ECO 601 Problem Set #10 Fall 2002

KEY

1. (a) $Q = 12L^{.5}$

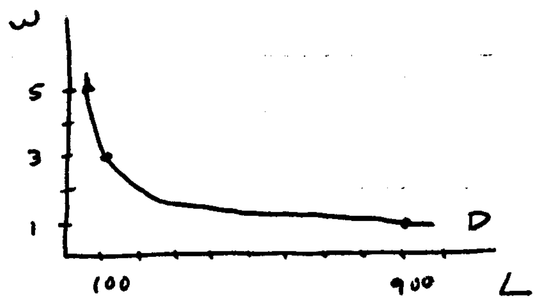
$MP_L = \frac{dQ}{dL} = 6L^{-.5}$

$MVP_L = 6PL^{-.5}$

if $P = \$5.00$ $MVP_L = 30L^{-.5}$

optimal employment of L is where $w = MVP_L$

so $30L^{-.5} = w$, and $L = 900/w^2$

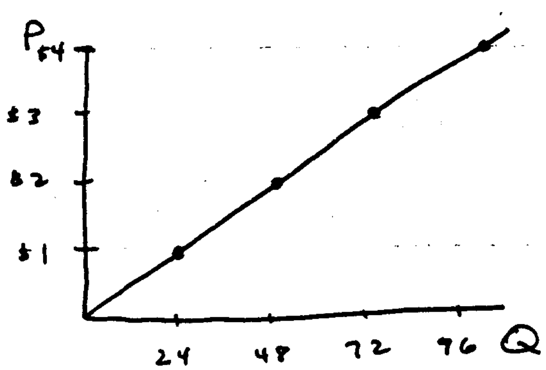


w	L
1	900
3	100
5	36

(b) from above $w = 6PL^{-.5}$, so $L = 36P^2/w^2$

$Q = 12L^{.5} = 72\left(\frac{P^2}{w^2}\right)^{.5} = 72P/w$

if $w = \$3$, $Q = 24P$



2:

a.

$$RTS\ (L \text{ for } K) = MP_L = \frac{\dfrac{K}{2\sqrt{KL}}}{\dfrac{L}{2\sqrt{KL}}} = \frac{K}{L}$$

Since $w = v = \$1$, $\frac{K}{L} = \frac{w}{v} = \frac{1}{1}$, so K and L will be used in a one-to-one ratio.

$TC = L \cdot w + K \cdot v = L + K = 2L$, so

$$AC = \frac{2L}{q} = \frac{2L}{\sqrt{KL}} = \frac{2L}{\sqrt{LL}} = 2 \text{ and } MC = 2 .$$

b. $MC = P = 2$ so $Q = 400{,}000 - 100{,}000(2) = 200{,}000$ pipe

$$q = \frac{200{,}000 \text{ pipe}}{1{,}000 \text{ firms}} = 200 \text{ pipe/firm}$$

$q = 200 = \sqrt{L \cdot K} = L$, so 200 workers are hired per firm, 200,000 by the industry.

c. $w = \$2$, $v = \$1$, so $K/L = 2$

$$TC = wL + vK$$
$$= 2L + K = 4L = 2\sqrt{2}\, q$$

so $AC = MC = 2\sqrt{2}$.

d. $P = 2\sqrt{2}$ $\qquad Q = 400{,}000 - 100{,}000(2\sqrt{2}) = 117{,}157$

$$L = \frac{117{,}157}{\sqrt{2}} = 83{,}000 \text{ workers hired by the industry.}$$

e. If $Q = 200{,}000$ at the new wage, $L = \frac{200{,}000}{\sqrt{2}}$

141,000 workers would have been hired by the industry.

So if Q were unchanged, 59,000 fewer workers would have been hired = substitution effect.
The remaining 58,000 fewer workers are the result of the lower output = output effect. As is usual in the Cobb-Douglas case, the effects are of approximately equal size.

3:

$$w_m^2 = \frac{L_m}{9} \qquad w_m L_m = \frac{L_m^{3/2}}{3}$$

$$ME_L = \frac{L_m^{1/2}}{2} = MRP_L = (2)(5) = 10 \quad \therefore\ L_m = 400,\ w_m = \frac{20}{3}$$

$$w_f = \frac{L_f}{100} \qquad w_f L_f = \frac{L_f^2}{100}$$

$$ME_L = \frac{L_f}{50} = 10 \qquad \therefore L_f = 500,\ w_f = 5 \qquad L_T = 900$$

per hour on machinery = 9000 − 5(500) − 6.66(400) = 3833.

If same wage for men and women $w = MRP_L = 10$, $\therefore\ L = 1000 + 900 + 1900$
per hour now = 1900(10) − 10(1000) − 10(900) = 0.