Development Economics

Lecture 5: Economic Growth—Stage Theory and Harrod-Domar

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Today

1. Rostow's Stages
2. Harrod-Domar model and extensions

Rostow's Stages

- In 1960 Walt Rostow wrote: *The Stages of Economic Growth: An anti-communist manifesto*

- Influential. It shaped the way many see development

- Idea of a linear progression
  - progression and progress, like development are optimistic terms, implying an ordering towards better things

- Partly description of societies at different stages, partly theory of transition between stages

Rostow's Stages

1. The traditional society *(agricultural subsistence)*
2. The pre-conditions for take-off into self-sustaining growth *(external demand, cash crops, investment in initial productive infrastructure like irrigation, ports and canals)*
3. The take-off *(urbanization, industrialization, growth of secondary sector like textiles/apparel)*
4. The drive to maturity *(multiple sectors, manufacturing of consumption goods rise, investment in social infrastructure like schools)*
5. The age of high mass consumption

The "takeoff"

- Rostow focused attention on the idea that some countries were growing and had grown (the developed world)
- While some countries had not (the developing world)
- What causes the transition into "takeoff"?
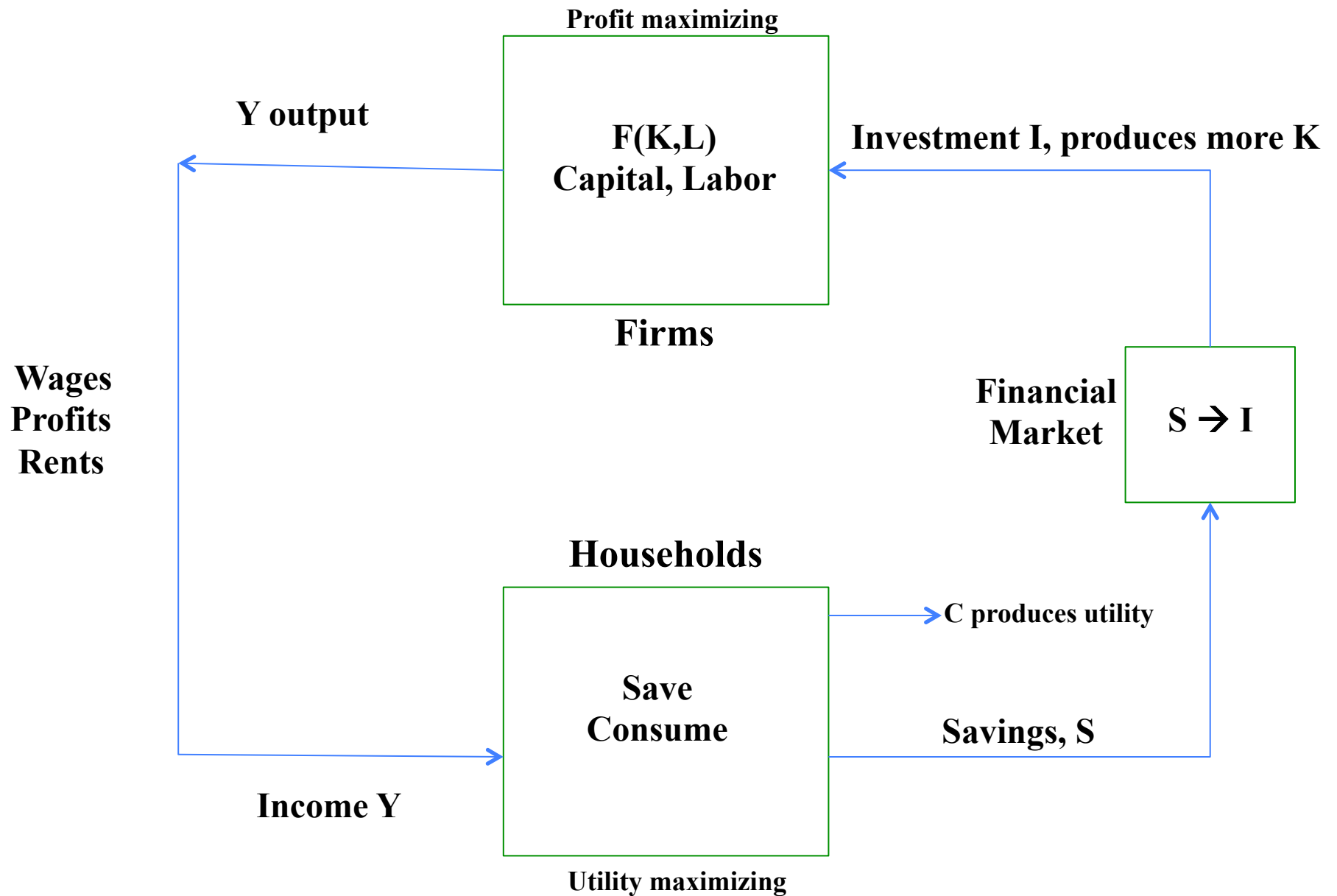- Need a theory of **Growth**

Growth models and production

- Growth models try to explain how to take what is made today, and make something more (or less) tomorrow

- Two typical properties of a growth model:
  1. <u>Temporal</u>: what happens next period depends on what happens this period
  2. <u>Cyclical</u>: Each period has a similar cycle of production and investment and consumption

Cycle of investment and consumption

1. Firms make stuff today, paying households that own the firms and work in the firms

2. Divide that stuff into
    1. Consumption goods (which are consumed today)
    2. Capital goods which are used to produce other goods such as consumption goods and more capital goods

3. Households buy the consumption goods with some of their income

4. Households save the rest of their income, investing in firms which buy capital goods.

5. Firms use capital goods and household labor to produce stuff tomorrow.

Flow diagram

Profit maximizing

Y output

F(K,L)
Capital, Labor

Investment I, produces more K

Firms

Wages
Profits
Rents

Financial
Market

S → I

Households

C produces utility

Save
Consume

Savings, S

Income Y

Utility maximizing

Savings and investment balance

- Savings of households is investments of firms, since firms need to acquire additional capital from somewhere
  - (Later allow foreign investment and aid)
- So countries with high savings would increase their capital, and so be able to produce more the next period.
- Rostow: traditional societies save little, and so do not grow.

Harrod-Domar Model

- Formalized the importance of savings.

- Savings produce capital for the next period

- Capital is used to produce.

- Harrod-Domar is actually a special case of more general models

  - Sometimes called the AK model. Why will be clear when we talk about Solow

Harrod-Domar Notation

K_t is capital at time t

Y_t is income or output from firms at time t

$\Delta Y_t = Y_t - Y_{t-1}$

Growth rate at t : $\dfrac{\Delta Y_t}{Y_{t-1}} = \dfrac{Y_t - Y_{t-1}}{Y_{t-1}}$

Harrod-Domar Assumptions

1. Net Savings of households is a constant proportion of income

    $S=sY$ where s is the savings rate

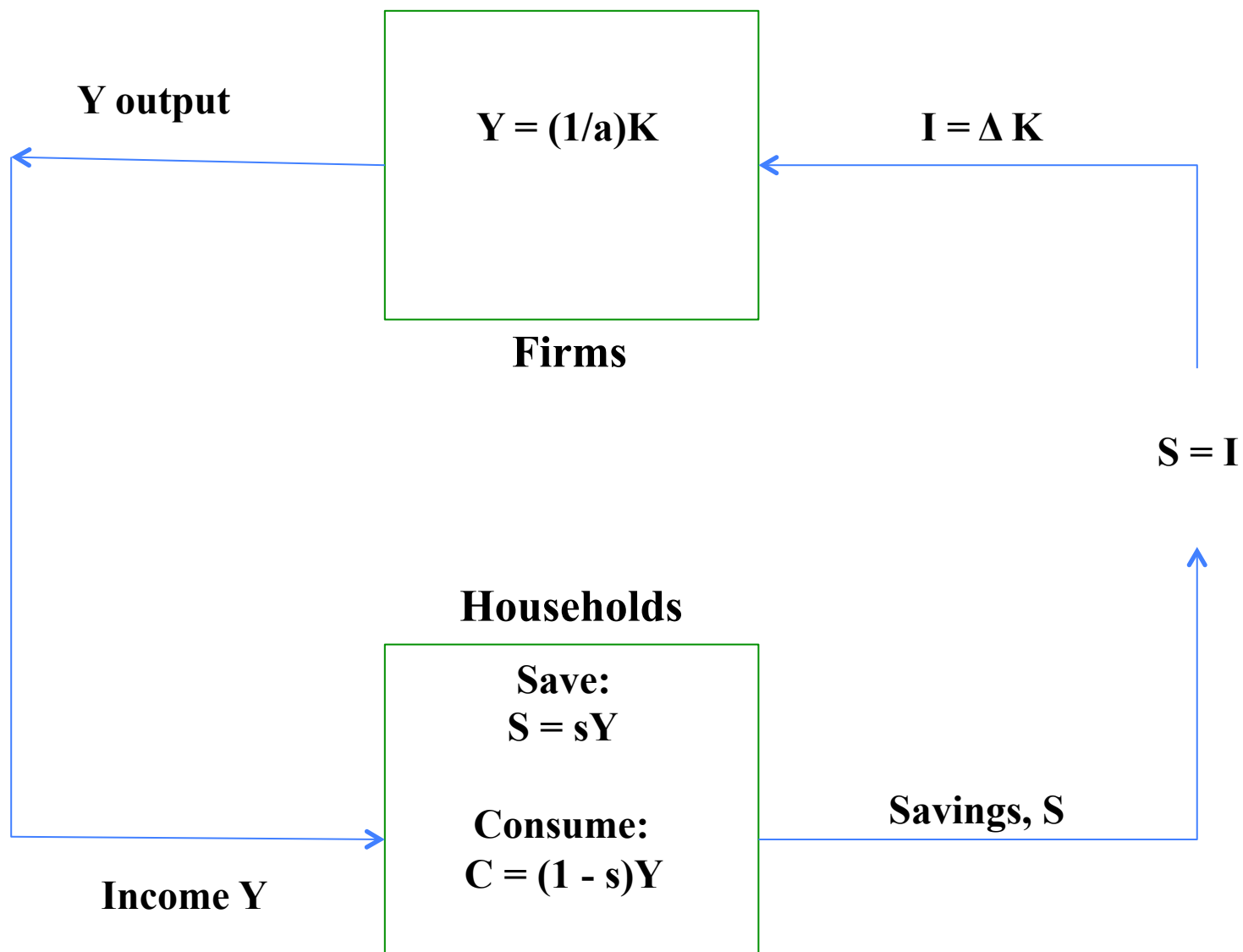2. Net Investment I is the change in capital

    $I = \Delta K$

3. Firms produce a constant capital-output ratio

    $a=K/Y$ where a is a constant $\rightarrow$ $Y = (1/a)\,K$

4. Savings equals investment

    $S=I$

Flow diagram

Y output $Y = (1/a)K$ $I = \Delta K$

Firms

$S = I$

Households

Save:
$S = sY$

Consume:
$C = (1 - s)Y$

Savings, S

Income Y

Harrod-Domar: All together now

$a = K/Y \quad \Rightarrow \quad aY = K \quad \Rightarrow \quad a\Delta Y = \Delta K$

Since $S = I = \Delta K$ and $S = sY$

$\Delta K = sY \quad \Rightarrow \quad a\Delta Y = \Delta K = sY$

So $\Delta Y/Y = s/a =$ growth of GDP

Harrod-Domar hidden assumptions

- ## Production

  - No Labor

  - *a* is constant $\rightarrow$ every additional unit of K produces same amount of Y *(no diminishing returns)*

- ## Savings

  - Constant savings rate

  - Financial markets are efficient (all S goes to I)

Harrod-Domar Savings Gap

Example: want to grow at 5% per year

$\Delta Y / Y = 5\%$ so if $a = K/Y = 3$

How much do needs to be saved?

$\Delta Y / Y = s/a \rightarrow$ $5 = s/3$ $\rightarrow$ $s = 15\%$

What happens if only save 10%?

Either: grow less fast (3.3%) or extra 5% of savings must come from elsewhere

Foreign direct investment or Aid

Harrod-Domar and Depreciation

Depreciation: every period a fraction of capital
wears out → $\Delta K = I - \delta K$

Work through model (what's the new growth rate?):

$I = S$; $S = sY$; $a = K/Y$; $\Delta K = I - \delta K$

$$aY = K \rightarrow a\,\Delta Y = \Delta K$$

$$a\,\Delta Y = \Delta K = I - \delta K = sY - \delta K \qquad \rightarrow$$

$$a\,\Delta Y/Y = s - \delta K/Y = s - \delta a \qquad \rightarrow$$

$$\boxed{\Delta Y/Y = s/a - \delta}$$

Harrod-Domar and Population Growth

Interested in: $y = Y/P$ $k = K/P$

          Population grows at a constant rate $g = \Delta P/P$

Then $k = K/P$ → $kP = K$ → $\Delta K = \Delta k\, P + \Delta P\, k$

Still have $aY = K$ → $aY/P = K/P$ → $a\, y = k$

          $\Delta K = sY - \delta K$ → $sY - \delta K = \Delta k\, P + \Delta P\, k$

          $sy - \delta k = \Delta k + \Delta P/P\, k$,   *so if $\Delta k = a\Delta y$*

          $sy - \delta k = a\, \Delta y + gk$,   *(divide by y)*

          $s - \delta k/y = a\, \Delta y/y + g\, k/y$ →   *(remember $k/y = a$)*

$$\Delta y/y = s/a - (\delta + g)$$

General Harrod-Domar

$$\Delta y/y = s/a - (\delta + g)$$

growth if $\quad \Delta y/y > 0$

$$s/a > \delta + g$$

savings times productivity of K must be higher than depreciation and population growth

Harrod-Domar: When do countries grow?

- Savings is the way to grow
- Low growth countries:
  - Do not save enough (low s)
  - Are not productive with their investments (high a=K/Y)
  - Have high population growth (high g)
  - Have high depreciation
- Such countries may need aid (which supplements low S) to avoid declining.

Criticisms of Harrod-Domar

- Investment probably necessary for growth, but not sufficient, much left out *(innovation)*

- Are savings and investment really equal? *(uncertainty, weak property rights)*

- Savings may be endogenous: people do not just save a constant fraction *(increase in income?)*

- Production function very simple: Y=(1/a)K

  - Where is labor? Where are declining returns to scale?

  - Adding these in gives the Solow model which develop next lecture.