Macro Econ Cheat Sheet Test #1

GDP

3 Methods of Evaluating GDP

↳ Given company chart

1. Value of Goods & Final services
   ↳ Value of only Final Goods, Don't count intermediaries!
2. Sum of Value Added
   ↳ Value Produced − Each's (non-Wage Related) Expenses
3. Sum of Incomes
   ↳ Sum of wages & corporate profits

Nominal vs. Real GDP

1. Nominal = Sum of All Good Quantities * Current Price
2. Real = Sum of Quantities of All Goods * Constant Not Current Price (Year n $)
   ↳ Year whose prices you use is called Base Year

Inflation Rate

* Using whatever year was given as Real GDP Base Year

Step 1) Calculate GDP Deflator for Years T & T−1

$$\text{GDP Deflator in Year } T = \frac{\text{Nominal GDP}_T}{\text{Real GDP Year}_T}$$

Step 2| Calculate Interest Rate

$$\text{Interest Rate} = \frac{\text{GDP Deflator}_T - \text{GDP Deflator}_{T-1}}{\text{GDP Deflator}_{T-1}}$$

* if No Base year given use CPI method $\left(\frac{\text{Nominal}_T - \text{Nominal}_{T-1}}{\text{Nominal}_{T-1}}\right)$

Employment Metrics

• Employment = # of People with jobs

• Unemployment = # of people who don't have job

• Labor Force = (# Employed + # unemployed)

$$\text{Unemployment Rate} = \frac{\text{Unemployment}}{\text{Labor Force}}$$

$$\text{Participation Rate} = \frac{\text{Labor Force}}{\text{Total working Age Population}}$$

↳ unemployment Rate indicates inefficient use of resources

Composition of GDP

1. Consumption (Largest)
2. Investment
3. Government Spending

The Demand For Goods

* in absence of Import/Export

$$Z = C + I + G$$

consumption:

$$C = c_0 + c_1 Y_D$$

c_0: From savings & personal Asset Sale

$c_1 Y_D$: Disposable income Dependent

↳ where $Y_D = (Y - T)$

Equilibrium Condition: $\boxed{Y = Z}$

Autonomous Spending: $[c_0 + I + G - c_1 T]$

* Use Multipliers

$\frac{\partial Y}{\partial \square}$ to see change in Y due to unit change in $\square$

Saving

Private Saving = $Y - T - C$

Public Saving = $T - G$

The Demand For Money

$$M^D = \$Y * L(i)$$

↳ Increase in Interest Rate Decreases Demand For Money

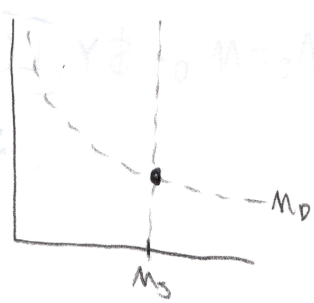
↳ Increase in Nominal Income shifts Demand for money to the right

Solving For Interest Rate

Money Supply $M_s = M$

* Eq Condition: $\boxed{M_s = M_D}$

↳ Find Interest Rate that makes this true



1. Increase in Nominal Income ↑ interest rate
2. Increase in Money Supply ↓ interest rate

How Banks Change Money Supply

- Banks Change Money Supply by Buying & Selling Bonds

Interest on Bond $= \dfrac{\text{Bond Pay} - P_B}{P_B}$

- ↑ Bond Price, ↓ Interest Rate

* Zero Low Bound, when Equilibrium $i = 0$, it can't go lower

IS-LM Model

- Investment Now Endogenous

IS Curve: get i in terms of Y

LM Curve:

$$M_S = M_D = \$Y \, L(i)$$

↓ Decreasing Function of

* At the intersection of IS & LM Curve
Equilibrium Output

Risk Premium

$$x = (1+i)p/(1-p)$$

Okun's Law

- Higher Output indicates Low Unemployment

Philip's Curve

- when unemployment is high inflation decreases

The Labor Market

1. Total Working age Population - # of People eligible for employment

2. Labor Force = Sum of those working or looking for work

3. Participation Rate = $\frac{\text{Labor Force}}{\text{Total working Age Population}}$

4. Unemployment Rate = $\frac{\text{unemployed}}{\text{Labor Force}}$

5. Employment Rate = $\frac{\text{Employed}}{\text{Total working age Population}}$

Wage Determination

- workers Bargaining Power Depends on
  1. Nature of Job
  2. Labor market conditions

$$\boxed{W = P^E * F(u, z)}$$

P^E = Expected Price Level

$F(u, z)$ = Decreasing function w/ respect to u & increasing w/ z

u = unemployment Rate

Z = Catch all variable

Price Determination

$$\boxed{Y = AN}$$

Y = Output

A = Labor productivity (usually 1 output per worker)

N = Employment

→ Can Manipulate Further

$$\boxed{N = L(1 - u_n)}$$

L = Labor Force

u = Rate of unemployment

Natural Rate of unemployment

Wage Setting Relation (WS)

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

- The higher the unemployment the lower the Real wage paid

Price Setting Relation

$$\boxed{\frac{W}{P} = \frac{1}{1+m}}$$

- As Markup increases,
  * Natural Rate of unemployment increases
  * Real wage Decreases

u_n = Natural Rate of unemployment is where WS & PS curves intersect

Shifts in the WS & PS Curves

↑ Unemployment Benefits; Firing Cost

↳ ↑ Shifts WS curve Up & Right (Higher u_n)

↑ in Markup

↳ Shifts PS curve Down (increases u_n)

Inflation, Expected Inflation,

- Starting w/: $P = P_E(1+m)F(u,z)$

$$\boxed{\pi = \pi^e + (m+z) - \alpha u}$$

1. An Increase in expected inflation π^e leads to an increase in Actual Inflation

2. Increase in m or z increases inflation

3. Decrease in unemployment leads to increase in Inflation

Mutations of Philips Curve

- Suppose inflation depends on constant value $\overline{\pi}$ with weight $(1-\theta)$, and partly on last years weight π_{t-1} with weight θ

$\theta = 0$	$\pi_t = \overline{\pi} + (m+z) - \alpha u_t$
$\theta > 0$	$\pi_t = [(1-\theta)\overline{\pi} + (m+z)] + \theta\pi_{t-1} - \alpha u_t$
$\theta = 1$	$\pi_t = \pi_{t-1} + (m+z) - \alpha u_t$

* Philips Curve

$$\boxed{\pi_t - \pi_t^e = -\alpha(u_t - u_n)}$$

- if π^e is well approximated π_{t-1}, then

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

Wage Indexation

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

↓

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

IS-LM-PC Model

Recall: $\pi - \pi^e = -\alpha(u - u_n)$

- when $u = u_n$

Natural Employment: $N_n = L(1 - u_n)$

Potential output: $Y_n = L$ (b/c Y=AN, A=1)

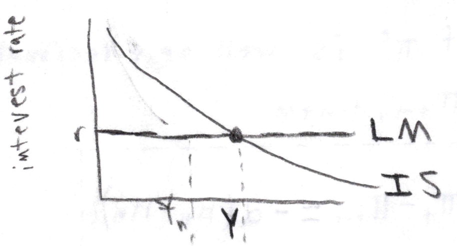
Output Gap: $Y - Y_n = -L(u - u_n)$

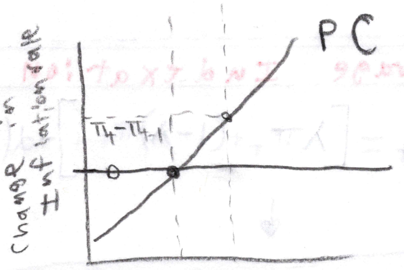
Substituting into Phillips Curve

$$\pi_t - \pi_{t-1} = \left(\frac{\alpha}{L}\right)(Y - Y_n)$$

↳ when Output is above Potential, Inflation increases & vice versa

IS-LM-PC | Graphical Form





"SHORT-RUN Equilibrium"

⇓

$Y \neq Y_n$ and $r \neq r_n$ such that Inflation is allowed

- A low Policy Rate leads to higher output. Higher output leads to change in inflation

Medium Run Equilibrium

- When Bank sets Rate r^n & output Y^n

↳ where Δ inflation = 0

- change in inflation is indicator of output gap

Deflation Spiral

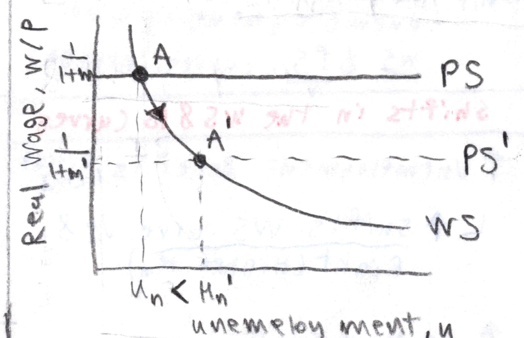
- When r hits zero Bound, Monetary Policy prevents return of $Y \rightarrow Y_n$

* Deflation → higher Real Policy Rate → Even Higher Deflation

Effect of an Increase in Price of oil

- Increase in the Price of Oil = Increase in Markup

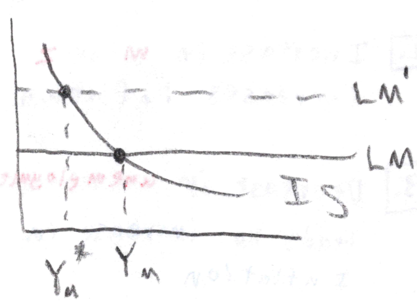
1. P_{oil} ↑ = ↑ Markup

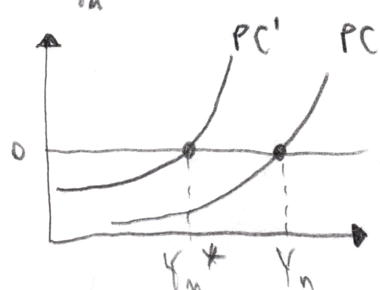


2. Using Phillips Curve Recognize ↑ u_n leads to ↓ Y_n

$$(Y - Y_n) = L(u_n - u)$$

↓ ↑





Openness in Goods Market

- The Real exchange Rate for US goods in terms of Foreign

$$\varepsilon = \frac{EP}{P^*}$$

E = Nominal exchange rate

P = GDP Deflator

P^* = GDP Deflator

Openness in Financial Markets

Domestic Bond Investment Return | $\boxed{P(1+i)}$

P = Principal

i = Nominal US interest Rate

Foreign Bond Investment Return:

$$\boxed{P * E_t (1+i^*_t)\left(\frac{1}{E_{t+1}}\right)}$$

E_t = exchange rate year t

i^* = Foreign nominal Interest Rate

Uncovered Interest Parity

$$i_t \approx i^*_t - \left(\frac{E_{t+1} - E_t}{E_t}\right)$$

IS Relation in Open Economy

Demand for Domestic Goods in Open Economy

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

C = Consumption

I = investment

G = Gov Spending

IM = Imports

X = Exports

Domestic Component for Demand of Domestic Goods

$$C+I+G = C(\underset{\uparrow\ \downarrow}{Y-T}) + I(\underset{\uparrow\ \downarrow}{Y,r}) + \underset{\uparrow}{G}$$

~~Exports~~ Imports & exports

$$IM = IM(\underset{\uparrow}{Y}, \underset{\uparrow}{\varepsilon})$$

* independant of ε, IM is divided over in market demand

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

↳ which makes sense because as US-Foreign exchange rate increases people abroad less inclined to buy Domestic Goods

Equilibrium Output & Trade Balance

$$\boxed{Y = Z}$$

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

• Graphically, Output equilibrium occurs where Demand ZZ crosses 45° Supply Line

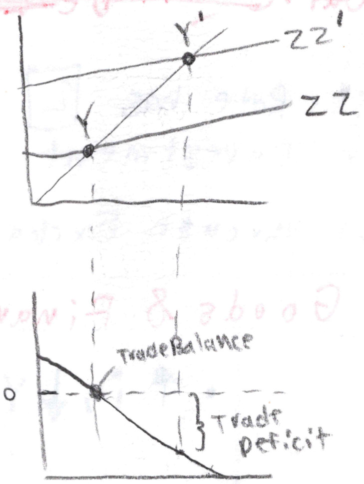
• Goods Market is in Equilibrium when $\boxed{Y = \text{Demand}}$

↳ At that output Y there could be a trade Deficit or Surplus

Increases in Demand (Domestic or Foreign)

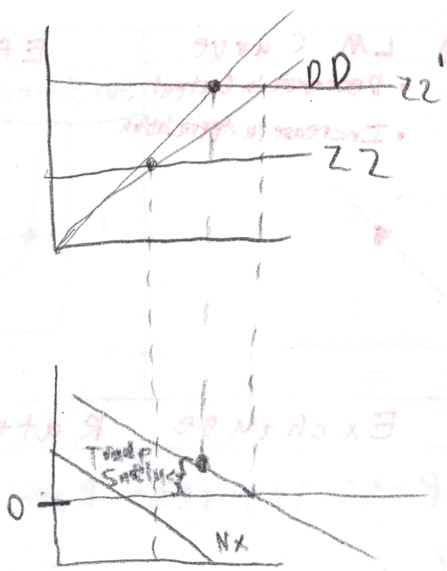
Case 1 | Increase in Domestic Government Spending

Result: Increase in output & trade Deficit



Case 2 | Increase in Foreign Demand

Result | - Increase in Output & trade Surplus



• In Summary

↑ Domestic Demand = { • Increase in output • Leads to worse trade Balance }

↑ Foreign Demand = { • Increase in output • Leads to Better Trade Balance }

Depreciation & Monetary Policy

• To Reduce Trade Deficit w/o changing output government must simultaneously

1. Induce Depreciation
2. Decrease Government Spending

Equilibrium in the Goods Market

Recall Equilibrium condition in open goods market

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

↓ Rewritten as

$$Y = C(\underset{+\ -}{Y-T}) + I(\underset{+\ -}{Y,r}) + NX(\underset{-\ +\ -}{Y,Y^*,\varepsilon}) + G$$

• if $\boxed{\varepsilon = E}\ \boxed{\frac{P}{P^*} = 1}$

↳ We can assume

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

Equilibrium in Financial markets

Recall Interest parity condition

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

↑ i, ↑ E

↑ i^*, ↓ E

↑ $\bar{E}^e$, ↑ E

Putting Goods & Financial Markets together

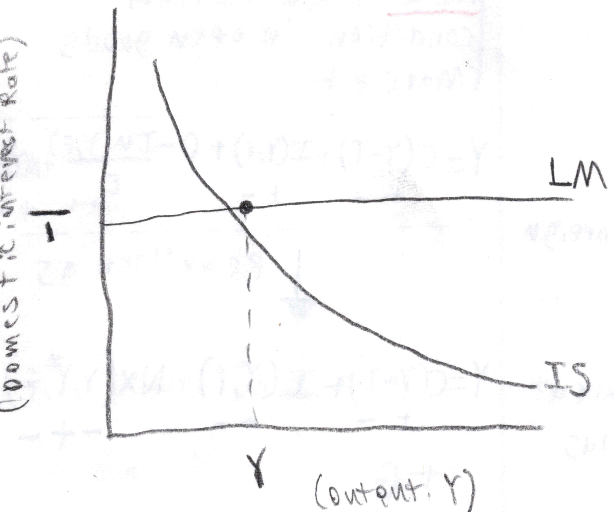
IS Relation: $Y = C(Y-T) + I(Y, i) + G + NX\left(Y, Y^*, \frac{1+i}{1+i^*}\bar{E}^e\right)$

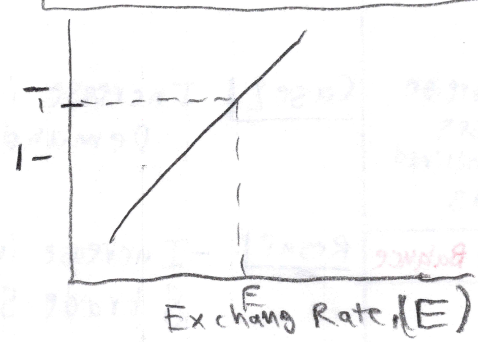
LM Relation: $i = \bar{i}$ → ~~Key assumption (by giving i as constant), IS Curve will be LINEAR~~

- Increase in Interest Rate has $\boxed{2}$ Effects
  - Direct Effect on Investment
  - Secondary Effect through Exchange Rate

Putting Goods & Financial Markets together

- ↑ i, ↓ Y Directly & Indirectly
  (I) (NX)

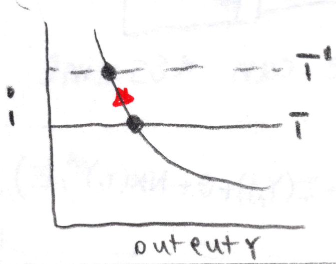




Effect of changing LM Curve

Increase in Interest Rate

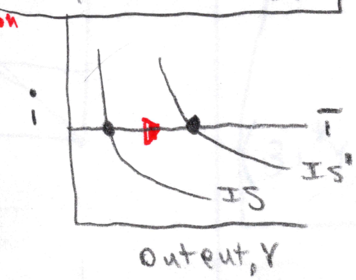
- Decrease in Output
- Increase in Appreciation

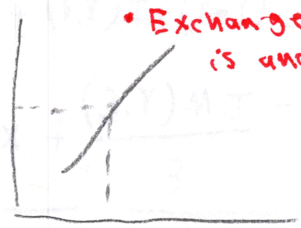


Effect of changing

Gov Spending Increased

- ↑ G, ↑ Y
- Exchange rate is unchanged





Fixed Exchange Rates

- If country Pegs interest Rate at $\boxed{E_t = \bar{E}}$
  & $E_{t+00} = \bar{E}$

↓

$(1+i) = (1+i^*)$

$\boxed{i = i^*}$

- Under Fixed Exchange Rate, Domestic Interest Rate Must Be equal to Foreign Interest Rate

* * Central Bank Forfeits Setting i as Policy instrument

Exam 3 Cheat Sheet

Present Discounted Value

• Expected Present Discounted Value (PDV) is the value of a future series of payments in Todays Money

$$\$V_t = \$z_t + \left(\frac{1}{1+i_t}\right)\$z^e_{t+1} + \left(\frac{1}{(1+i_t)(1+i^e_{t+1})}\right)\$z^e_{t+2}$$

case 1) where interest rate i pays out forever	case 2) case where interest rate the same
$\$V_t = \frac{\$z}{i}$	$\$V_t = \$z_t + \left(\frac{1}{1+i}\right)\$z^e_{t+1} + \left(\frac{1}{1+i}\right)^2\$z^e_{t+2}$

Bonds

• Price of a Bond that promises to pay \$100 next year

$$\$P_{1t} = \frac{\$100}{(1+i_t)}$$

• Price of a bond that promises to pay \$100 in 2 years

$$\$P_{2t} = \frac{\$100}{(1+i_t)(1+i^e_{t+1})}$$

* The yield to Maturity is the constant annual interest rate on an n-year bond that makes the bond price today = PDV of future Bond Payments

Arbitrage

• The expected return on 2 assets must be equal

Bonds w/ Risk Premium

• If $\$P_{2t} = \frac{\$100}{(1+i_{1t})(1+i^e_{1t+1}+x)}$

↳ yield $\approx \frac{1}{2}(i_t + i^e_{t+1} + x)$

Stock Market & Stock Price Movement

$$Q_t = \frac{D^e_{t+1}}{(1+r_t+x)} + \frac{D^e_{t+2}}{(1+r_t+x)(1+r^e_{t+1}+x)}$$

Implications:

• Higher expected future Dividends = higher Stock Price

• Higher current & future interest rates means lower stock price

• higher equity premium means lower stock price

Consumption

• Consumption Function

$$C_t = C(\underset{+}{\text{Total Wealth}}, \underset{+}{Y_{Lt} - T_t})$$

• Dependent on After Tax income
• And total wealth

Investment

• To compute expected profits resulting from an investment we must consider Depreciation Rate δ

$$V(\pi^e_t) = \left(\frac{1}{1+r_t}\right)\pi^e_{t+1} + \frac{1}{(1+r_t)(1+r^e_{t+1})}(1-\delta)\pi^e_{t+2}$$

$$\boxed{I_t = I(V(\pi^e_t))}$$

Expectations & Decisions

• Recall $Y = C(Y-T) + I(Y, r+x) + G$

• Call A = Private Aggregate Spending

* $Y = A(\underset{+}{Y}, \underset{-}{T}, \underset{-}{r}, \underset{-}{x})$

↓

$$Y = A(Y, T, r, Y'^e, T'^e, r'^e) + G$$

Implications:

• Y or Y'^e increase

↳ Increase in A

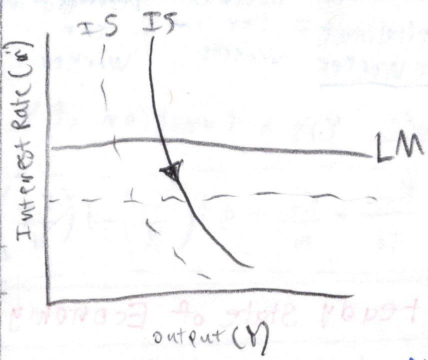
• T or T'^e increase

↳ ~~Increase~~ Decrease in A

• r or r'^e increase

↳ A decreases

"The new IS Curve"



Shift IS Right	Shift IS left
$\Delta G > 0$	$\Delta T > 0$
$\Delta Y'^e > 0$	$\Delta T'^e > 0$
$\Delta r'^e < 0$	$\Delta r'^e > 0$
$\Delta T'^e > 0$	

* The Fed directly controls real current interest rate

* however Policy effects Alone don't do much

↳ expectations must change

Interaction Between Output & Capital

$$K_{t+1}=(1-\delta)K_t + I_t$$

1. call $I_t = sY_t$
2. Divide by Labor Force

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

* $$\frac{K_{t+1}}{N} - \frac{K_T}{N} = s\frac{Y_t}{N} - \delta\frac{K_T}{N}$$

Change in capital Stock per Worker = Savings Per worker − Depreciation Per Worker

b/c Y is a function of Y_t

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

Steady State of Economy

• The state where output & capital is no longer changing is called the Steady State of the Economy

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

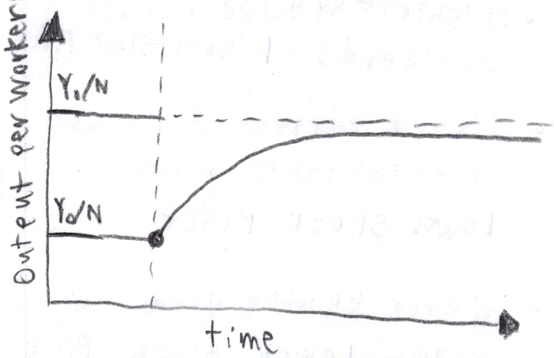
steady state level of capital per worker $= \frac{K^*}{N} = k^*$

Steady State output per worker $= \frac{Y^*}{N} = y^*$

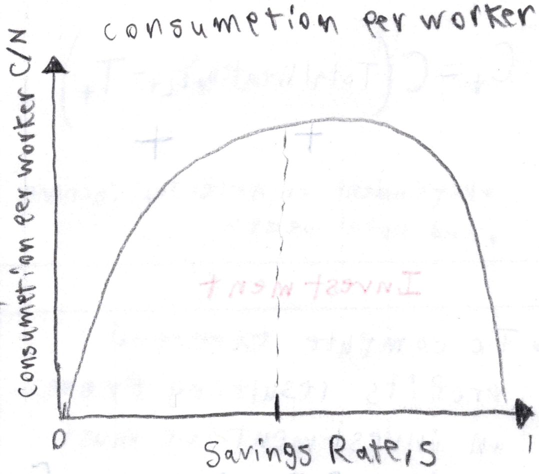
Implications

• A country with a higher savings rate has a higher steady-state level of output

"Effect of an Increase in Savings Rate on Output per worker"



"Effect of Savings Rate on Steady State consumption per worker"



* At some Golden Rate Consumption per worker is Maximized

Getting Sense of Magnitudes

• Assume production function f:

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

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

• This Means at steady State

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

eqn for steady state capital per worker

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

Eqn for Steady State output per worker

Consumption Equation:

$$\frac{C}{N} = \frac{Y}{N} - \delta\frac{K}{N} = \frac{s(1-s)}{\delta}$$

Technological Progress & Rate of Growth

• $\boxed{A}$ = given state of technology

$$xY = F(xK, xAN)$$

• if $x = \frac{1}{AN}$

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

• since $I = sY$

$$\boxed{\frac{I}{AN} = s f\left(\frac{K}{AN}\right)}$$ *

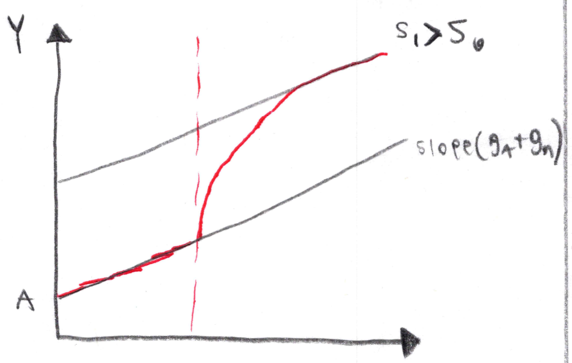
$$\boxed{I = (\delta + g_A + g_N)K}$$ *

- g_A = rate of Technological Progress
- δ = depreciation rate

Technological Progress & Growth rate

	Growth rate
Capital per Effective worker	0
Output per Effective worker	0
Capital per worker	g_A
Output per worker	g_A
Capital	$g_A + g_n$
Output	$g_A + g_n$

"Effect of increase in Savings Rate on Output"



Productivity, Output, Unemployment

- $Y = AN$

  ↳ where $\boxed{A}$ = Productivity

- increase in productivity can either increase or Decrease Equilibrium output

- In the WS-LM model

  ↑A does not change natural Rate of Unemployment