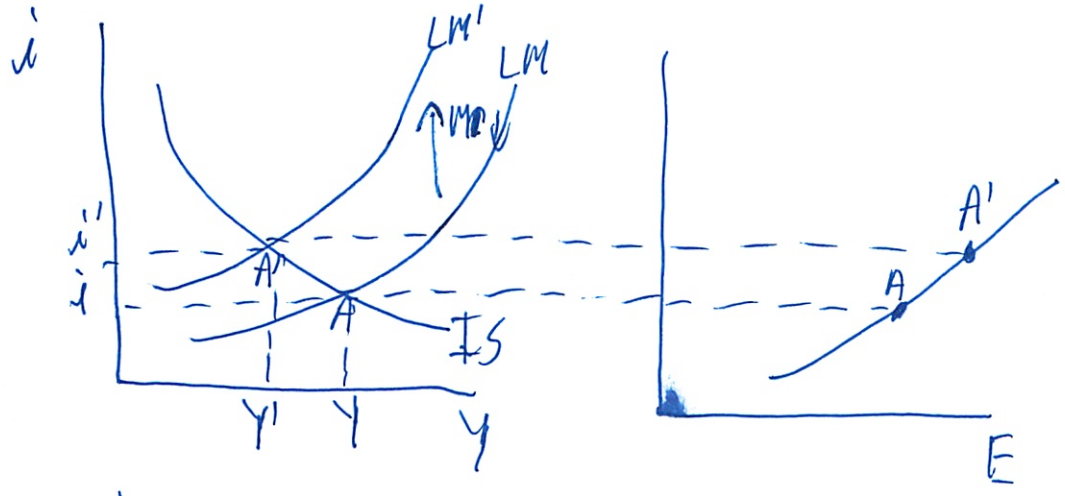
- output ↑ meaning more $ to invest
- but i also a ↑ - meaning less desire to invest

both ↑ output, appreciation combine to ↓ NX

X ↓ IM ↑

- so more of a trade deficit or less surplus

Monetary Policy (↓ M)



↓ output, ↑ i, appreciation

20.5 Fixed Exchange Rate

- gov can't set exchange rate directly usually
- but some central banks set targets + use monetary policy to shape
- pegs, crawling pegs, bands EMS, Euro
- trying to fix one rate to the other (or a basket)
- but can't just announce it
- must satisfy parity condition

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

- Suppose gov wants to peg $E_t = \bar{E}$
  - if fin markets think this will hold $E^e_{t+1} = \bar{E}$
  - then $(1+i_t) = (1+i_t^*)$

$$i_t = i_t^*$$

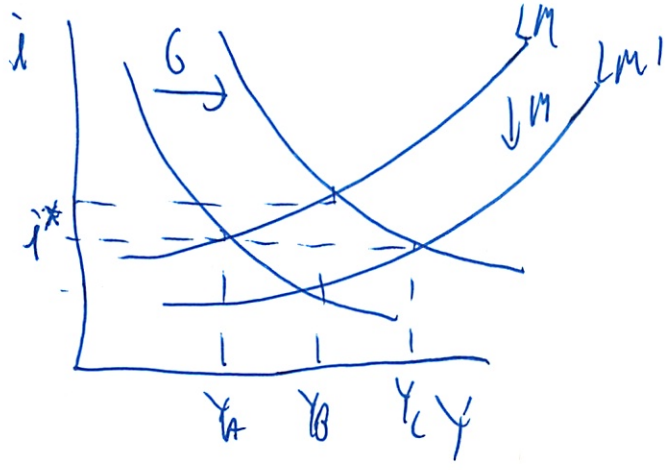
$$\frac{M}{P} = YL(i^*)$$

↑ gov must ↑ M supply to keep peg

* can not use M supply as policy instrument

(7)

- gov can't let currency appreciate
- ↑ output ↑ M demand
- gov must ↑ M supply
- LM down and IS right to maintain same i, and thus exchange rate



Moves from A to C

fiscal policy more powerful under fixed rates

- by fixing rate gov gives up powerful tool trade imbalances or level econ activity
- must match ↑ esp.
- fiscal policy means large deficits
- Con. fiscal means large unemp - w/ no way to fix!