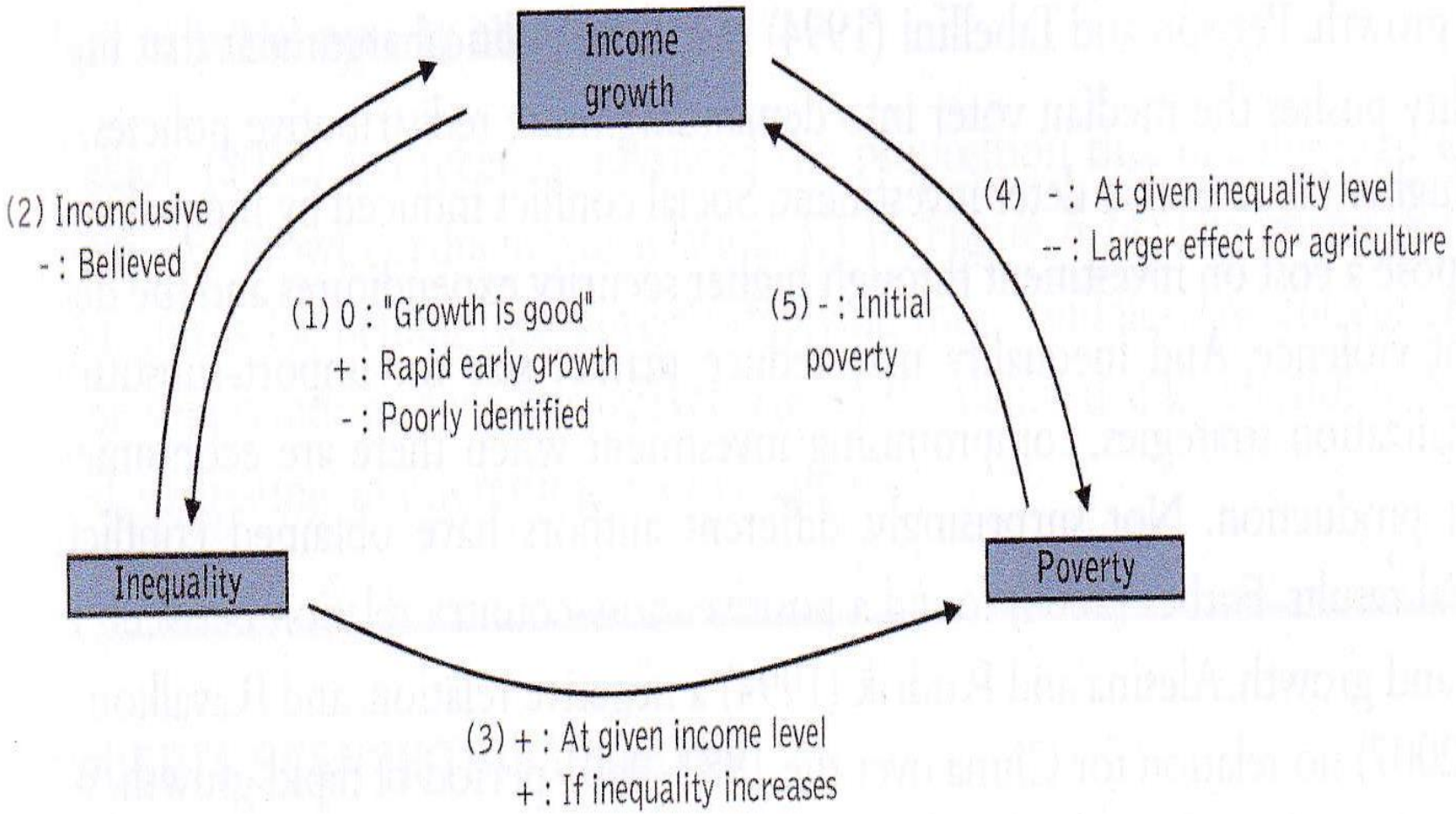
Growth and Convergence

Poverty, Inequality, and Growth

- *Growth on Inequality*: Kuznets inverted-U(descriptively likely, but causally ??), (1) If the impact of growth on the poor is neutral, then growth is good (Dollar-Kraay(2001))
- *Inequality on Growth*: (2) Positive with aggregate rete of saving/investment, but Negative with credit market access, education, health, or through social instability, market size constraints…→ Tackling inequality is believed to be positive in the long-run.)
- *Inequality and Poverty* (3) : Better inequality for poverty reduction
- *Growth on Poverty* (4): Positive depending upon the quality
- *(Initial) Poverty on Growth* (5): High level of poverty bothers growth

Poverty, Inequality, and Growth

（Resource: Janvry and Sadoulet (2016) ）



How to grow then? : (1) Capital accumulation (Harrod-Domar Model)

- Capital accumulation and growth (Linear model)
- Assumptions

① Close economy (No trade)
② Capital and Labor used in fixed proportion (No substitution)
③ Capital is the limited factor but Labor is unlimited supply (Population growth does not matter)
④ Constant return to scale for two factors
⑤ Technology: Fixed quantity of additional capital leads to fixed proportional increase in output
($k=\Delta K/\Delta Y$=Incremental Capital Output Ratio: ICOR)
→No marginal decrease in capital

Implications from H-D Model

- ICOR: $k=\Delta K/\Delta Y$, *Then* $\Delta Y=1/k\Delta K$
- Saving function: $S=sY$ *(s:Saving ratio)*
- Investment function: $I=\Delta K=S$
- Then Growth rate of $y=\Delta Y/Y$

  So, $y=\Delta Y/Y=1/k*\Delta K/Y=1/k*S/Y=s/k$
- Therefore, y(Growth rage) ↑ if s (Saving ratio) ↑ or ICOR (k) ↓
- If there is depreciation of capital, $I\equiv\Delta K+\delta$(depreciation rate)$K=S$
- Then, $y=s/k-\delta$ (Zero or negative growth happens if s is insufficient to cover depreciation

2008 Country Name	Gross fixed capital formation (% of GDP)	GDP growth (annual %)	ICOR
India	32.9	4.9	6.7
South Africa	22.6	3.6	6.3
China	40.8	9.6	4.2
Brazil	19.1	5.2	3.7

Source: World Bank, World Development Indicators.

How to grow then: (2) Productivity and Factor deepening (Solow Model)

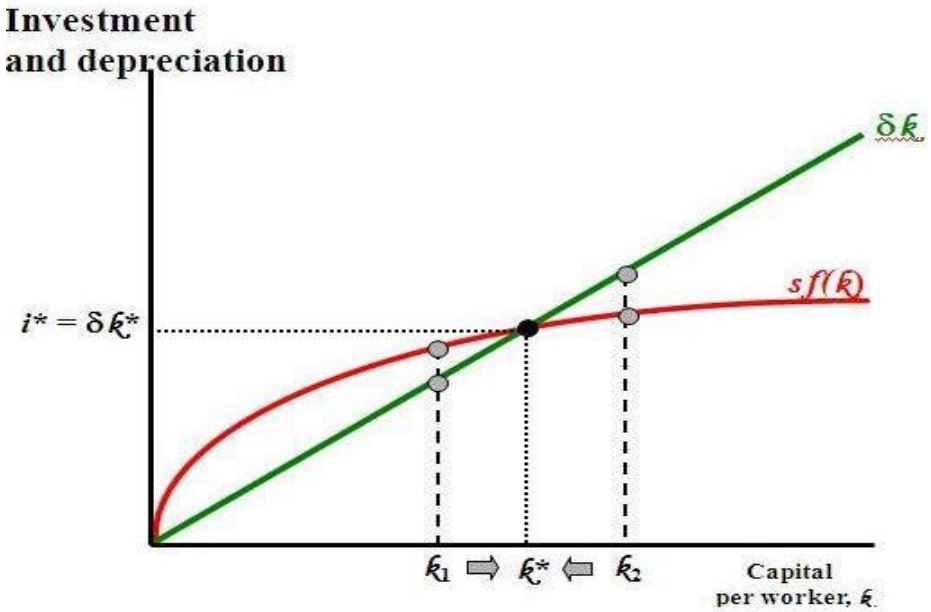
- Long-term equilibrium and Income convergence
- Assumptions:
  ① Closed economy (No trade)
  ② Income＝C:Consumption ＋S:Saving
  ③ Population=Laborers (Increases at constant rate)
  ④ Technology= Constant (No innovation)
- Gross production=Gross income
- Diminishing Marginal product of capital (If capital stock per capita *k* is smaller, the production increases faster but if larger *k* then slower growth
- Possible substitution between L and K
- Capital stock per capita k ↓
  1) By capital wastage
  2) By L (Population) ↑

Solow equilibrium

- Pace of *k* increase falls, while the loss for *k* goes up with depreciation and population size
- Equilibrium *k**: *k* increases until *k** but after *k* loss for k surpasses then goes back to k**
- However, then per capita income of *y* converges into *k*, then no y increases*
- Change of technology is important (Exogenous)

Solow model

4. The Steady State (k^*)
Long-run equilibrium of the economy



- At **k***:

Investment=depreciation, capital won't change

- Below k* ($\mathbf{k_1}$):

investment >depreciation, the capital stock grows.

- Above k* ($\mathbf{k_2}$):

depreciation > investment, the capital stock shrinks.

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$\Delta k = sf(k) - \delta k$; In the steady state capital is not changing→
$\Delta k = 0 \rightarrow sf(k^*) - \delta k^* = 0 \rightarrow \mathbf{sf(k^*) = \delta k^*}$

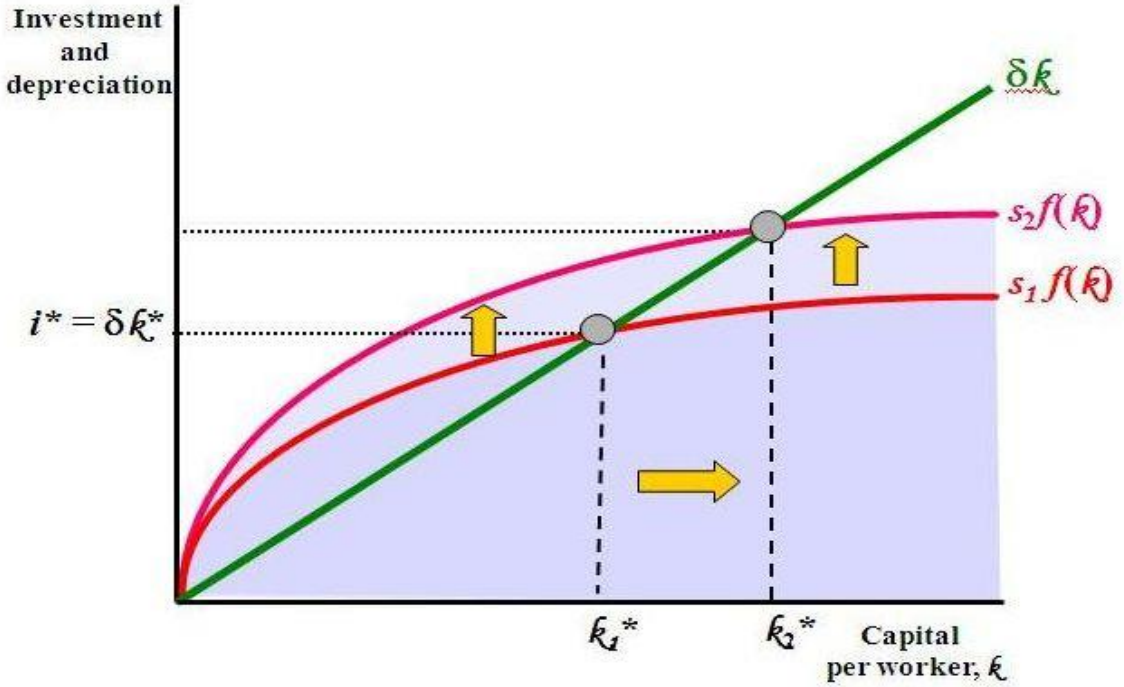
Change of Saving rate or Population

- Saving rate s is lager, then $sf(k)$ shifts to upper, then $k \uparrow$
- Higher saving rate, better equilibrium income

  ← Without foreign saving, domestic saving= Investment
- If larger population growth → Per capita capital stock $k \downarrow$ then equilibrium $k \downarrow$(income $\downarrow$)

⇨Population control is important

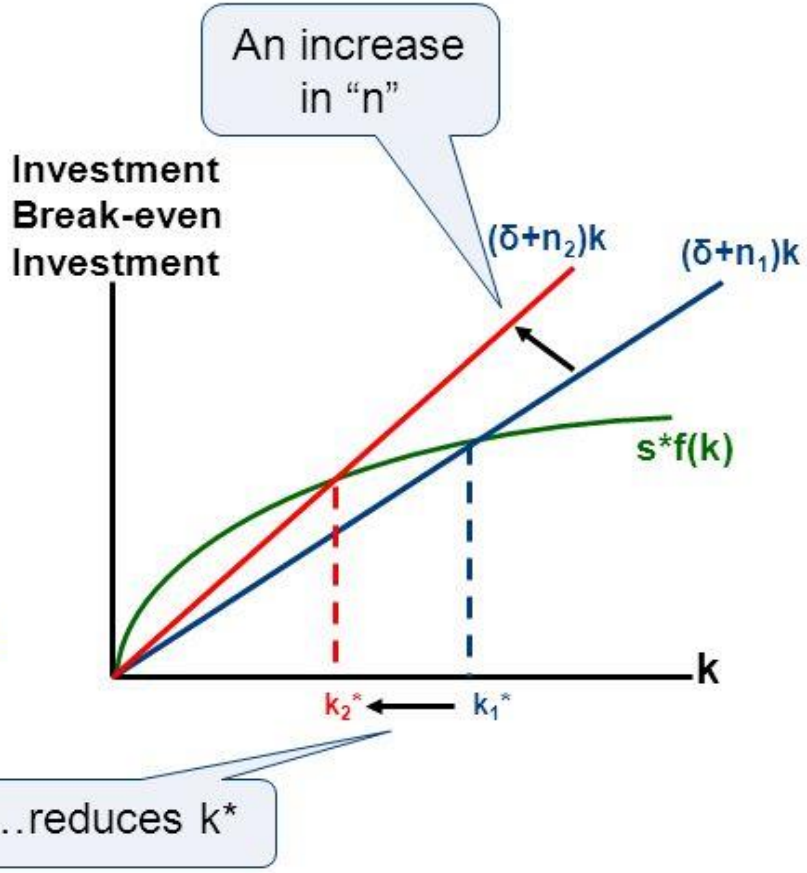
5. Changes in Saving Rate



- An increase in the saving rate→ the capital stock grow to a new steady state.
- High saving rate→ a large capital stock and high level of output.
- Low saving rate → a small capital stock and a low level of output.

The impact of population growth

- Suppose population growth changes from n_1 to n_2.
- This shifts the line representing population growth and depreciation upward.
- At the new steady state k_2^* capital per worker and output per worker are lower
- The model predicts that economies with higher rates of population growth will have lower levels of capital per worker and lower levels of income.

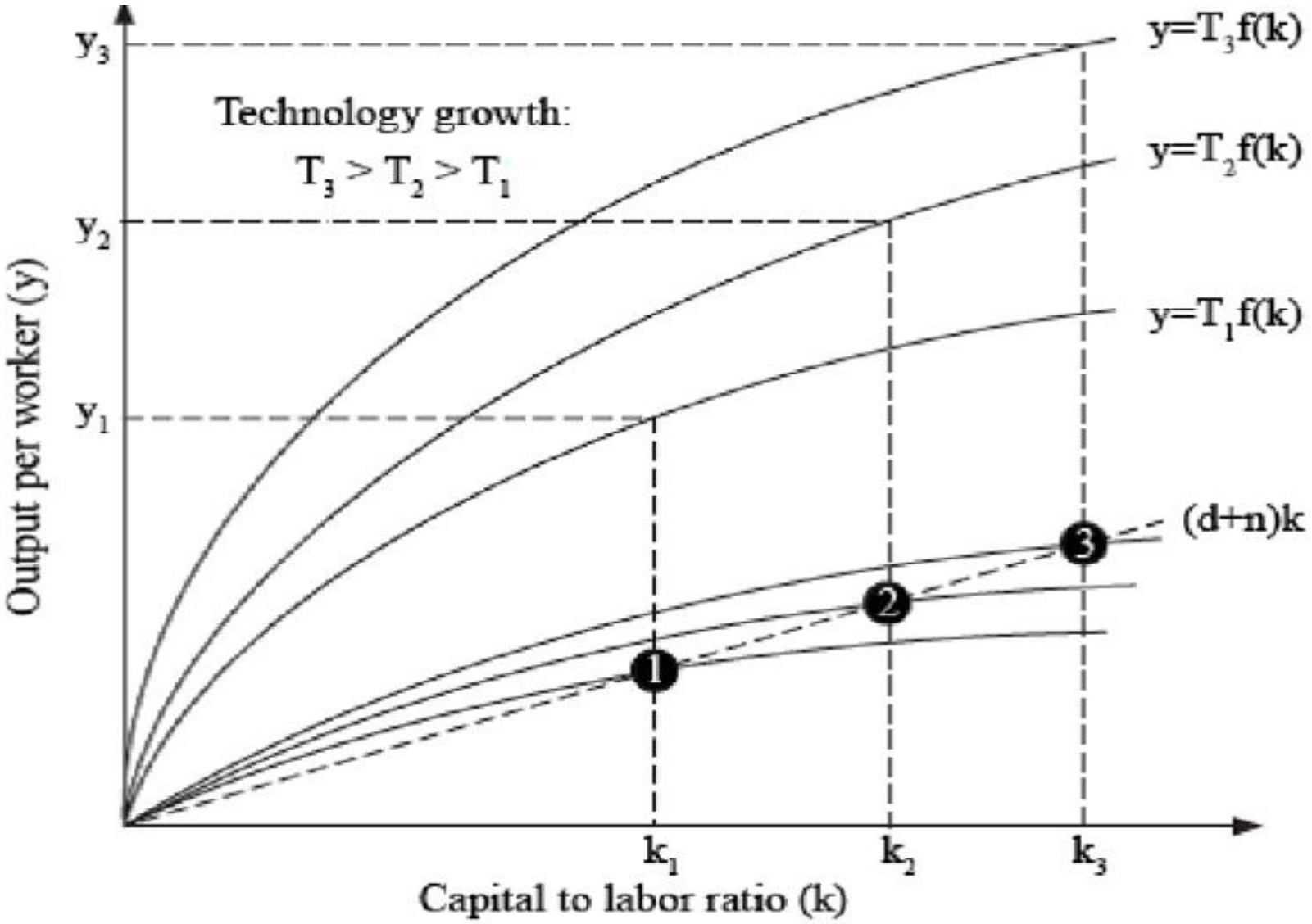


solowtech1.gif

Change of technology

- Exogenous technological change ≠ Endogenous
- $y=sf(k)$ goes up (same capital stock but more efficiency or productivity) and if saving rate remains the same Saving S will go up and investment increases
- Shift of k* goes to the right (Change of equilibrium)

  ⇨ In long-term equilibrium, increase of y depends on technology development


y3
y2
y1
Technology growth:
T3 > T2 > T1
y=T3f(k)
y=T2f(k)
y=T1f(k)
(d+n)k
1
2
3
k1
k2
k3
Output per worker (y)
Capital to labor ratio (k)

Factor Deepening and Productivity

- Out-put growth comes from: *Factor deepening* (more L and/or more K according to the proportion) and Total Factor Productivity (TFP) (Technology, Quality of factors, Efficiency (Institutional changes etc.)
- $Y=Af(K, L)$ (Y: National income, A: TFP)
- $\triangle Y/Y=\triangle A/A + w_K \triangle K/K + w_L \triangle L/L$

  (w_K : r (interest rate) K/Y, the share of capital in total income, w_L : w (wage) L/Y, share of labor in total income)
- **TFP growth (Quality of growth) :**

  $\triangle A/A = \triangle Y/Y - w_K \triangle K/K - w_L \triangle L/L$

Implications from Solow model

(1)In the short run, Capital accumulation is important for investment increase

(2)In the long run, Technology change is important for diminishing marginal productivity of capital

(3)Income convergence for the developing economies is possible (Catching up by late comers' advantage

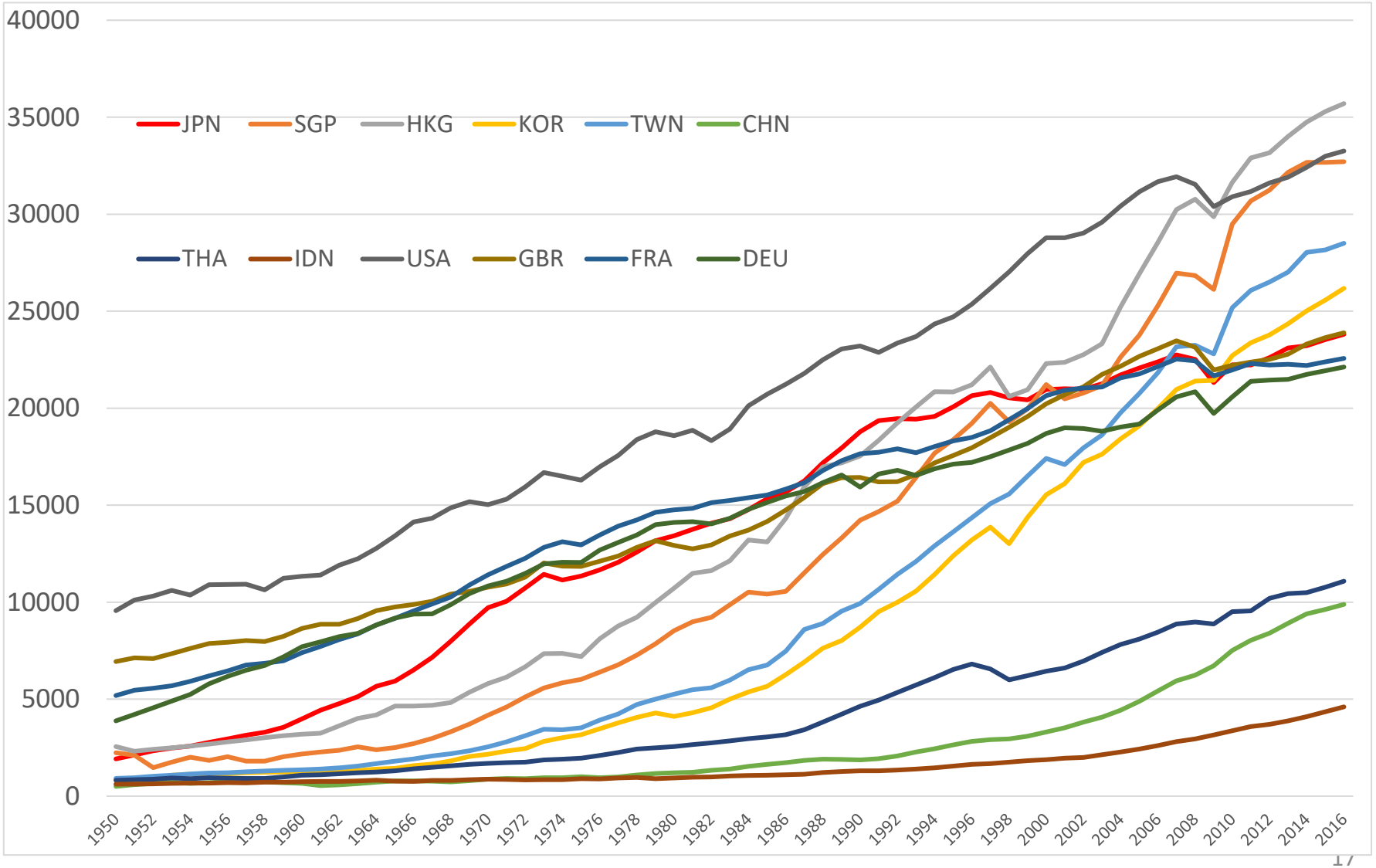
Conditional Convergence

- Equilibrium is decided by investment rate and population growth rate
- Even the same *low income economies may reach different equilibrium* depending on *investment rate or population growth rate*

⇨*Conditional convergence* (Convergence into different equilibrium)

Income convergence in the real world

(Geary-Khamis dollar, Source:
https://www.rug.nl/ggdc/historicaldevelopment/maddison/releases/maddison-project-database-2018)



Gerschenkron theorem for "Cathing-up")

- A. Gerschenkron (1952): *Economic Backwardness in Historical Perspective*
  - Late industrialization: German, Russia, Japan
- Unique structures in Economic catch-up:

(1) Growth acceleration by late comers' advantage
(Leap-frogging, Learning ≠ Innovation)

(2) Rapid growth in capital-intensive industries
(Heavy and Chemical industries← Limited skilled labor, Technology embodied in facilities, Smaller sunk cost

(3) Rising large corporations and Economic concentration
←Intensive capital input

(4) Ideologies for capital mobilization ← Gov. intervention

Suggested Readings

- Gerschenkron, Alexander (1952), "Economic Backwardness in Historical Perspective" in Bert F. Hoselitz ed., (1952), *The Progress of Underdeveloped Areas*, 3-29)
- Helpman, Elhanan(2004), "The Mystery of Economic Growth", Cambridge, Harvard University Press.
- Esterly, William and Ross Levine (2001) "What have we learned from a decade of empirical research on growth?", World Bank Economic Review 15(2):177-219.
- World Bank (1991) The East Asian miracle : economic growth and public (http://documents.worldbank.org/curated/en/975081468244550798/Main-report)