Microeconomics for Public Policy I
Fall 2017

Problem Set 7
Due Lecture 9 in class on paper

1. GLS Chapter 6, Question 3

The completed table looks like

Labor Input	Total Product	Marginal Product	Average Product
0	0	n/a	n/a
1	70	70	70
2	135	$135 - 70 = 60$	$135/2 = 67.5$
3	$63 * 3 = 189$	$189 - 135 = 54$	63
4	$189 + 51 = 240$	51	$240/4 = 60$
5	$57 * 5 = 285$	$285 - 240 = 45$	57
6	324	$324 - 285 = 39$	$324/6 = 54$

2. GLS Chapter 6, Question 5

(a) Abel's Bakery: $MP_L = 13$, $AP_L = 12$.

Abel's average product of labor would increase if he hired another worker, since the marginal product of this additional worker (at 13) is higher than the average.

(b) Baker's Bakery: $MP_L = 7$, $AP_L = 12$.

Baker's average product of labor would decrease if he hired another worker, since that additional worker would add only 7, much less than the average of 12.

(c) Charlie's Bakery: $MP_L = -12$.

Even though Charlie's $MP_L < 0$, this does not imply that the average product of labor must also be negative. All previous workers (until this potential additional one) could have positive marginal products.

(d) Can you generalize the relationship between average and marginal products?

Average product will increase when marginal product is greater than average product; it will decrease when marginal product is less. When marginal product is negative, each additional worker causes output to decline; yet average product will still be positive as long as some output is produced.

3. GLS Chapter 6, Question 11

(a) The ratio of capital to labor that minimizes costs is the ratio such that

$$\frac{MP_K}{R} = \frac{MP_L}{W}$$

We can plug in from the problem to write

$$\begin{aligned}\frac{MP_K}{R} &= \frac{MP_L}{W}\\ \frac{K^{0.75}}{L^{0.75}}\left(\frac{1}{2}\right) &= \frac{3L^{0.25}}{K^{0.25}}\left(\frac{1}{10}\right)\\ K &= \frac{3L}{5}\\ K &= (3/5)L\end{aligned}$$

(b) To find the total amount of capital and labor needed each week, recognize that when the firm is minimizing costs, two equations must hold. The first is the one you calculated in part (a); the second is the firm's production function, which at a quantity of 1000 is $1000 = 4K^{0.75}L^{0.25}$.

With two equations and two unknowns, you can find K and L. There are many ways to do this. I plugged $K = (3/5)L$ into the production function:

$$\begin{aligned}1000 &= 4K^{0.75}L^{0.25}\\ 1000 &= 4((3/5)L)^{0.75}L^{0.25}\\ 1000 &= 4(3/5)^{0.75}L\\ L &\approx 367\end{aligned}$$

Given L, we can find K: $K = (3/5)L \approx 220$.

(c) How much will these inputs cost them?

Input cost follows the isocost curve: $C = 10K + 2L$, and in our case $C = 10(220) + 2(367) \approx 2,934$.

4. Returns to Scale

Do you think the production of MPPs exhibits constant, increasing or decreasing returns to scale? Explain your answer succinctly.

The key to answering this question is to think about what would happen to the quality of MPP output if you doubled the number of MPP inputs.

At GW, I suspect that we would have somewhat decreasing returns to scale. The quality of the average MPP would decline and the quality of the average faculty might decline as well. Class sizes may or may not increase; if you double the number of faculty and students, class sizes should stay the same.

Following the same logic, perhaps career services would improve with additional staff who could provide things that are useful to all students. These would be things like more job listings, or more events.

Alternatively, if there are things that make good MPP students that are due to the somewhat small size of the Trachtenberg School, these would be negatively affected by the increase in students and faculty.