National Income: Where It Comes From and Where It Goes

MACROECONOMICS

Outline of model

A closed economy, market-clearing model

- Supply side
  - factor markets (supply, demand, price)
  - determination of output/income
- Demand side
  - determinants of ***C***, ***I***, and ***G***
- Equilibrium
  - goods market
  - loanable funds market

The production function: $Y = F(K,L)$

- shows how much output (Y) the economy can produce from K units of capital and L units of labor
- reflects the economy's level of technology

Returns to scale:

Initially $Y_1 = F(K_1, L_1)$

Scale all inputs by the same factor z:

$K_2 = zK_1$ and $L_2 = zL_1$

(*e.g.*, if $z = 1.2$, then all inputs are increased by 20%)

What happens to output, $Y_2 = F(K_2, L_2)$?

- If **constant returns to scale**, $Y_2 = zY_1$
- If **increasing returns to scale**, $Y_2 > zY_1$
- If **decreasing returns to scale**, $Y_2 < zY_1$

Assumptions

1. Technology is fixed.
2. The economy's supplies of capital and labor are fixed at

$$\boldsymbol{K} = \overline{\boldsymbol{K}} \quad \text{and} \quad \boldsymbol{L} = \overline{\boldsymbol{L}}$$

(bar over a variable indicates a particular number. For example, in 2014 an estimate of the US capital stock was $51.2 trillion, that would be an example of $\overline{K}$, while the labor force is about 160 million people, an $\overline{L}$

The distribution of national income

- determined by **factor prices**,
  the prices per unit firms pay for the factors of production
  - wage = price of ***L***
  - **rental rate** = price of ***K***

Notation

W	= nominal wage
R	= nominal rental rate
P	= price of output
W/P	= real wage (measured in units of output)
R/P	= real rental rate

Diminishing marginal returns

- As an input is increased,
  its marginal product falls (other things equal).
- Intuition:
  Suppose $\uparrow$***L*** while holding ***K*** fixed
  $\Rightarrow$ fewer machines per worker
  $\Rightarrow$ if a worker is added, their productivity will be lower than previously added workers since they are less well equipped with the tools they need.

The Neoclassical Theory of Distribution

- states that each factor input is paid its marginal product
- a good starting point for thinking about income distribution

How income is distributed to *L* and *K*

$$\text{total labor income} = \frac{W}{P}\bar{L} = MPL \times \bar{L}$$

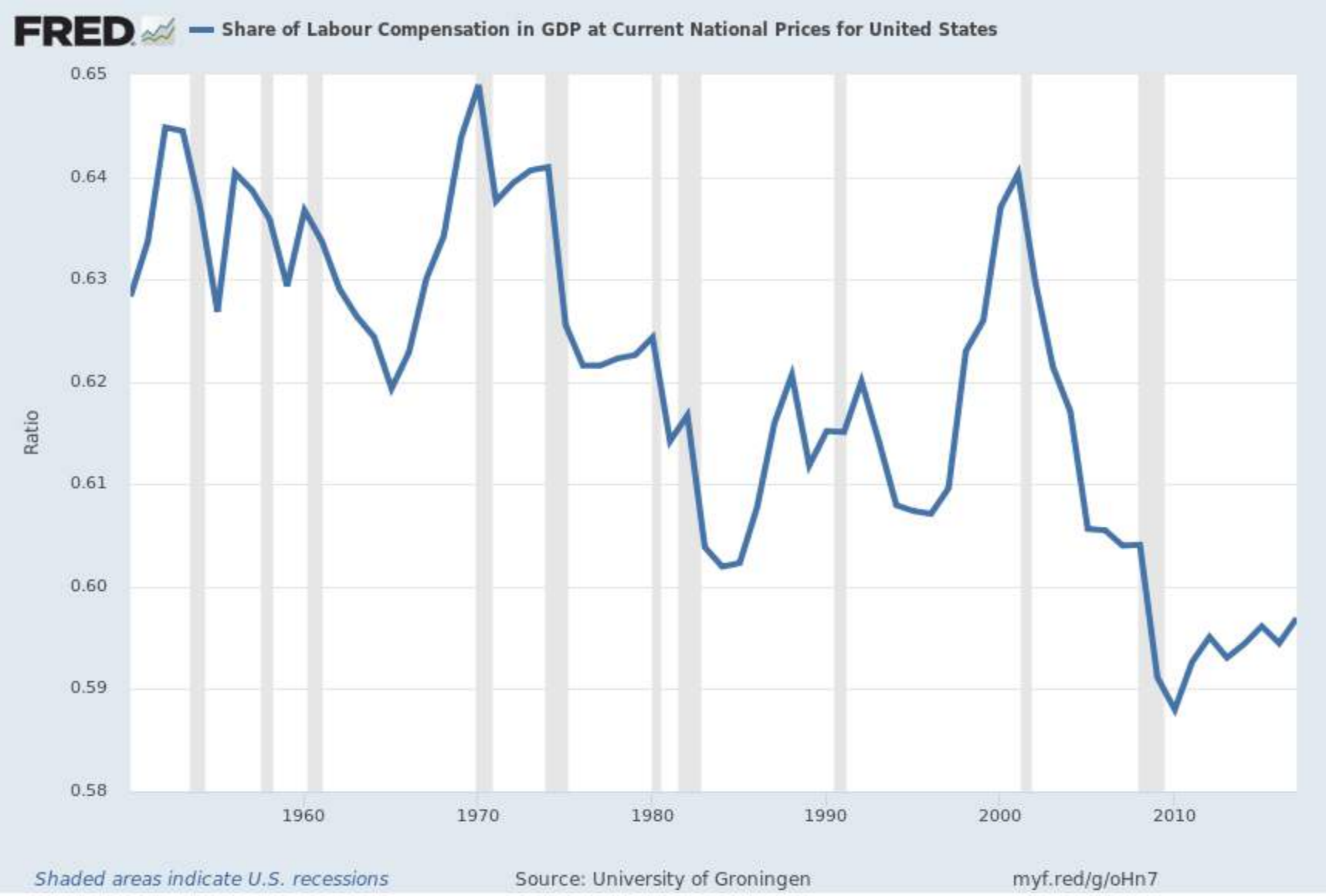
$$\text{total capital income} = \frac{R}{P}\bar{K} = MPK \times \bar{K}$$

If production function has constant returns to scale, then

$$\bar{Y} = \underbrace{MPL \times \bar{L}}_{\text{labor income}} + \underbrace{MPK \times \bar{K}}_{\text{capital income}}$$

national income

Labor's share of income in the U.S., 1950-2017



The Cobb-Douglas Production Function

- The Cobb-Douglas production function has constant factor shares:

  α = capital's share of total income:

  capital income $= MPK \times K = \alpha Y$

  labor income $= MPL \times L = (1 - \alpha) Y$

- The Cobb-Douglas production function is:

$$Y = AK^{\alpha} L^{1-\alpha}$$

  where A represents the level of technology.

The Cobb-Douglas Production Function

- Each factor's marginal product is proportional to its average product:
- Marginal product of input is the partial derivative of Y with respect to an input.

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

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

Demand for goods and services

Components of aggregate demand:

C = consumer demand for g & s

I = demand for investment goods

G = government demand for g & s

(closed economy: no ***NX***)

Consumption, *C*

- def: **Disposable income** is total income minus total taxes: $Y - T$.
- Consumption function: $C = C(Y - T)$
  Shows that $\uparrow(Y - T) \Rightarrow \uparrow C$
- def: **Marginal propensity to consume (MPC)** is the change in C when disposable income increases by one dollar.

Investment, I

- The investment function is $I = I(r)$

  where r denotes the **real interest rate**,
  the nominal interest rate corrected for inflation.

- The real interest rate is
  - the cost of borrowing
  - the opportunity cost of using one's own funds to finance investment spending

  So, $\uparrow r \Rightarrow \downarrow I$

Government spending, *G*

- ***G*** = govt spending on goods and services
- ***G*** excludes transfer payments
  (*e.g.*, Social Security benefits,
  unemployment insurance benefits)
- Assume government spending and total taxes are exogenous:

$$G = \bar{G} \quad \text{and} \quad T = \bar{T}$$

The market for goods & services

- Aggregate demand: $C(\bar{Y} - \bar{T}) + I(r) + \bar{G}$
- Aggregate supply: $\bar{Y} = F(\bar{K}, \bar{L})$
- Equilibrium: $\bar{Y} = C(\bar{Y} - \bar{T}) + I(r) + \bar{G}$

The real interest rate adjusts to equate demand with supply.

The loanable funds market

- A simple supply–demand model of the financial system.
- One asset: "loanable funds"
  - demand for funds: investment
  - supply of funds: saving
  - "price" of funds: real interest rate

Types of saving

private saving $= (Y - T) - C$

public saving $= T - G$

national saving, S

= private saving + public saving

$= (Y - T) - C + T - G$

$= Y - C - G$

Loanable funds market equilibrium