Macroeconomics Lecture 2

SGPE Summer School

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Introduction

Time Horizon

The long run:

- Wages and prices have had time to adjust so that production and employment are at their equilibrium values, but the capital stock is fixed.
- Time perspective: ‘a few years’

The very long run:

- Even the capital stock has had time to adjust

Long run

Why is it important to study the economy in the long run?

- Long run growth affects the population's standard of living much more than short-term fluctuations
- Decisions about consumption and investments depend on expectations of what will happen in the long run
- You can't analyse what stabilisation policy should do – or should not do – without knowing more about the long-run equilibrium level

Questions to be addressed

- What factors determine the income level and the distribution of income in the long run?
- What determines demand (investments and consumption) and the real interest in the long run?
- Why are some countries richer than others?
- Why is there always unemployment in a market economy?
- What determines inflation in the long run? (Later on)

Production

Questions

- How much can a country produce?
- How does the product market work and how are prices determined?
- What factors determine the distribution of income between labor and capital income?

Production Factors

- Labor
- Capital (buildings,machines etc.)
- Fixed factors (land, natural resources etc.)
- Intermediate goods (raw materials, energy, components etc.)
- Technology (knowledge)

Production Technology

In the model the typical firm produces a commodity that can be used for consumption or investment

Production function:

$$Y = F(K, N)$$

Y production

K capital stock

N number of workers

We disregard fixed factors and intermediate goods. This production function describes the technology

Characteristics of Production Function

- The marginal product of capital: how much production increases when we add a unit of capital
- The marginal products are positive: production is an increasing function of K and N
- The marginal product of capital is lower if we have more capital already
- The marginal product of capital is higher if we have more labor that can use the machines

Production Function

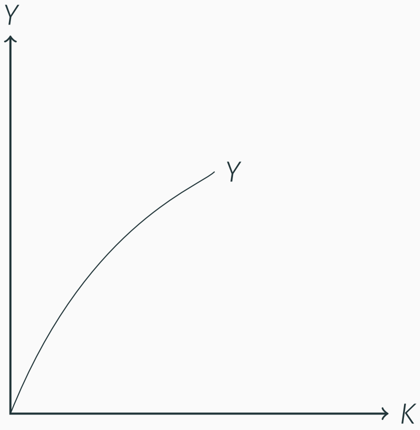

Figure 1: A typical production function

Marginal Product of Capital

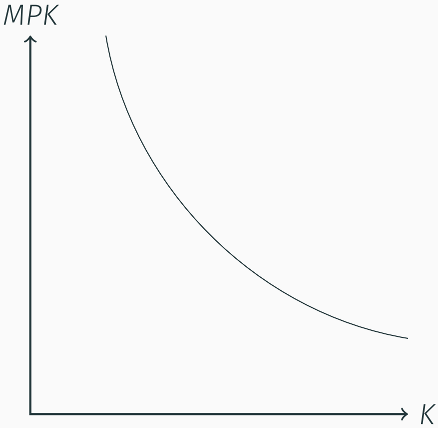

Figure 2: MPK for given labor input

Characteristics of Production Function

Constant returns to scale (CRS)

If we double K and N, then Y is doubled

$$F(zK, zN) = zY \text{ for } z > 0$$

E.g. $F(2K, 2N) = 2Y$

Technical Development

- Production Function: $Y = F(K, EN)$
- E is a measure of the efficiency of labor
- An increase in E by 10% has the same effect on production as a 10% increase in the number of workers
- We can think of EN as the efficient number of workers

A Canonical Example

We often use the Cobb-Douglas production function:

$$Y = K^{\alpha}(EN)^{1-\alpha} \quad) \leq \alpha \leq 1$$

Rewrite this as $K^{\alpha}E^{1-\alpha}N^{1-\alpha}$ and take derivative wrt N:

$$MPL = K^{\alpha}E^{1-\alpha}(1-\alpha)N^{-\alpha} = (1-\alpha)E^{1-\alpha}(\frac{K}{N})^{\alpha}$$

- The more N, the lower is MPL
- The more K, the higher is MPL
- The higher the E, the higher is MPL

Production: Example

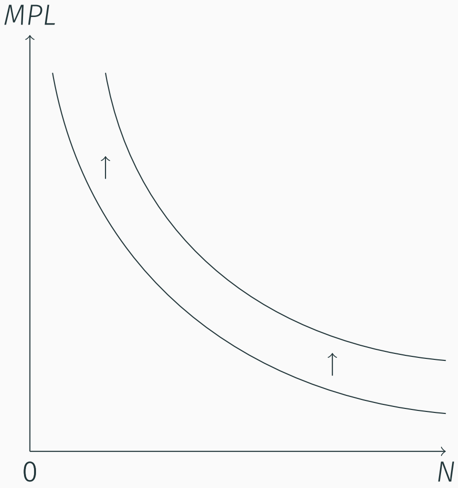

Figure 3: The effect on MPL of an increase in E or K

Price Setting

Introduction

Questions:

- How does the product market work?
- How are prices set?

Introduction Con't

Perfect Competition:

Firms produce identical goods and they can sell everything they produce, but they have to set the price equal to the market price

Monopolistic competition:

Firms produce goods that are similar but not identical to the goods of other firms. A firm can set its own price and the price affects sales

In both cases: many firms – no 'strategic' interaction

Price- Setting; Demand

We study a company named i – one of many companies in the economy. To be more concrete, let $i = 4711$

- How much will the company sell (produce)?
- What price will the company set?

These two decisions are really just one: the company must choose a point on the demand curve

Price-Setting: Demand Con't

Higher price leads to lower demand for a company's product, that is, the company will face a downward sloping demand curve.

Demand for a company's product: $Y_i = D(P_i/P)Y$ where P_i/P is the company's price relative to the general price level and Y is the aggregate income in the economy.

Price- Setting: Demand Con't

What happens to the demand for the product produced by firm 4711 if the price is raised, for a given P and Y?

The answer depends on the degree of competition the company faces. How similar is the company's product compared to the products of other firms?

A measure of the 'degree of competition' is the price elasticity, which tells us by what percentage demand will decrease if the price is raised by one percent.

$$\eta = \frac{dY_i/Y_i}{dP_i/P_i} \quad \eta < -1$$

Price- Setting: Demand Con't

The inverse demand function is the relationship between company's price and production/sales

$$P_i = P(Y_i, P, Y)$$

If the company wants to sell more it has to lower the price.

Price-Setting: Profit maximization

Firm's goal: greatest possible profit

Profit maximization requires:

MR=MC

Marginal revenue from selling one more unit must be equal to the marginal cost of producing one more unit

Price Setting: Profit Maximization Con't

Revenue: $Y_i P_i = Y_i P(Y_i, P, Y)$

How much does the revenue increase if you sell one more unit?

$$MR = \overbrace{P_i}^{\text{Increase in revenue from selling one more}} + \underbrace{Y_i \frac{dP_i}{dY_i}}_{\text{Decrease in revenue from lower prices}}$$

$$= P_i \frac{dP_i}{dY_i} \frac{P_i}{P_i} = (1 + \frac{dP_i/P_i}{dY_I/dY_i}) P_i = (1 + \frac{1}{\eta}) P_i$$

Remark: $MR < P_i$ and positive.

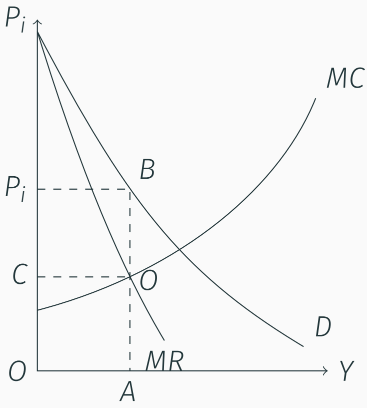

Figure 4: Profit maximizing price and production level

Price-setting: Profit maximization

Profit maximization: $MR = MC$

$$(1 + \frac{1}{\eta})P_i = MC \text{ or } P_i = (1 + \mu)MC_i$$

where $1 + \mu = \frac{1}{1+1/\eta} > 1$

E.g., $\eta = -5 \implies \mu = 0.25$ Mark-up is 25%

Conclusions:

- Optimal price is higher than MC
- Mark-up is determined by the degree of competition

Price-setting: Profit maximization Con't

MC measures how much cost increases if a company sells (produces) one more product

The capital stock is given in the short run

The firm can increase production by employing one more worker

Cost: W_i

Production increase: MPL_i

Marginal cost: $MC_i = \frac{W_i}{MPL_i}$

Note that cost of labors is W_iN for firm i then marginal cost of i is

$$MC_i = \frac{dTC_i}{dY} = W_i \frac{dN}{dY} = W_i \frac{1}{MPL_i} = \frac{W_i}{MPL_i}$$

The firm i's optimal price then becomes

$$P_i = (1+\mu)\frac{W_i}{MPL_i}$$

what about the other firms?

Symmetry: We pick a "representative firm" which means that we pick one of many firms that face the same conditions and solve the same problem, thus set the same price

$$P = (1+\mu)MC = (1+\mu)\frac{W}{MPL}$$

Consider a Cobb-Douglas production function and remember

$$MPL = K^{\alpha}E^{1-\alpha}(1-\alpha)N^{-\alpha} = (1-\alpha)E^{1-\alpha}(\frac{K}{N})^{\alpha}$$

So

$$P = (1+\mu)MC = (1+\mu)\frac{W}{MPL} = \frac{1+\mu}{1-\alpha}WE^{\alpha-1}(\frac{K}{N})^{-\alpha}$$

The price level is influenced by

- The wage level W (+)
- Technology E (-)
- The size of the mark-up μ (+)
- The amount of capital per worker K/N (-)

Distribution of Income

Questions

- How is the production level determined in the long run (= the natural level of production)?
- How are real wages determined?
- How is the distribution of income determined?

Production in Equilibrium

L labour force = the number of people who have a job or are looking for work

u^n equilibrium level for unemployment

Natural rate of employment $N^n = (1 - u^n)L$

Production: $Y^n = F(KEN^n) = F(K, E(1 - u^n)L)$

Production in Equilibrium Con't

What determines the equilibrium level of production?

$$Y^n = F(K, E(1 - u^n)L)$$

- Amount of capital K (+)
- Size of labor force L (+)
- Equilibrium level of unemployment u^n (-)
- Technology E (+)

Distribution of Income: Real Wages

Real wage = wage in terms of consumption=nominal price/price level=W/P

$$P = (1+\mu)\frac{W}{MPL} \implies \frac{W}{P} = \frac{MPL}{1+\mu}$$

Real Wages

Cobb- Douglas: $MPL = (1-\alpha)E^{1-\alpha}(\frac{K}{N})^{\alpha}$

$$\frac{W}{P} = \frac{MPL}{1+\mu} = \frac{1-\alpha}{1+\mu}E^{1-\alpha}(\frac{K}{N^n})^{\alpha}$$

Real wage increases:

- Technology E is improved
- Capital per worker K/N^n increases
- The size of the markup μ decreases

Who gets what

Closed economy: income=production

Types of income in the model:

- Wage income
- Interest income on loans to firms
- Dividends which are paid out to households (In our context pure profits)

Labor share

Cobb-Douglas

$$MPL = (1-\alpha)E^{1-\alpha}(\frac{K}{N})^{\alpha} = (1-\alpha)\frac{Y}{N} \text{ and } \frac{W}{P} = \frac{MPL}{1+\mu}$$

which implies $\frac{W}{P} = \frac{1-\alpha}{1+\mu}\frac{Y}{N}$.

Labor share of GDP $\frac{WN}{PY} = \frac{1-\alpha}{1+\mu}$

Labor share Con't

Distribution of income

Labor share of GDP is $(1-\alpha)/(1+\mu)$ than capital share of GDP is $(\alpha+\mu)/(1+\mu)$

What affects the distribution of income?

- Technology α
- Degree of competition μ in the product market

Comparative Statics

Wage share will be high if:

- Labor is an important production factor
- The degree of competition is high

In developed countries the labour share of GDP at factor price is about 2/3; capital share is approximately 1/3. See Fig 2.9 at the textbook

Social insurance fees (wage taxes) are included in the wage share.

We consider the share of GDP at basic (≈factor) price because VAT goes neither to capital owners nor to workers

Additional reading

Technology and wages

http://krugman.blogs.nytimes.com/2012/12/10/technology-and-wages-the-analytics-wonkish/