**Technology and Economics**

**Questions**

1. Discuss how the Solow’s model of growth is related to the quote below:

“The most genuine guide in life is science.” – Atatürk

**Answer:** In the class, we discussed the Solow’s growth model according to which the long-run growth of GDP per capita is equal to the growth of technology and information. In formal terms, this idea can be expressed as

where is technology and information while is average income, i.e. GDP per capita. The reason behind this fundamental finding can be seen by inspecting the law of motion for capital:

where is the saving rate, and is the depreciation rate. Therefore, the growth of is

This means in the long-run (because endogenous variables are constant in the long-run and our endogenous variables are growth rates).

Now let us suppose that the production technology is Cobb-Douglas, given by:

Take the logarithms of both sides to see

The time derivative of both sides give us

This completes the argument to show

Remark: The only way to achieve long-run growth is technological change and increasing information/knowledge according to the Solow’s model, consistent with the quote from Atatürk.

1. The graph below plots the natural logarithm of output (Y), capital (K), and (L) in the US between 1899 and 1922. The solid lines are the trend lines.

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| --- | --- |
|  | 1. Find the slopes of each straight line.
2. What is the average growth rates of Y, K and L.
3. Is your result consistent with the long-term predictions of the Solow model? Explain.
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Answers. a) dt=24, and d(lnK)=6.1-4.7 which means the slope is

and d(lnY)=5.4-4.7 which means the slope is

and d(lnL)=5.4-4.7 which means the slope is

b) The answer is , .

c) According to the Solow’s model but here they are very different.

3) Asparagus market is competitive where marginal cost of harvesting 1 kg. of crop is €4. In the EU, %40 of this cost is labor cost. Assume that the demand for asparagus is

There is a recent automated harvesting technology which reduces the labor cost to zero, and will be sold for €16.5.

1. Would a European firm buy the harvesting robot?
2. In Turkey, %20 of the cost is labor cost. Would a Turkish firm buy the harvesting robot?

Answer. If a firm buys this technology, then the marginal cost is beause 40% of 4 is 1.6=labor cost. Hence the new cost would be 4-1.6=2.4. The profit maximization problem for the company with the superior technology is maximizing

Take the derivative and equate it to zero to solve

So the optimal production level with robots is , which means that , and therefore, . The level of profit in this case is

The cost of robot is lower than this profit so the firm should buy it.

b) If a firm buys this technology, then the marginal cost is beause 20% of 4 is 0.8=labor cost. Hence the new cost would be 4-0.8=3.2. The profit maximization problem for the Turkish company with the superior technology is maximizing

Take the derivative and equate it to zero to solve

So the optimal production level with robots is , which means that , and therefore, . So the firm with the superior technology would choose to charge which is practically equal to That is because, other competitors can sell the same good at as well.

So the profit of the Turkish firm is

The cost of robot is higher than this profit so the firm should not buy it.

1. Zapital, a widely known magazine on business life, makes an interview with Ayşe Pekduru, a famous industrialist. Mrs. Pekduru comments that “If we would scale up our capacity in our plant, then the cost of the last item in our production line would be higher. That is the reason why, we are not planning any further capacity increases in the foreseeable feature.”
2. Does Mrs. Pekduru describe increasing returns to scale or decreasing returns to scale?

Short answer: Decreasing returns to scale.

b) Suppose that the production technology described by Mrs. Pekduru can be captured by the following function:

What should the value of be in order to ensure that this technology is consistent with Mrs. Pekduru’s description?

Long answer: Let Therefore, due to decreasing returns to scale,

This is only possible when .

1. A new vaccination technology is so efficient that it requires 75% reduction in vaccines (1 dose instead of 4) to be as effective as the old technology.
2. Is this a labor augmenting or capital augmenting technology?
3. Assume that labor and capital are complements? How would these kinds of technological developments affect capital share of income?

Definition: Suppose that the technology is

In this formulation, the role of as a technology parameter is to capture the effectiveness of capital. For example, if doubles, then this is equivalent to doubling with the old technology. This is called “capital augmenting technological factor”. The same idea applies to labor. For example, if doubles, then this is equivalent to doubling with the old technology. This is called “labor augmenting technological factor”.

Answer.

1. This is a capital augmenting technological change because the new vaccine acts as if there are more vaccines with the old technology. This is the definition of capital augmenting tech.
2. The capital share of income is

So the increase in when would decrease capital share.