Introductory Macroeconomics

Lecture 14: long run growth overview

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This Lecture

- Overview of economic growth
  - potential output
  - determinants of economic growth
  - production function
- BOFAH chapter 13 and 14.3

What Is Economic Growth

- *Economic Growth* refers to the growth of the economy's potential real GDP per capita

  Y_t^*

  output gap $\frac{Y_t - Y_t^*}{Y_t^*}$

  = income = output

- Study of economic growth is often labelled as long-run macroeconomics

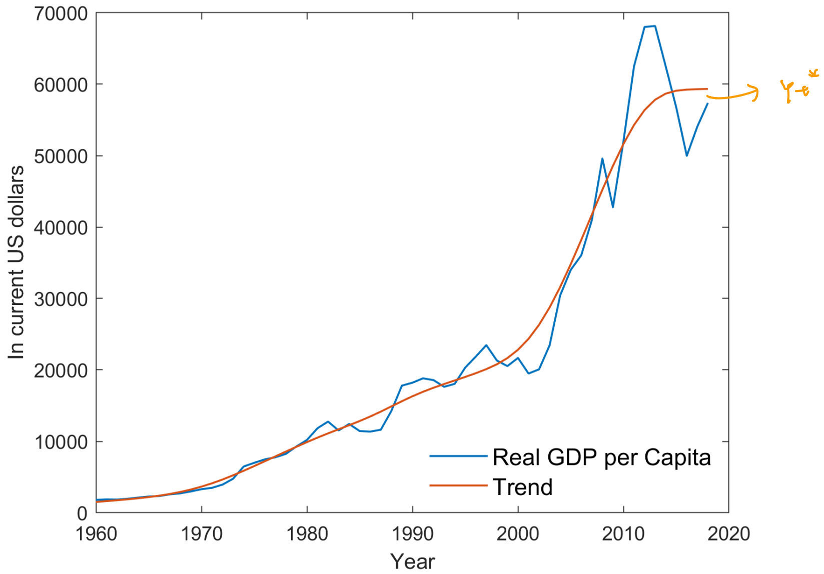
  Y_t^* = trend
  = long-run average output

  – short-run macroeconomics focus on the deviation of output from potential output

  – deviation of output converges to potential output (≈ long-run output) over time

  – role of fiscal and monetary policy is to bring the output closer to potential output

Short-Run and Long-Run Output in Australia



Why Study Economic Growth?

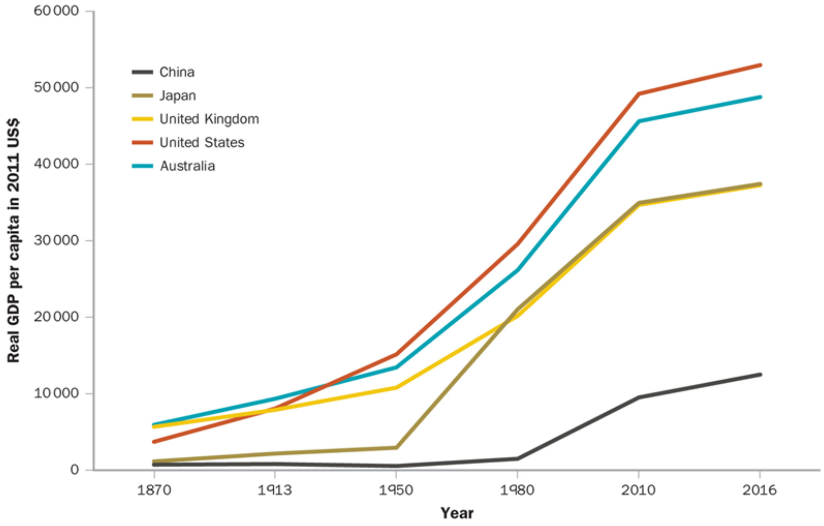
- Output per capita measures one's standard of living
  - clothes, food, healthcare, entertainment, etc
  - high output per capita is associated with low infant mortality
- Output per capita does not necessarily reflect one's happiness
  - less leisure, a rise in inequality, environmental damage, etc

work more

Some Facts

- Relatively little dispersion in income per person across countries prior to 1950
  - huge dispersion in income per person across countries in more recent times
- Huge differences in income per person over time within a country
  - slight evidence of convergence more recently

Long-Run Real Output per Capita



Determinants of (potential) Output per Capita

- Consider the following decomposition   for simplicity use Y (not Y_t^*)

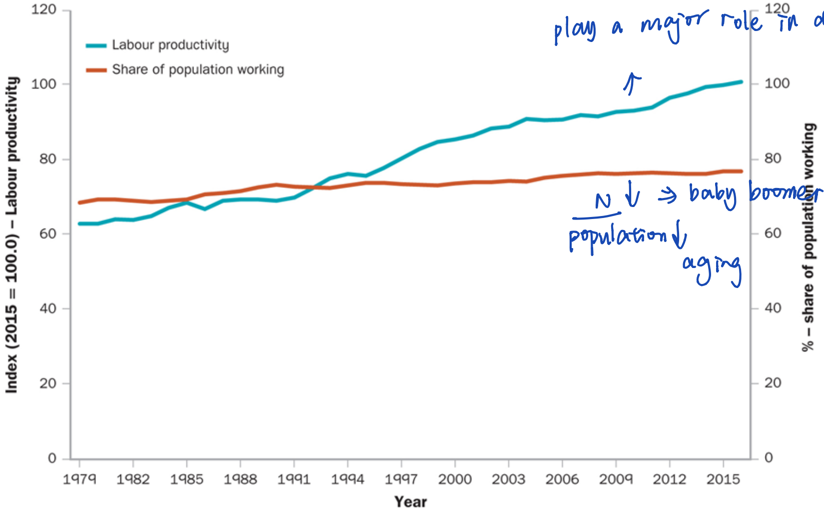
output per worker

$$\frac{Y}{Population} = \frac{Y}{N} \times \frac{N}{Population}$$

  - N is the number of employed workers
  - $\frac{Y}{N}$ is the output per worker, which is the measure of the level of *labour productivity*
  - $\frac{N}{Population}$ is the share of population employed
    <1

- Increase in output per capita in Australia can be explained by two facts
  - a rapid increase in labour productivity
  - the share of population employed has increased over time but is likely to drop in the future, as more and more baby boomers retire

Breakdown of Output per Capita in Australia



play a major role in driving the output per capita

↑

N ↓ ⇒ baby boomer retire

population ↓

aging

Determinants of Labour Productivity $\frac{Y}{N}$

$\Rightarrow$ primary factor

- Physical capital eg computer vs handwritting production ↑
- Technology
- Human capital: talents, education, skills and training
- Land and other natural resources: fertile land more crops
- Entrepreneurship and management
  - entrepreneurs help to transform scientific knowledge into new products
- Political and legal environment: property rights, political stability

factor of production

Total factor productivity

Factors of Production

- Factors that affect real output per person can be divided into *primary factors* and *total factor productivity*
  - *primary factors of production*: capital, labour (number of employed workers or number of hours worked)
  - *total factor productivity (secondary factors of production)*: all factors other than the primary factors
    - technology, human capital, land and other natural resources, entrepreneurship and management, political and legal environment
  - primary factors and total factor productivity together are referred to as *factors of production*

Production Function

- How can we formalise the way factors of production affect real output per person?

- *Production function* is a general mathematical expression of the relationship between factors of production and output Y_t

primary factors

$$Y_t = A_t \underline{f(K_t, L_t)}$$

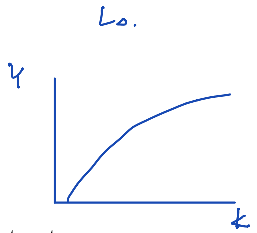
  – L_t is labour

  – K_t is capital

  – A_t is total factor productivity

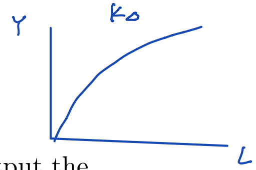
  – $f()$ means 'a function of'

Standard Assumptions



Y_t K_t positivity related

- Marginal product of capital is positive $\left(\frac{\partial Y_t}{\partial K_t} > 0\right)$
  - *marginal product of capital* (MPK) is the extra amount of output the firm gets from an extra unit of capital, holding the amount of labour fixed



$L_t \uparrow$ $Y_t \uparrow$

- Marginal product of labour is positive $\left(\frac{\partial Y_t}{\partial L_t} > 0\right)$
  - *marginal product of labour* (MPL) is the extra amount of output the firm gets from an extra unit of labour, holding the amount of capital fixed

Standard Assumptions

eg. 1 computer . prod↑

2 computers, don't need to have 2 comp.

MPK1 K=1

MPK2 K=2

prod doesn't increase that much

MPK1 > MPK2

L↔ K↑, MPK↓

- Diminishing marginal product of capital $\left(\frac{\partial MPK}{\partial K_t} < 0\right)$
  - MPK declines as the amount of capital used increases, holding the amount of labour fixed

K↔ L↑ MPL↓

- Diminishing marginal product of labour $\left(\frac{\partial MPL}{\partial L_t} < 0\right)$
  - MPL declines as the amount of labor used increases, holding the amount of capital fixed

Standard Assumptions

- Production function exhibits constant returns to scale (CRS)
  - scaling up each primary factor by a factor λ results in λ times the output
  - formally,

$$\lambda Y_t = A_t f(\lambda K_t, \lambda L_t)$$

$Y_t = A_t f(K_t, L_t)$

scale both factors!

$\lambda Y_t = A_t f(\lambda K_t, \lambda L_t)$

Cobb-Douglas Production Function

- Cobb-Douglas production function is a widely used production function, satisfying standard assumptions

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \quad = A_t f(K_t, L_t)$$

where $0 < \alpha < 1$

  - it exhibits CRS

$$A_t(\lambda K_t)^{\alpha}(\lambda L_t)^{1-\alpha} = \lambda Y_t$$

  - to check positive marginal products and diminishing marginal products, assume $\alpha = 1/3$

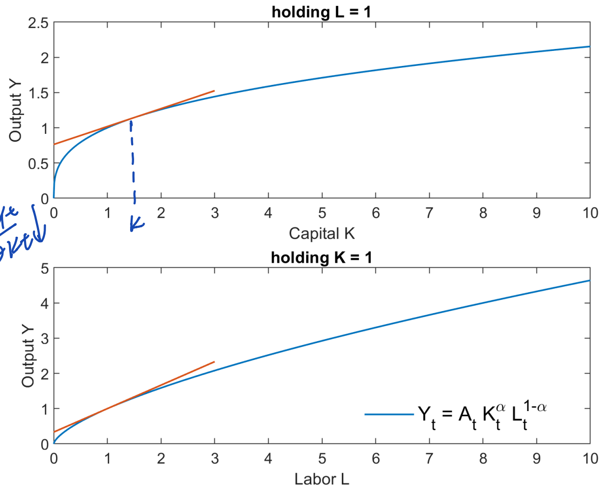
Cobb-Douglas Production Function

$\frac{\partial Y_t}{\partial K_t} > 0$

$\frac{\partial MPK_t}{\partial K_t} < 0$

$= \frac{\partial \left(\frac{\partial Y_t}{\partial K_t}\right)}{\partial K_t}$

$K \uparrow \quad \frac{\partial Y_t}{\partial K_t} \downarrow$



$\frac{\partial Y_t}{\partial L_t} > 0$

$\frac{\partial MPL}{\partial L_t} < 0$

- As the level of a primary factor increases, the slope of the CD function decreases (diminishing marginal products)

Next Lecture

- Firm's demand for capital and labour
  - interpretation of the parameter of Cobb-Douglas production function
- Growth accounting
- Outline of Solow-Swan model