# Sessions 5-6

Production Theory…Continued

Production Function – An empirical example

Problem 1

For each of the following examples, draw a representative isoquant. What can you say about the marginal rate of technical substitution in each case?

a. A firm can hire only full-time employees to produce its output, or it can hire some combination of full-time and part-time employees. For each full-time worker let go, the firm must hire an increasing number of temporary employees to maintain the same level of output.

Problem 1 solution

P

F
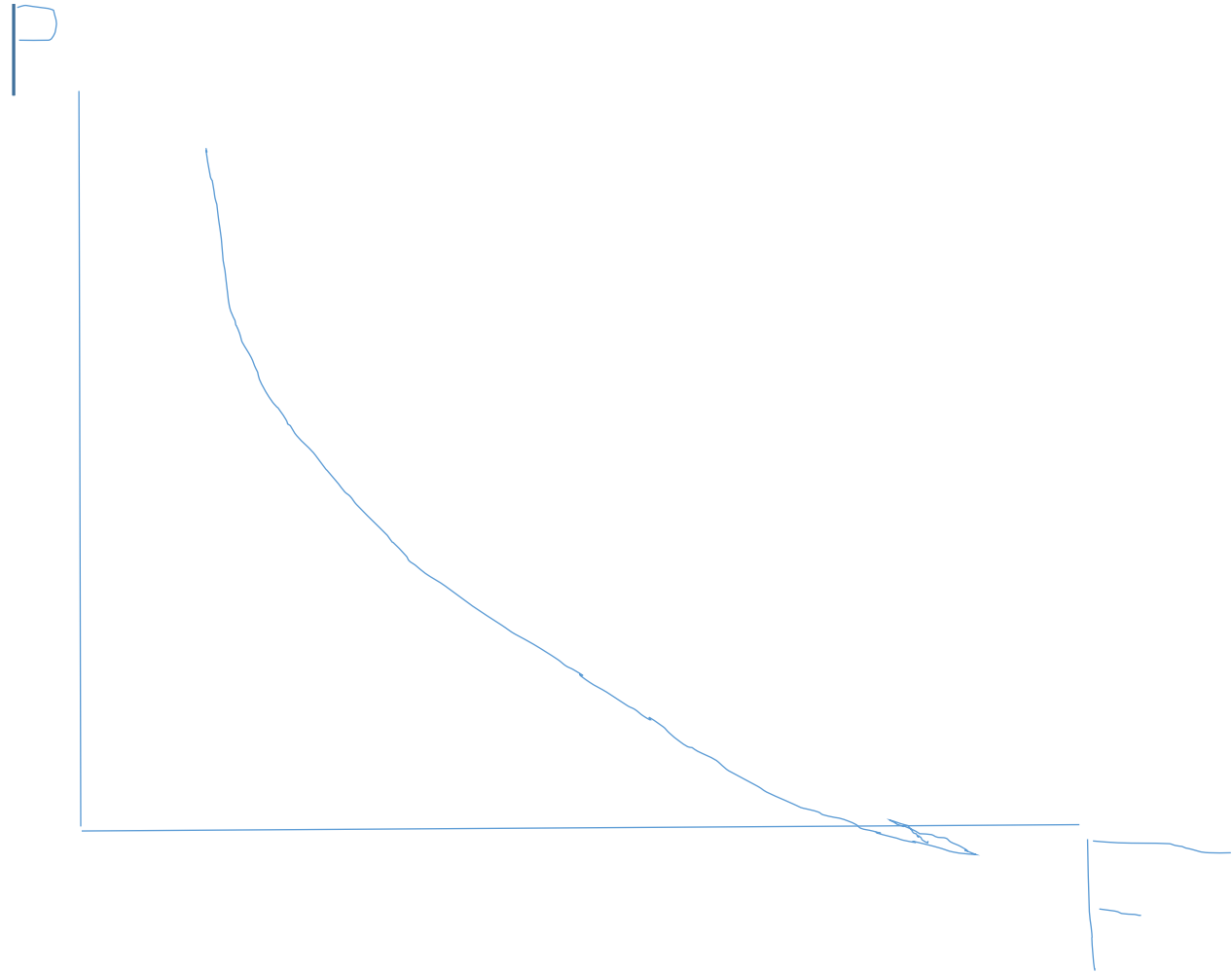
Isoquant cuts the x-axis as it is possible to produce only with full-time workers

Problem 2

Do the following functions exhibit increasing, constant, or decreasing returns to scale? What happens to the marginal product of each individual factor as that factor is increased and the other factor held constant?

a. $q = 3L + 2K$

b. $q = (2L + 2K)^{1/2}$

Problem 2 solution

(a) q= 3L+2K; If L=2, K= 2, q = 10; Suppose, we double the inputs, i.e., L= 4, K= 4, q= 20; Hence, f here exhibits CRS; dq/dL = 3; dq/dK= 2;

(b) q= (2L+2K)**1/2;

If L=1=K, q= 2;

If L=2=K, q= 8**0.5 = 2.8; hence, f exhibits DRS; dq/dL = 2/(2). Sqrt (2L+2K)=1/sqrt(2L+2K);

As L >>, dq/dL shrinks ; DRS operates on f here.

Regression basics

In a **linear regression,** the relationships are of the following form:

$$Y = b_0 + b_1X_1 + b_2X_2 + \cdots + b_kX_k + e \qquad \textbf{(A.1)}$$

Equation (A.1) relates a *dependent* variable Y to several *independent* (or *explanatory*) variables, X_1, X_2,…For example, in an equation with two independent variables, Y might be the demand for a good, X_1 its price, and X_2 income. The equation also includes an *error term e* that represents the collective influence of any omitted variables that may also affect Y (for example, prices of other goods, the weather, unexplainable shifts in consumers' tastes, etc.). Data are available for Y and the Xs, but the error term is assumed to be unobservable.

Regression basics…

- The objective is to estimate b0, b1, b2, …, bk that provide a best fit for the data

- For this best fit, we use the criterion: minimize the sum of squared residuals between actual Y and the computed (or the fitted) Y (Ordinary Least Squares method)

- Let S be the sales of automobile cars (Rs. bn) and P be the price of a new car

$$S = b_0 + b_1 P + e$$

Production function (PF) – an empirical example

- Joint forest management (JFM), characterized by multiple - social, economic, and physical (biological) - outputs, has emerged as one of the approaches to address the problems of forest degradation in developing economies, and has attracted the attention of scholars, forest managers, and donors.

- The outputs used in production analyses should capture the objectives of JFM and the prevalent forest policies. Hence, the three outputs of this PF are- social empowerment (Y1), forest canopy cover (Y2), and supply of forestry products to meet the local requirement (Y3)

Production function (PF) – an empirical example

- The theoretical model for the PF used the following inputs:
  - Social factors (homogeneity of the user group) (+ for Y1)
  - Economic factors (dependence of user group on forests) (+ for Y2)
  - Cultural factors (presence of a village leader : + for Y1, existence of conflict resolution mechanism: + for Y1)
  - Organizational factors (support of FD: + for Y2, clarity of govt. orders: + for Y1 and Y2)
  - Market factors (existence of local markets, and distance of markets to forest areas: signs unclear)
  - Physical factors (total forest area, and condition of forests before JFM : + for Y1)

Production function (PF) – an empirical example

- For empirical results, see the word doc attached

- The results have provided enough evidence to the initial argument that social, economic, cultural, organizational, and market factors, in additional to physical factors, should also be included in the production functions of JFM.

- However, the different factors may have different contributions to different outputs. For example,
  - an increase in the dependence of the user group on forest resource by one percent will increase the supply of forest produce by 2.92% and forest canopy cover by 0.67%.
    - Similarly support of bureaucracy is very important for forest cover and not for other outputs.
    - Time is significant in empowerment and but not in two other outputs.

- Hence, designing of JFM planning and management strategies will require output specific focus of forest managers, representative of local communities and NGOs

Thanks

The end