

### Macro Module 3 Cobb-Douglas production function practice exam questions

An economy has a Cobb-Douglas production function:  $Y = AK^\alpha L^{(1-\alpha)}$ .

A is the technology level, K is capital; L is labor; and Y is income.

- In 20X1, the technology level A is 143, capital K = 236, labor L = 458, income Y = 8,808
- In 20X2, the technology level A is 149.05, capital K = 248.74, labor L = 472.98, income Y = 9,620.56
- In 20X3, the technology level A is 155.59, capital K = 263.12, labor L = 490.71

#### Question 3.1: Percentage changes

What are the percentage changes for A, K, L, and Y from 20X1 to 20X2?

Answer 3.1: percentage change =  $(20X2 \text{ value} - 20X1 \text{ value}) / 20X1 \text{ value}$ :

- technology level (A):  $(149.05 - 143) / 143 = 4.23\%$
- capital (K):  $(248.74 - 236) / 236 = 5.40\%$
- labor (L):  $(472.98 - 458) / 458 = 3.27\%$
- income (Y):  $(9,620.56 - 8,808) / 8,808 = 9.2253\%$

#### Question 3.2: $\alpha$ parameter (exponent of capital)

What is the  $\alpha$  parameter (the exponent of capital) of the Cobb-Douglas production function?

Answer 3.2:  $4.23\% + \alpha \times 5.40\% + (1 - \alpha) \times 3.27\% = 9.2253\% \Rightarrow$   
 $\alpha \times (5.40\% - 3.27\%) = (9.2253\% - 3.27\% - 4.23\%) \Rightarrow$   
 $\alpha = (9.2253\% - 3.27\% - 4.23\%) / (5.40\% - 3.27\%) = 81.00\%$

#### Question 3.3: Elasticity of income with respect to capital

What is the elasticity of income with respect to capital?

Answer 3.3: 81% (=  $\alpha$ )

#### Question 3.4: Elasticity of income with respect to labor

What is the elasticity of income with respect to labor?

Answer 3.4:  $1 - 81\% = 19\%$

#### Question 3.5: Percentage changes for factors of production

What are the percentage changes for A, K, and L from 20X2 to 20X3?

Answer 3.5: percentage change =  $(20X3 \text{ value} - 20X2 \text{ value}) / 20X2 \text{ value}$ :

- technology level (A):  $(155.59 - 149.05) / 149.05 = 4.39\%$
- capital (K):  $(263.12 - 248.74) / 248.74 = 5.78\%$
- labor (L):  $(490.71 - 472.98) / 472.98 = 3.75\%$

Question 3.6: Percentage change for income

What is the percentage change for Y from 20X2 to 20X3?

Answer 3.6:  $4.39\% + 81\% \times 5.78\% + 19\% \times 3.75\% = 9.7843\%$

Question 3.7: Income

What is income (Y) in 20X3?

Answer 3.7:  $9,620.56 \times (1 + 9.7843\%) = 10,561.86$