

SGPE Summer School. Tutorial 2.

Q1. What factors determine the natural level of production and how?

Q2. What is a production function? What are the three basic assumptions that we make about the production function? Do you think the assumptions are reasonable? - Justify your answer.

Q3. Macroeconomists often use the Cobb-Douglas production function<sup>1</sup>, for example:  $Y = K^\alpha (EN)^\beta$ . Where Y is output, K is the capital stock, E is the level of technology, N is the number of workers, and  $\alpha$  and  $\beta$  are each fixed parameters between zero and one.

For each of the following, state whether the production function exhibits increasing, decreasing, or constant returns to scale to the inputs K and N. Can you spot the general pattern?

(a)  $\alpha = 0.3, \beta = 0.9$

(b)  $\alpha = 0.3, \beta = 0.7$

(c)  $\alpha = 0.3, \beta = 0.5$

Q4. Suppose that your production function is  $Y = K^\alpha (EN)^\beta$ , where  $\alpha$  and  $\beta$  are both fixed parameters between zero and one. Assume that you have perfectly competitive goods markets and factor markets (i.e. no mark-up, no unemployment, and where landlords and workers are paid their marginal products):

(a) Find the wage ( $W$ )

(b) How does the wage depend on  $\beta, K, E,$  and  $N$ ?

(c) Find the aggregate payments to labour

(d) Find the rental price of capital ( $r$ )

(e) How does the rental price depend on  $\alpha, K, E,$  and  $N$ ?

(f) Find the aggregate payments to capital

(g) Now find the sum of aggregate payments to capital and aggregate payments to labour. Are these aggregate payments greater or less than the sum of aggregate income? Comment on the results, making note of the relevance of returns to scale.

Q5. Use the neoclassical theory of distribution to predict the impact on the real wage and the real rental price of capital of each of the following events:

(a) A wave of immigration increases the labour force.

(b) An earthquake destroys some of the capital stock.

(c) A technological advance improves the production function.

(d) High inflation doubles the prices of all factors and outputs in the economy.

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<sup>1</sup> One history of the Cobb-Douglas form can be found in: Biddle, Jeff. "Retrospectives: The Introduction of the Cobb-Douglas Regression." *The Journal of Economic Perspectives* 26.2 (2012): 223-236.

**Q6. Which factors affect the real price level and why?**

**Q7. In general, why is the marginal product of labour smaller than the average product of labour?**

**Q8. Assume that price and production are (respectively) determined as follows:**

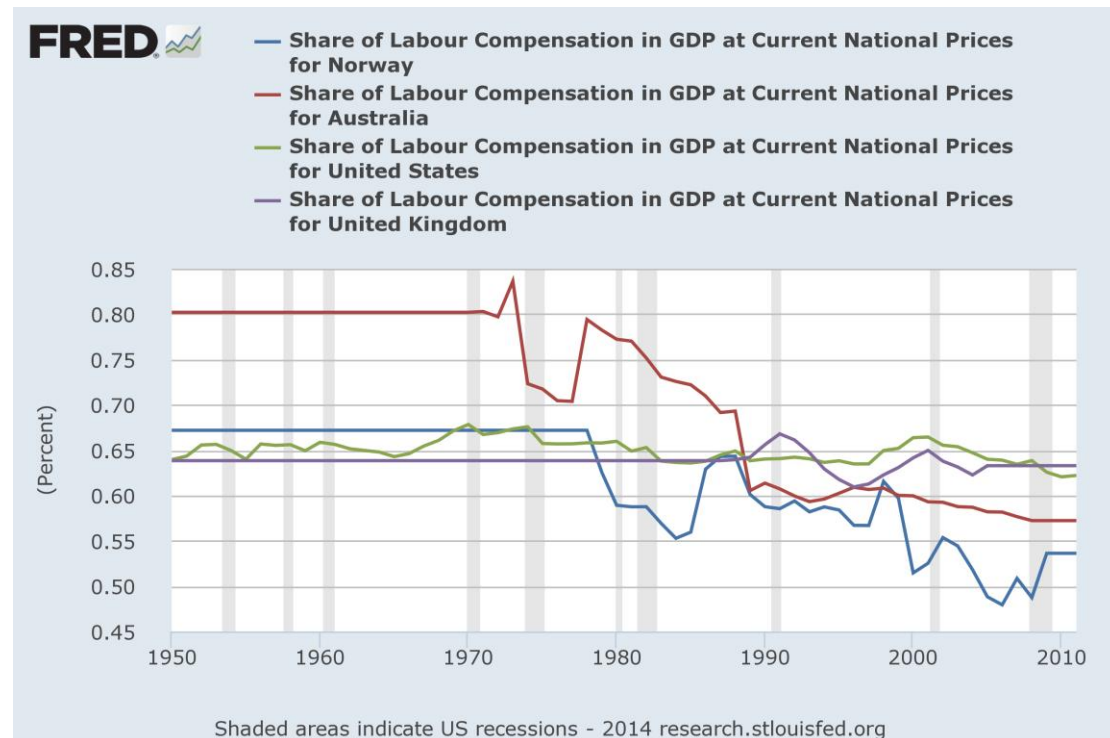
$$P = (1 + \mu) \frac{W}{MPL}$$

$$Y = K^\alpha N^{1-\alpha}$$

- (a) Find an expression for MPL in terms of K, N, and  $\alpha$ .**
- (b) Find an expression for labour's share of income and give an intuitive interpretation of it.**
- (c) Calculate labour's share if  $\alpha = 0.4$ , and  $\mu = 0.2$ .**
- (d) Calculate labour's share if  $\alpha = 0.4$ , and  $\mu = 0.5$ .**
- (e) Calculate labour's share if  $\alpha = 0.5$ , and  $\mu = 0.5$ .**

**Q9. In what ways can the government policies affect the degree of competition and the mark-up, positively or negatively?**

**Q10.** As you can see in the graph below<sup>2</sup>, labour compensation as a share of GDP in the USA and the UK for the past 60 years has been relatively constant at around 2/3. Labour compensation in Norway and Australia, however, having been higher than the UK/US levels in the 1950s and 1960s, started to fall dramatically in the 1970s. Since the mid 1990s, the compensation shares in Australia and Norway have been consistently lower than the British and American levels. According to the theory developed in the textbook (and in the previous question) what factors could potentially explain these trends?



**Q11.** Suppose that a political party wants to increase labour's share of income after tax. Analyse how the following measures might affect labour's share:

- (a) Limits on the number of firms that enter individual markets
- (b) A law stipulating reduced working hours

**Q12.** A country has 10 percent unemployment. The production function is Cobb-Douglas with  $\alpha = 0.3$ .

- (a) By how much will production increase if unemployment is reduced to 5 percent while the capital stock, the labour force, and technology are unchanged? Explain your result.
- (b) If unemployment remains permanently on the lower level, is it likely that the capital stock will remain unchanged?

<sup>2</sup> University of Groningen and University of California, Davis, Share of Labour Compensation in GDP at Current National Prices for Norway [LABSHPNOA156NRUG], retrieved from FRED, Federal Reserve Bank of St. Louis <https://research.stlouisfed.org/fred2/series/LABSHPNOA156NRUG/>, December 22, 2014.