ECON 110, Professor Hogendorn

Problem Set 5

1. *USChinaWages.* Suppose the production functions of a US and a Chinese textile mill are the same:

$$q = f(L) = -(L-10)^2 + 100$$

Assume that neither mill ever hires more than 10 workers, and both factories are perfect competitors in both the textile and labor markets.

   (a) Graph the production function. Are there diminishing, constant, or increasing returns to labor?

   (b) If the wage in China is $0.57 and the wage in the United States is $11, and the price per unit of output is $1, how many workers will the Chinese mill hire? How many at the US mill?

   (c) True or false, and explain: If the production function and wages are exactly as described here, it shows that the workers at the US textile mill are more skilled than the workers at the Chinese textile mill.

   (d) Find the labor demand curve $L(w)$ for the factories. What is the elasticity of labor demanded with resepct to the wage in the US? In China?

2. *Low.* Suppose a firm has cost curves $MC(q) = 0.0512q$ and $AC(q) = \frac{50}{q} + 0.0256q$. Use the first derivative of AC to prove that MC crosses AC at the lowest point on the AC curve.

Review Problems only, not to turn in:

3. *MBAs.* The 2001 recession was very hard on the strategic consulting industry. Firms like McKinsey, Bain, and Booz Allen & Hamilton laid off 30% of their workforce.

   There were two components to the downturn. First, demand fell dramatically, in large part because of the demise of the dot-coms. Second, more executives began to have business school degrees and/or experience with the consulting firms. This made the "sage advice" of the consultants themselves less useful and effectively reduced the marginal product of laborers with MBA degrees (see *The Economist*, 11/2/02, pg. 61).

   For this problem, assume that the wage of MBAs is \$100. (Note: for more realism, you can think of all money amounts in this problem in thousands.)

   (a) Let a typical consulting firm have production function $f(L) = 10000L^{1/2}$ and the firm also incurs a fixed cost of 1000. What is this firm's total cost function, average cost function, average variable cost function, and marginal cost function?

   (b) Graph these curves.

   (c) If the price of consulting is $p = 2$ and there are 5 consulting firms, how many MBAs are hired?

   (d) Suppose that p falls to 1.60 and also the production function changes to $f(L) = 10000L^{149/300}$. Now how many MBAs are hired?

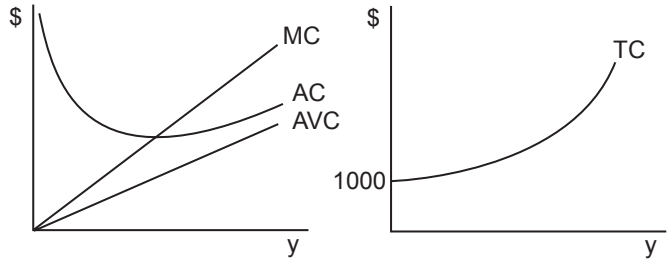
Answers to Review Problems:

3. *MBAs_a.*

   (a) Since $y = 10000L^{1/2}$, $L(y) = \left(\frac{y}{10000}\right)^2$. Thus,

$$\begin{aligned} TC(y) &= 1000 + wL = 1000 + 100\left(\frac{y}{10000}\right)^2 \\ AC(y) &= \frac{1000}{y} + \frac{y}{1000^2} \\ AVC(y) &= \frac{y}{1000^2} \\ MC(y) &= \frac{y}{500000} \end{aligned}$$

   (b)



   (c) We know that a profit-maximizing, perfectly competitive firm sets $p = MC(y)$. Here, that implies

$$\frac{y}{500000} = 2$$

   Solving this for y, we find that $y = 1,000,000$. Then $L(1,000,000) = 10,000$. Since there are 5 such firms, the total number hired is 50,000.

   (d) Now the labor needed is:

$$L(y) = \left(\frac{y}{10000}\right)^{300/149}$$

and the optimal output solve:

$$MC(y) = 100\frac{1}{10000}^{300/149}\frac{300}{149}y^{151/149} = 1.60$$

Now the solution is $y = 750,000$ and $L(750,000) = 5,959$, for a total market employment of 29,795.