8 Endogenous Growth

•How can we get endogenous growth? (i.e. growth that does not depend on exogenous technological growth)

•There are essentially three ways, linear technology, externalities and ideas.

•We do not want increasing returns to scale from the point of view of the firm.

•1. There are linear returns to inputs that can be reproduced. So labor is not in the production function.

$$Y = A\,K$$

or even

$$Y = A\,K^{\alpha}\,H^{1-\alpha}$$

If

$$s\,Y + (1-\delta)\,K > K \qquad \text{i.e.} \qquad s\,A - \delta > 0$$

we have perpetual growth at a constant rate.

•2. An Externality in Capital: Other people's capital increase my productivity. Imagine a firm's output is

$$y = A\, k^{\alpha}\, \ell^{1-\alpha}\, K^{1-\alpha}$$

where small letters imply chosen by the firm and big letters are the influence of the economy (aggregate per firm capital). Note that for the economy as a whole $K = k$, $L = \ell$ and $Y = y$ which means

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

to grow we have again the condition

$$s\, Y + (1-\delta)\, K > K \qquad \text{i.e.} \qquad s\, A - \delta > 0$$

•3. Innovation by firms. New ideas. What are the basic characteristics of an idea?

1. Ideas are *nonrivalrous* goods.

2. Ideas are, at least partially, *excludable*.

Different Types of Goods

1. Rivalrous goods that are excludable: almost all private consumption goods, such as food, apparel, consumer durables fall into this group.

2. Rivalrous goods that have a low degree of excludability: tragedy of the commons.

3. Nonrivalrous goods that are excludable: most of what we call ideas falls under this point.

4. Nonrivalrous and nonexcludable goods: these goods are often called public goods.

Nonrivalrousness and Excludability of Ideas

- Nonrivalrousness: implies that cost of providing the good to one more consumer, the *marginal cost* of this good, is constant at zero. Production process for ideas is usually characterized by substantial fixed costs and low marginal costs. Think about software.

- Excludability: required so that firm can recover fixed costs of development. Existence of intellectual property rights like patent or copyright laws are crucial for the private development of new ideas.

The actual way to implement this in a model is quite complicated. Firms have to make investments in ideas, and capture profits later to make up for the investment. This requires some form of monopoly power. We call it monopolistic competition since it has features from both.

This is a two sector model. One produces the good the other produces R&D.

We will not get into details.

This finishes the part of growth and development of the course. We now move to fluctuations.