

Accounting For Growth

Accounting For Growth—Economics of Global Business, Revised: March 6, 2019

One Question...

- ▶ Where does economic growth come from?
 - Link our model from Chapter 3 with how capital changes over time.
 - An approach to determine the sources of economic growth (Appendix Chapter 9; PS #2).

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Capital Accumulation

- ▶ Capital accumulation equation

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

- ▶ δ is the rate of depreciation of capital.
- ▶ Savings equals investment (loanable funds equilibrium) (end of Chapter 3)!

$$I_t = S_t = (Y_t - T_t) - \beta \times (Y_t - T_t) + (T_t - G_t)$$

1. Changes that affect production **today** (A , L , or K) affect investment and in turn capital tomorrow!
2. Changes that affect spending behavior **today** (β or T or G) affect investment and in turn capital tomorrow!

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Important food for thought...

- ▶ Previous equation now links stuff happening today with stuff in the future through capital accumulation.
- ▶ Now we can distinguish between short run (K is fixed) and then long run (as K changes).
- ▶ Return to our two examples:
 1. **The Wall...** how would you expect K to change? What will happen to GDP and wages, real interest rates as this takes place?
 2. **The GND...** how would you expect K to change? What will happen to GDP and wages, real interest rates as this takes place?

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- ▶ Our production function...

$$Y = A \times F(K, L)$$
$$= AK^\alpha L^{1-\alpha}$$

- ▶ Only three ways output can grow...
 - More capital (K), aka "capital deepening"
 - More labor inputs (L), may be from more workers, better educated workers, etc. aka "labor deepening"
 - Better TFP (A), aka "technological progress"

Step #1: Measure K and L

- ▶ K is measured as the accumulation of investments (PPE) over time (see previous slides).
- ▶ L is measured in various ways
 - Number of people working, e.g. labor force participation multiplied by the population.
 - Adjusted for how hard they work, e.g. hours worked per person, etc.
 - Adjusted for how well they work, e.g. education adjusted, etc.

Step #2: Measure TFP

- ▶ No direct way to measure TFP.
- ▶ Solution: Infer growth in TFP as a residual. All the growth in output **NOT** accounted for by growth in inputs...

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

- ▶ Often called the "Solow residual" after Robert Solow who first showed how to measure it.

Step #3: Log Difference the Production Function

- ▶ From the production function, log difference everything.
- ▶ And from our previous steps we can measure each component.

$$\Delta \log Y = \underbrace{\Delta \log A}_{\text{Change in Tehcnology}} \dots$$
$$+ \underbrace{\alpha \times (\Delta \log K)}_{\text{Change in Capital}} \dots$$
$$+ \underbrace{(1 - \alpha) \times (\Delta \log L)}_{\text{Change in Labor}}$$

Growth in Living Standards in the US...

- ▶ Since the recession, real wages (W/P) have grown very little? Why? How would you use these tools to answer this question.
- ▶ Prof. Robert Gordon's new book "The Rise and Fall of American Growth: The U.S. Standard of Living Since the Civil War"
 - Argues that technology will not advance as it has in the past.
 - This implies slower growth in living standards. Why?
 - What do you think?

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Growth in Living Standards

- ▶ Prior results were all about growth in total GDP. Can do the same thing on per worker or per worker basis...

$$\Delta \log \frac{Y}{L} = \underbrace{\Delta \log A}_{\text{Change in Tehcnology}} \dots + \underbrace{\alpha \times \left(\Delta \log \frac{K}{L} \right)}_{\text{Change in Capital per Worker}}$$

- ▶ Ok, how would you connect this with standard of living?

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Problem Set #2: Growth in China

- ▶ Problem Set #2. You do this for China.

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Important Questions to Think About...

- ▶ If most of growth is projected to come from capital, is this good or worrying? Why or why not?
- ▶ If most of growth is projected to come from TFP, is this good or worrying? Why or why not?
- ▶ Can you connect your answers to core principles about the production function?

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