Long Run Macroeconomics

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Lecture 9
(note: this lecture will be recorded)

Looking ahead to the Midterm

- Today:
  Solow Model
  How firms make investment decisions

- Thursday: Review ahead of Midterm

- **Monday May 8:**
  Out-of-Class Midterm, 7 pm – 9 pm, Solis 107

Midterm

- 2 Hours, 7 pm to 9 pm
- All material covered up to Thursday (Lectures 1-10)
- Multiple Choice + Short Answer questions
- Closed book/notes exam. Calculator is allowed.
- Pre-assigned seating. Just bring your pen/pencil.

Preparation for Midterm

- Old midterms posted on Canvas
- Review session this Thursday at class time
- Extra office hours on Monday

Plan for Lecture 9

- The Solow Model
  - Recap
  - Experiments
  - Lessons from the Solow Model

- What determines the investment rate? (Ch. 17.2)

Recap

The Solow Model is a model of capital accumulation

- What factors drive capital accumulation?
- Is capital accumulation the key to growth?
- How important is TFP for growth when capital can accumulate over time?
- Is capital accumulation helpful in explaining different growth experiences?

A summary of the key equations:

$$\Delta K_{t+1} = \bar{s}\,\bar{A}\,K_t^{\alpha}\,\bar{L}^{1-\alpha} - \bar{d}\,K_t$$

$$Y_t = \bar{A}\,K_t^{\alpha}\,\bar{L}^{1-\alpha}$$

Steady state: $\Delta K_{t+1} = 0$

K^*: $\bar{s}\,\bar{A}\,K^{\alpha}\,\bar{L}^{1-\alpha} = \bar{d}\,K$

$$K^* = \left(\frac{\bar{s}}{\bar{d}}\,\bar{A}\right)^{\frac{1}{1-\alpha}}\bar{L}$$

so

$$y^* = \left(\frac{\bar{s}}{\bar{d}}\right)^{\frac{\alpha}{1-\alpha}}\bar{A}^{\frac{1}{1-\alpha}}\bar{L}$$

output per worker

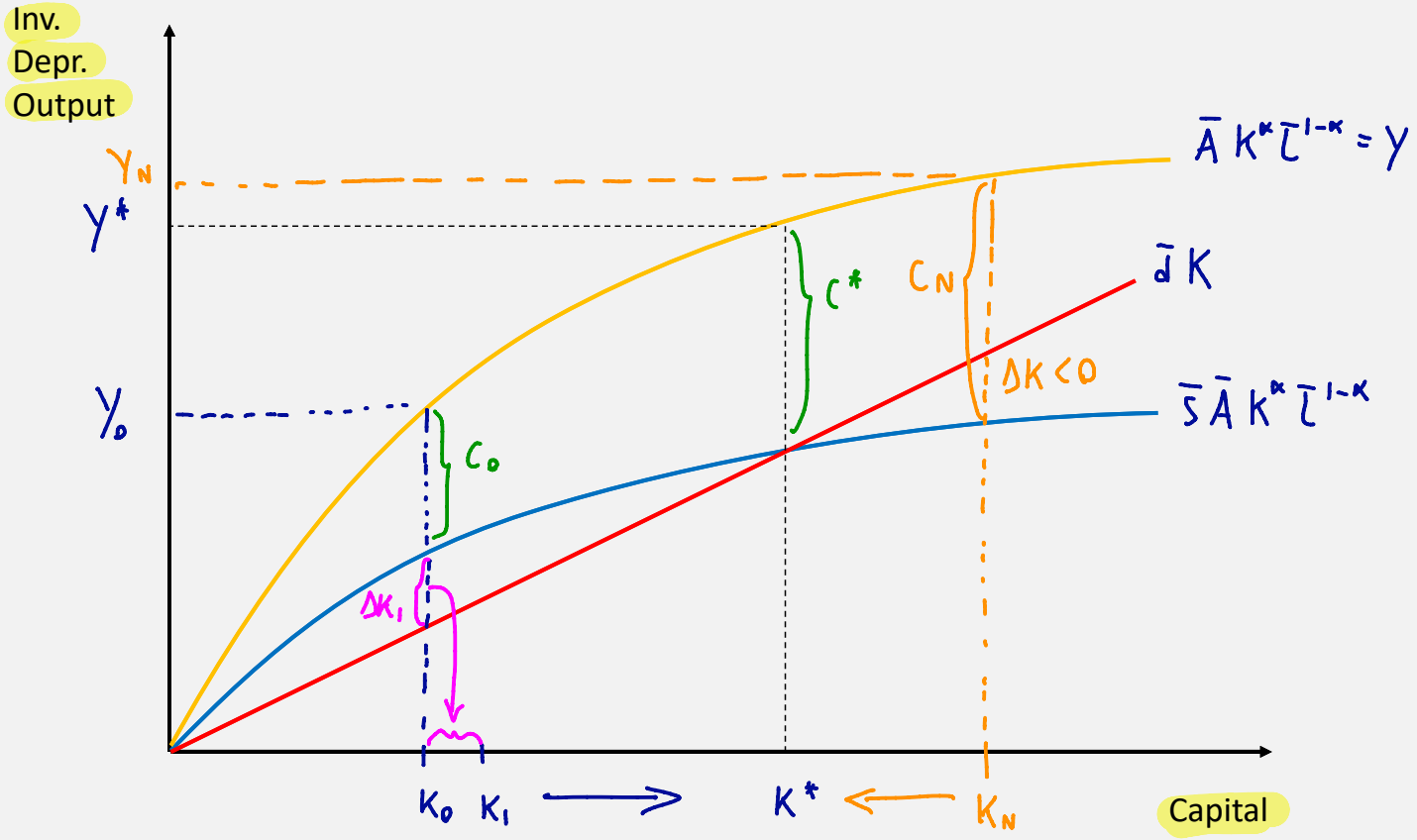
$$y_t \equiv \frac{Y_t}{\bar{L}}$$

$$y^* = \left(\frac{\bar{s}}{\bar{d}}\right)^{\frac{\alpha}{1-\alpha}}\bar{A}^{\frac{1}{1-\alpha}}$$

ex: $\alpha = 1/3$, $\frac{\alpha}{1-\alpha} = 1/2$ $\frac{1}{1-\alpha} = 3/2$

$$y^* = \left(\frac{\bar{s}}{\bar{d}}\right)^{1/2}\bar{A}^{3/2}$$

The Solow Diagram



TFP: Solow vs. Production Model

What is the role of TFP in Solow compared to the production model?

Production model:

$$\underbrace{\frac{y^*_{\text{rich}}}{y^*_{\text{poor}}}}_{70} = \underbrace{\frac{\bar{A}_{\text{rich}}}{\bar{A}_{\text{poor}}}}_{14} \times \underbrace{\left(\frac{\bar{k}_{\text{rich}}}{\bar{k}_{\text{poor}}}\right)^{1/3}}_{5}$$

Solow model:

$$\frac{y^*_{\text{RICH}}}{y^*_{\text{POOR}}} = \frac{\bar{A}_{\text{RICH}}^{3/2}\left(\frac{\bar{s}_{\text{RICH}}}{\bar{d}_{\text{RICH}}}\right)^{1/2}}{\bar{A}_{\text{POOR}}^{3/2}\left(\frac{\bar{s}_{\text{POOR}}}{\bar{d}_{\text{POOR}}}\right)^{1/2}} = \underbrace{\left(\frac{\bar{A}_{\text{RICH}}}{\bar{A}_{\text{POOR}}}\right)^{3/2}}_{35} \times \underbrace{\left(\frac{\bar{s}_{\text{RICH}}^{28\%}}{\bar{s}_{\text{POOR}}^{7\%}}\right)^{1/2}}_{2}$$

70

The Solow Model: Taking Stock

1. Is there sustained growth in the Solow model?

No!

2. What is the main force that brings the economy to a steady state?

Diminishing MPK!

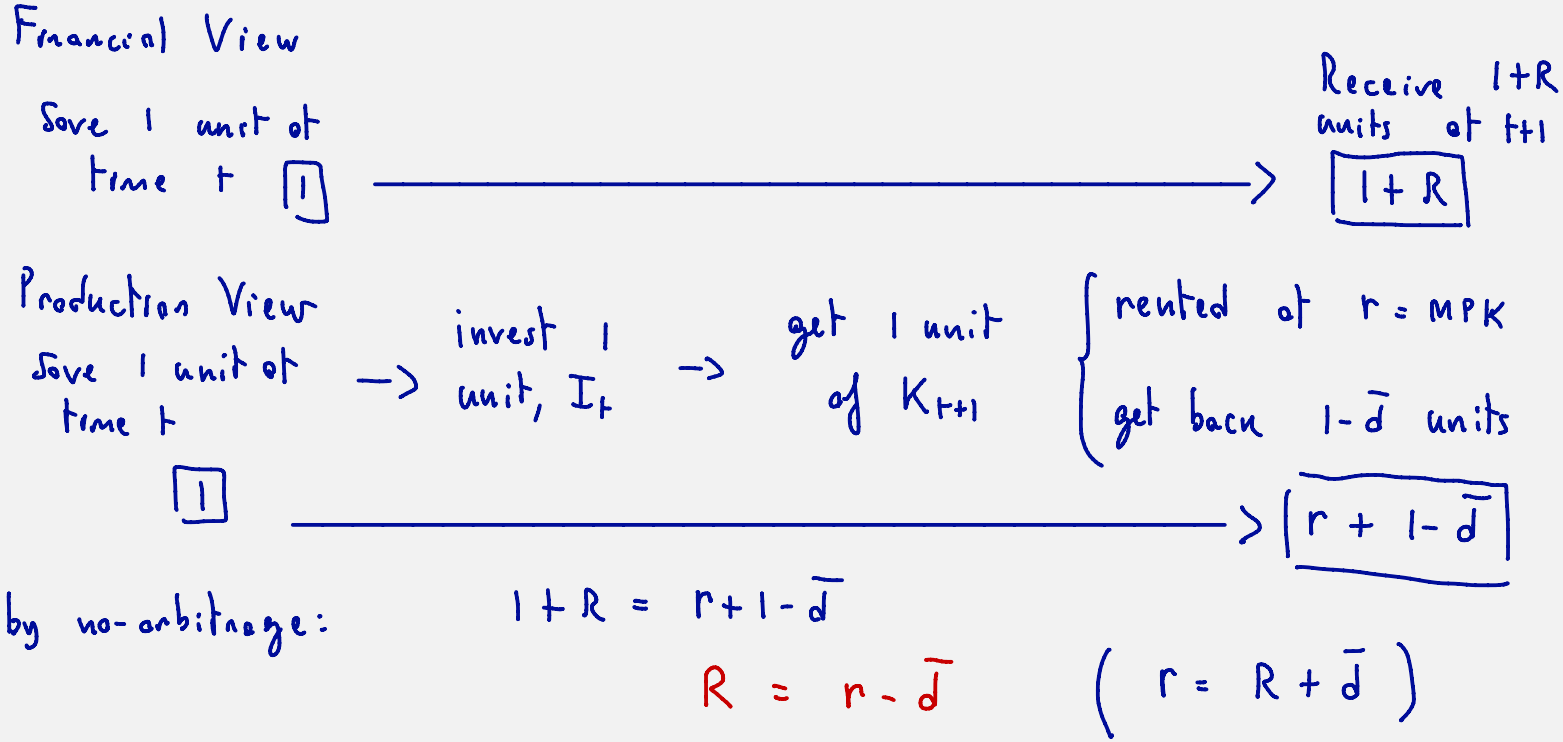
3. Does population size matter for living standards in the Solow model?

No!

4. What is the Real Interest Rate in the Solow Model?

The Real Interest Rate

Amount of output a person can earn by saving one unit of output for a year, or amount of output a person must pay to borrow one unit of output for a year.



The Solow Model: Experiments

1. Increase in Investment/Saving Rate ✓
2. Increase in Depreciation Rate ✓
3. Increase in Population
4. Increase in Capital from Foreign Aid

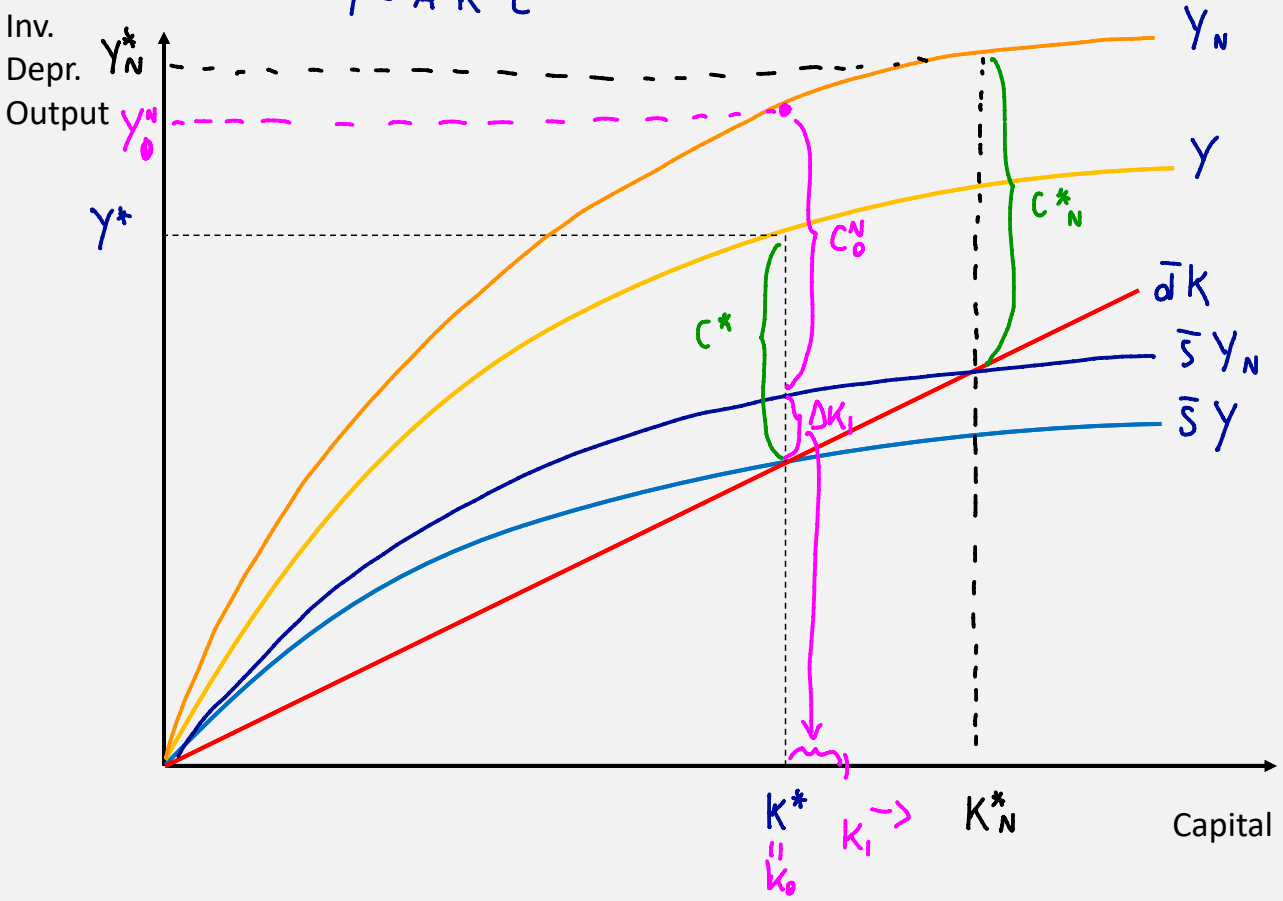
Experiment 3

Experiment 3: Suppose the economy is in the steady state of the Solow model. Unexpectedly, there is a permanent increase in **Population, $\bar{L}$.** What happens to capital, output and consumption according to the model?

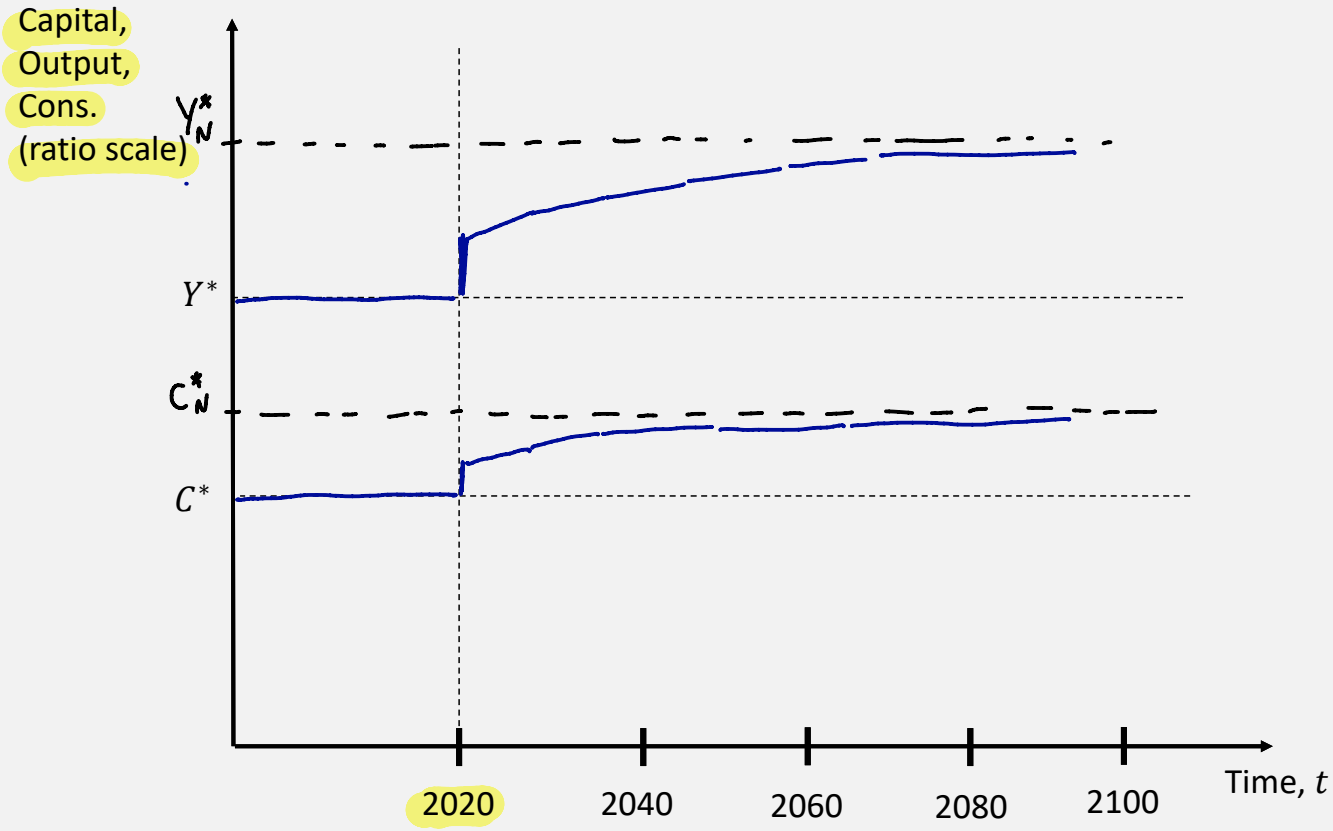
Experiment 3: Increase in **Population,** $\bar{L}$

$\bar{L}_N > \bar{L}$

$Y = \bar{A} K^{\alpha} \bar{L}^{1-\alpha}$



Experiment 3: Impulse Response



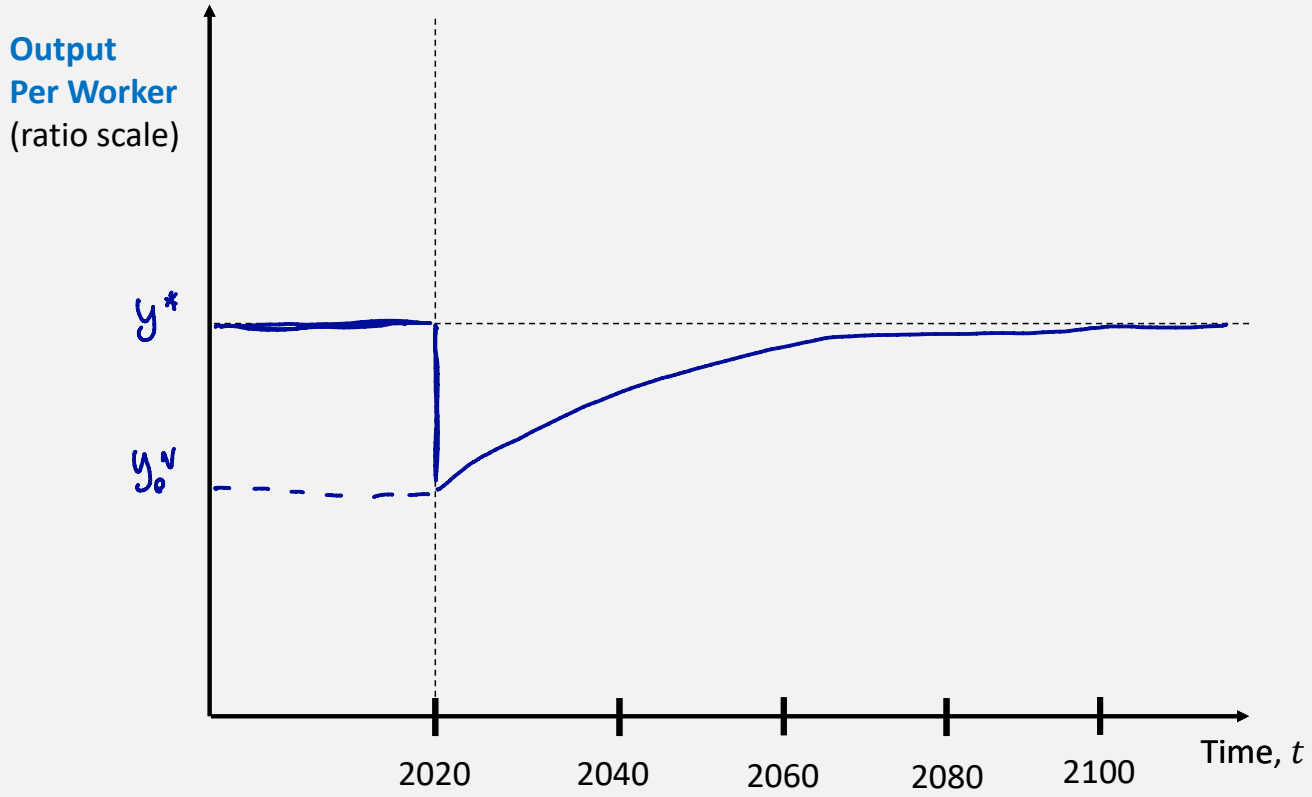
Experiment 3: Increase in Population, $\bar{L}$

What is the effect on output per worker (GDP per capita)?

$$y^* = \bar{A}^{\frac{1}{1-\alpha}} \left(\frac{\bar{s}}{\bar{d}}\right)^{\frac{\alpha}{1-\alpha}} \quad : \text{ no impact in steady state}$$

$$y_0^N = \frac{\bar{A} K^{*\alpha} \bar{L}_N^{1-\alpha}}{\bar{L}_N} = \bar{A} \left(\frac{K^*}{\bar{L}_N}\right)^{\alpha} < \bar{A} \left(\frac{K^*}{\bar{L}}\right)^{\alpha} = y^*$$

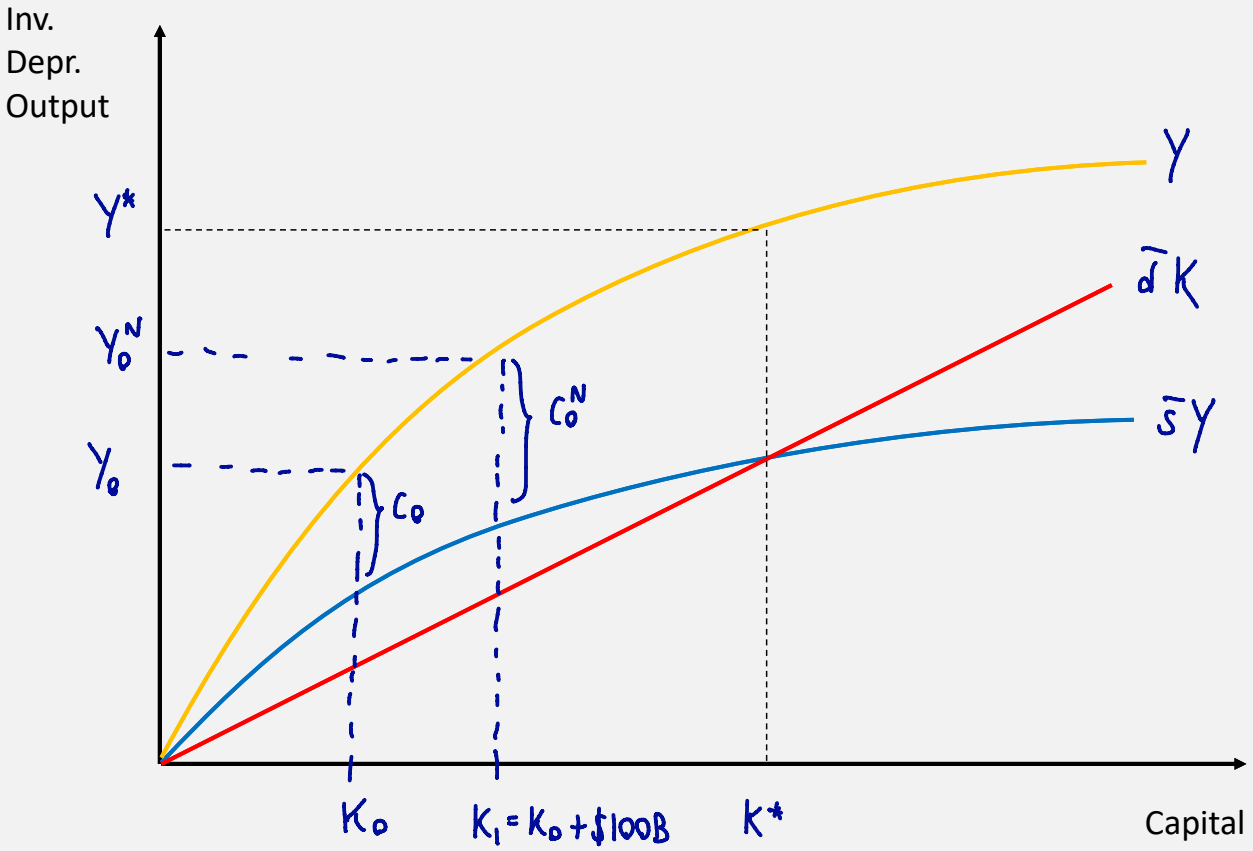
Experiment 3: Impulse Response, Output per Worker



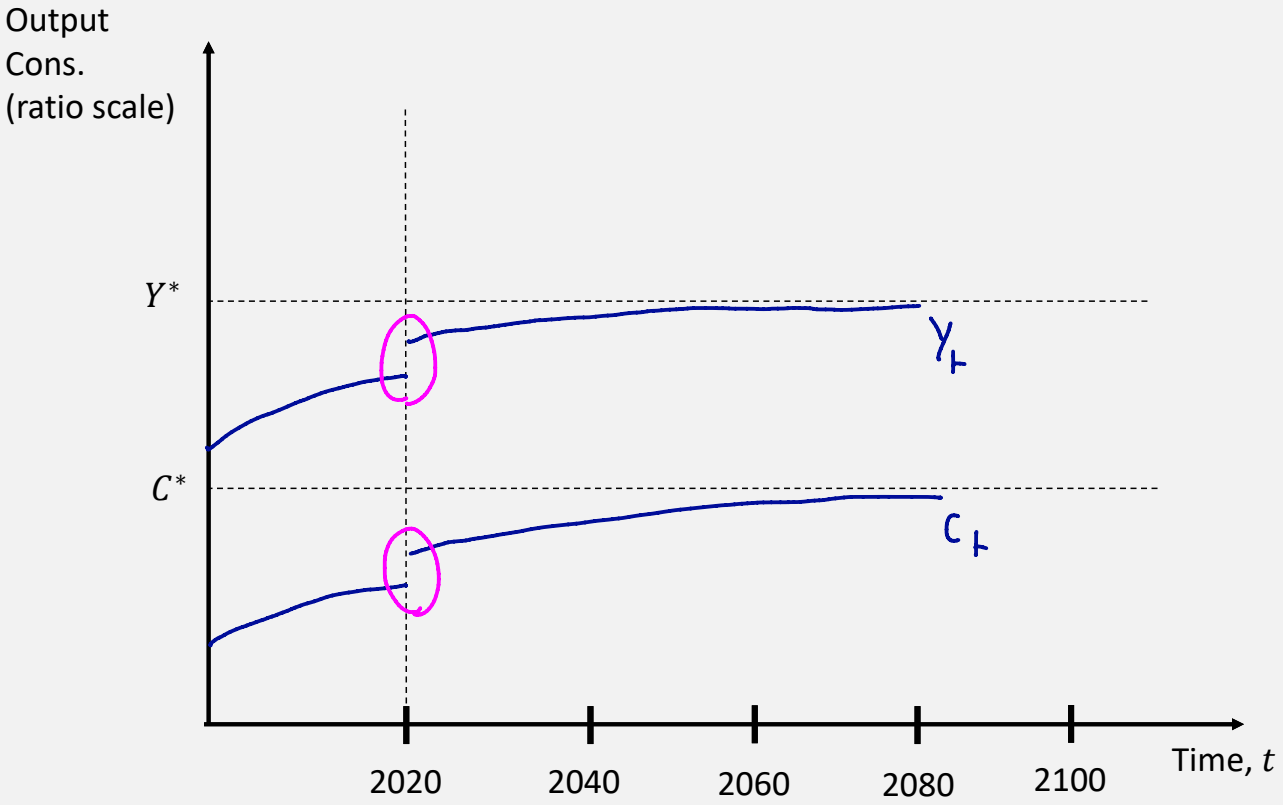
Experiment 4

Suppose the economy is along the transitional dynamics of Solow model at the capital level K_0. Unexpectedly, the economy receives **foreign aid** equivalent to $100B in Capital. What happens to capital, output and consumption according to the model?

Experiment 4: Foreign Aid, $100B in Capital

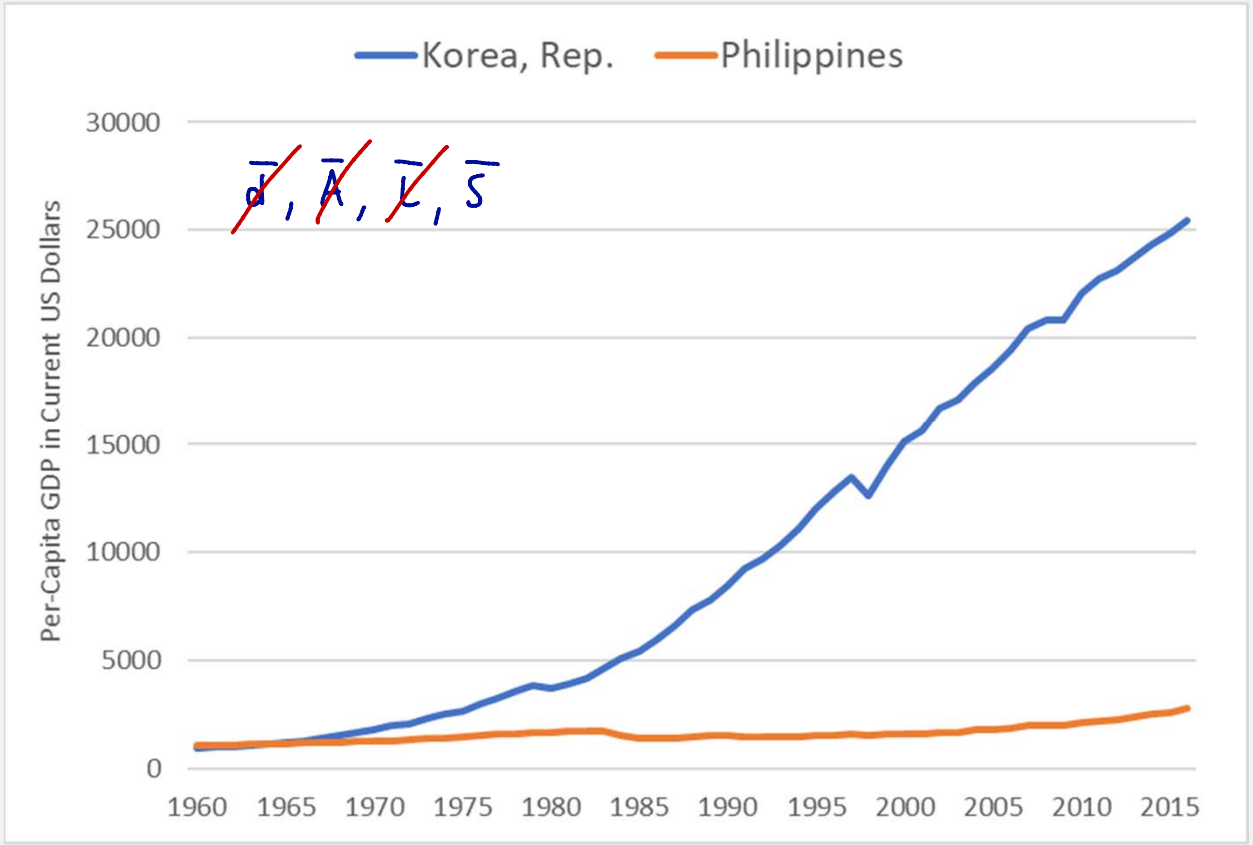


Experiment 4: Impulse Response

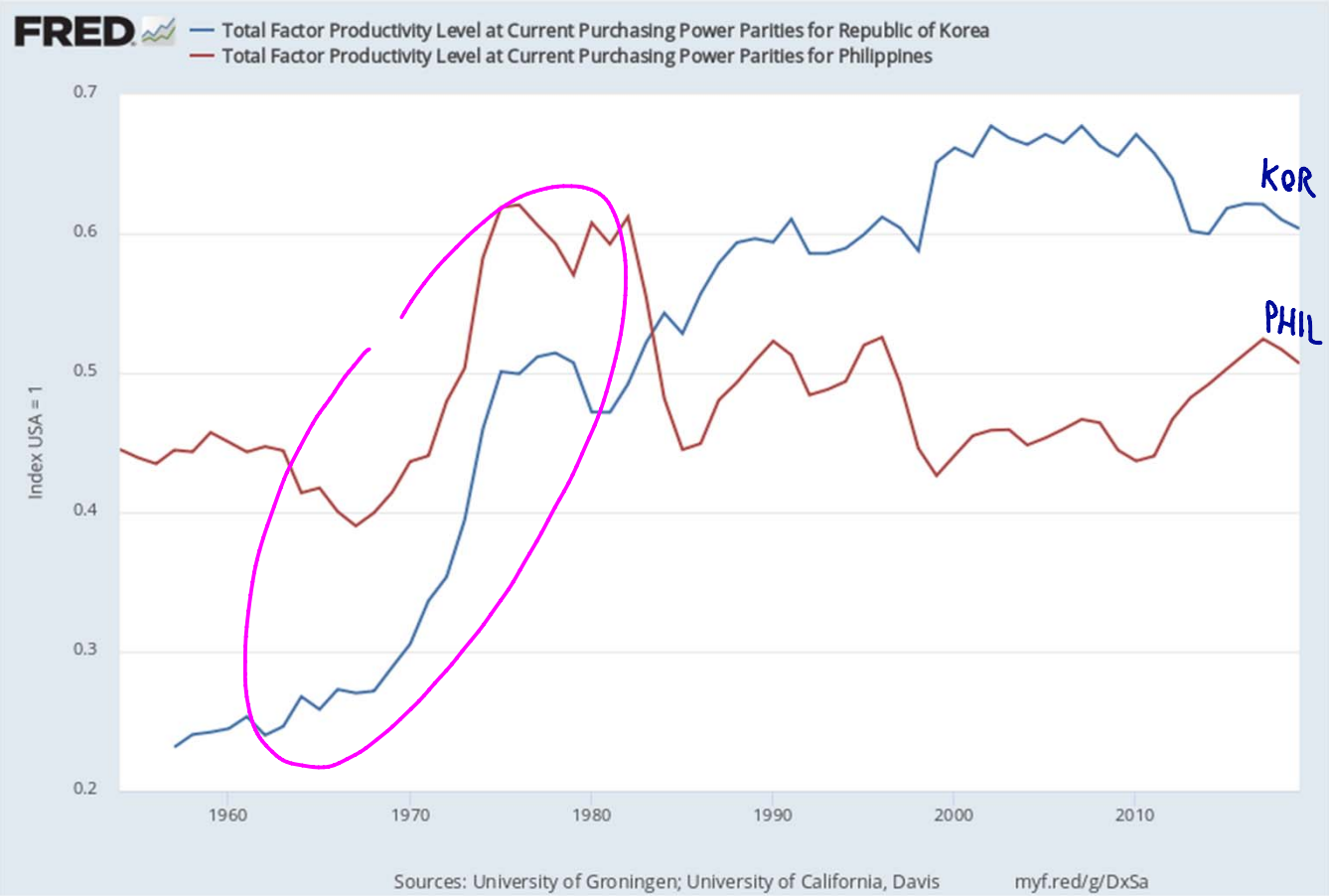


Lessons from the Solow Model

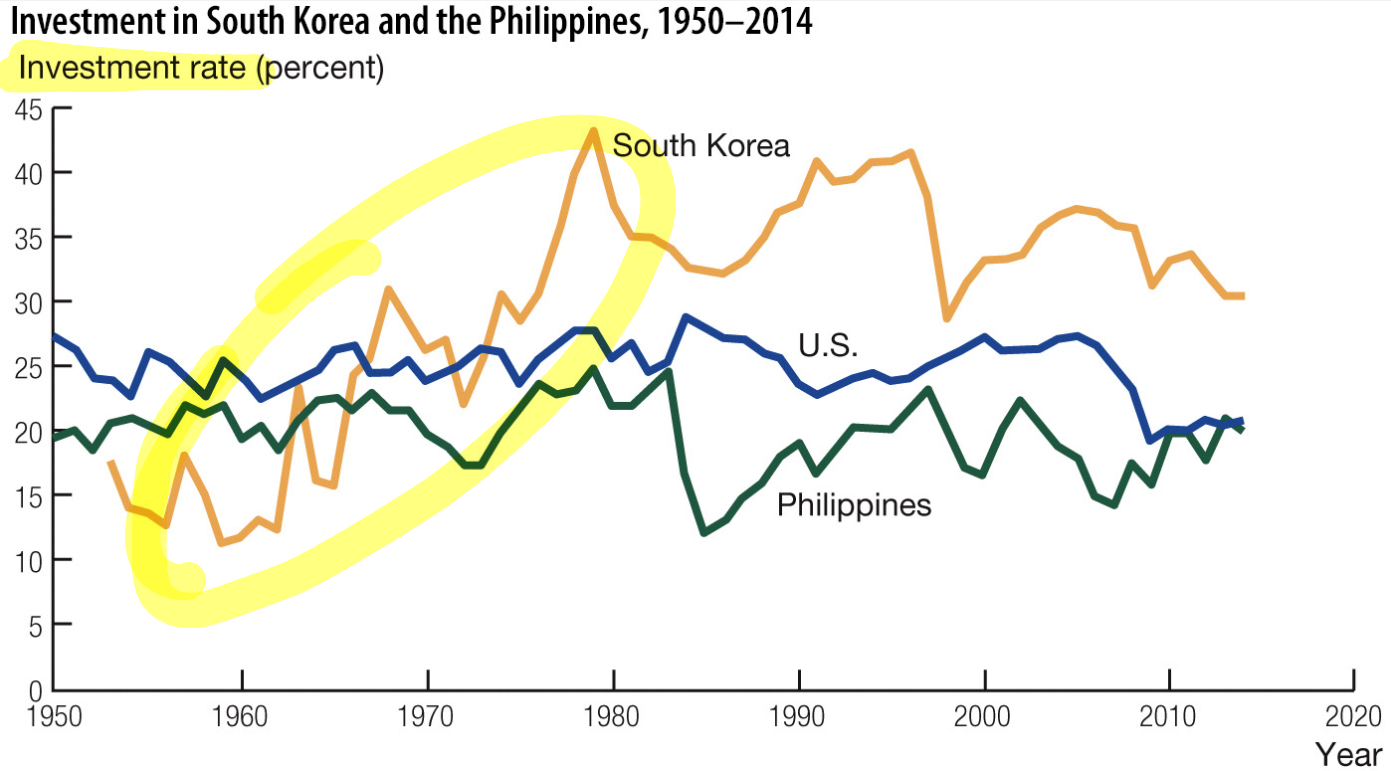
South Korea and the Philippines



South Korea and the Philippines: TFP



South Korea and the Philippines: Saving Rate



Interpretation from Solow Model: Increase in $\bar{s}$ in South Korea "responsible" for faster growth.

The South Korea “Miracle”

Korea was under de facto dictatorship from 1961 to 1979 (President Park assassination)

The history of economic development of a country is always complicated. Korea is no exception.

The spectacular growth that took off in the1970’s in Korea happened under a political repressive regime.

At the same time, the government took a more central role in directing the development of heavy industry (steel, ships), which required large investments, made by “borrowing” from private citizens (which had access to better saving instruments compared to before).

The Solow model offers that perspective, of an increased investment rate, associated with a higher accumulation of capital. But it does not explain how the investment rate increased and why. And it is completely oblivious to the respect of human and civil rights in the capital accumulation process.