Econ 110: Introduction to Economic Theory

9th Class **2/9/11**

poll the class on timing of the two exams
designed to take 50 minutes, but you can take as long as you like
decided on Wed. March 2 5-9:30
and Thu. April 14 5-10:30

first of three lectures on producer, or firm, theory; this material will all be covered on the second problem set (to be handed out a week from today), along with some subsequent material on markets

similar to the start of our discussion of consumer theory where we stated some basic assumptions about what makes consumers tick, we're going to need to state some basic assumptions about how firms work.

Firms have a very simple, single goal in producer theory: to maximize profit
profit Π is made up of two components, revenue (total revenue, TR) and costs (total cost, TC)

very simply $\Pi = TR - TC$

so clearly in order to maximize profit firms must want to make revenue bigger, subject to whatever constraints they operate under, and also make costs smaller, again subject to constraints, the goal being to increase the difference between these two things.

We'll work up to solving that problem but let's first examine the various constraints

Note again this doesn't mean that we necessarily think that firms really only have this one goal of profit maximization. What other goals might firms have? But it does mean that we have a benchmark against which we can measure firms' actual behavior. In addition, we will make a strong equilibrium argument that in certain cases, profit-maximizing firms will drive non-profit-maximizing firms out of business, so the surviving firms will be the profit-maximizers.

We're also going to assume for simplicity that firms only produce one thing. This is again an obvious simplification but allows us to make the problem tractable for this course.

think of examples of what firms produce, both very concrete and more abstract outputs

So the first constraint that the firm operates under is the available technology for producing whatever it is the firm is producing

We can show this as a production function.

output = f(inputs)

think of examples of production functions

Note it becomes important to distinguish between the short run (SR), the medium run, and the long run (LR), and even the very long run when we talk about production (and later costs) because constraints on firms loosen if they have a longer planning, or time, horizon.

in particular, we define the short run as a time period in which all but one input is fixed. For simplicity, we often assume that the one variable input is labor (measured in hours, or workers, or some other unit depending the application), so the short-run production function can be written as:

$Q = f(L)$

[draw a graph] we define a number of new concepts already from this:

since total product, or output, is Q:

average product of labor = $AP_L = \frac{Q}{L}$, the output per unit of input

marginal product of labor = $MP_L = \frac{dQ}{dL}$, the added output for the last unit of added input

e.g $Q = 2\sqrt{L}$; then $AP_L = \frac{2\sqrt{L}}{L} = \frac{2}{\sqrt{L}}$ and $MP_L = \frac{1}{\sqrt{L}}$

inputs are also often called factors; factors can include besides labor (L), capital (K), energy, land, etc. Sometimes differentiate between skilled and unskilled labor similar to diminishing marginal utility, it is generally thought that at least over some range, firms experience diminishing marginal product (so MP is positive but decreasing as L increases as in the case above)

In the medium run, the firm is able to vary additional factors, thus in the two-factor case:

$$Q = f(K, L)$$

note there are now two additional related concepts:

$$\text{average product of capital} = AP_K = \frac{Q}{K}$$

$$\text{marginal product of capital} = MP_K = \frac{dQ}{dK}$$

Now the firm has choices regarding how to produce the same level of Q using different amounts of the two inputs

think of examples of how the same thing may be produced using different amounts of capital and labor

this generates a concept related to the indifference curve, namely the <u>isoquant</u>, which shows combinations of K and L that, when used as inputs in the production function, generate the same amount of output Q*

what does the slope of the isoquant signify?

derive it similarly to the indifference curve case as the ratio of marginal products:

$$\text{along an isoquant, } \Delta Q = dQ = \frac{dQ}{dK} dK + \frac{dQ}{dL} dL = 0$$

$$\text{so } \frac{dQ}{dK} dK = -\frac{dQ}{dL} dL \text{ and } \frac{dK}{dL} = -\frac{dQ/dL}{dQ/dK} = -\frac{MP_L}{MP_K}$$

we define the marginal rate of technical substitution, or MRTS = $-\frac{dK}{dL} = \frac{MP_L}{MP_K}$

Again, consider some special cases of isoquants (discuss):

perfect substitutes $Q = K + L$

perfect complements (also known as the Leontief function) $Q = \min[K,L]$

What is the long run? Firm can vary plant size, i.e. choose a new production function out of the range available

What is the very long run? New technologies become available, i.e., new production functions are added to the range available

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Economics 110-01
Spring Semester 2010-11

Practice Problems 2/9/11

I. Consider the following production function:

$$Q = K + \sqrt{L}$$

1) What is the formula/function for MP_K? And for MP_L?

2) If the firm uses 2 units of K and 4 units of L, what is the firm's total output Q? What is the marginal product of capital? What is the marginal product of labor?

3) Give two pairs of numbers for K and L that both make Q = 12. Sketch the isoquant that contains both of these points.

4) What is the formula for the MRTS?

II. Sketch the following cases:

1) A couple of isoquants for making paper airplanes out of pink paper and green paper.

2) A couple of isoquants for making triple burgers (one bun and three patties per burger)