Chapter 26 NAME______________________

Factor Markets

Introduction. In this chapter you will examine the factor demand decision of a monopolist. If a firm is a monopolist in some industry, it will produce less output than if the industry were competitively organized. Therefore it will in general want to use less inputs than does a competitive firm. The value marginal product is just the value of the extra output produced by hiring an extra unit of the factor. The ordinary logic of competitive profit maximization implies that a competitive firm will hire a factor up until the point where the **value marginal product** equals the price of the factor.

The **marginal revenue product** is the extra revenue produced by hiring an extra unit of a factor. For a competitive firm, the marginal revenue product is the same as the value of the marginal product, but they differ for monopolist. A monopolist has to take account of the fact that increasing its production will force the price down, so the marginal revenue product of an extra unit of a factor will be *less* than the value marginal product.

Another thing we study in this chapters is **monopsony**, which is the case of a market dominated by a single buyer of some good. The case of monopsony is very similar to the case of a monopoly: The monopsonist hires less of a factor than a similar competitive firm because the monopsony recognizes that the price it has to pay for the factor depends on how much it buys.

Finally, we consider an interesting example of factor supply, in which a monopolist produces a good that is used by another monopolist.

Example: Suppose a monopolist faces a demand curve for output of the form $p(y) = 100 - 2y$. The production function takes the simple form $y = 2x$, and the factor costs \$4 per unit. How much of the factor of production will the monopolist want to employ? How much of the factor would a competitive industry employ if all the firms in the industry had the same production function?

Answer: The monopolist will employ the factor up to the point where the marginal revenue product equals the price of the factor. Revenue as a function of output is $R(y) = p(y)y = (100 - 2y)y$. To find revenue as a function of the input, we substitute $y = 2x$:

$$R(x) = (100 - 4x)2x = (200 - 8x)x.$$

The marginal revenue product function will have the form $MRP_x = 200 - 16x$. Setting marginal revenue product equal to factor price gives us the equation

$$200 - 16x = 4.$$

Solving this equation gives us $x^* = 12.25$.

If the industry were competitive, then the industry would employ the factor up to the point where the value of the marginal product was equal to 4. This gives us the equation

$$p2 = 4,$$

so $p^* = 2$. How much output would be demanded at this price? We plug this into the demand function to get the equation $2 = 100 - 2y$, which implies $y^* = 49$. Since the production function is $y = 2x$, we can solve for $x^* = y^*/2 = 24.5$.

26.1 (0) Gargantuan Enterprises has a monopoly in the production of antimacassars. Its factory is located in the town of Pantagruel. There is no other industry in Pantagruel, and the labor supply equation there is $W = 10 + .1L$, where W is the daily wage and L is the number of person-days of work performed. Antimacassars are produced with a production function, $Q = 10L$, where L is daily labor supply and Q is daily output. The demand curve for antimacassars is $P = 41 - \frac{Q}{1{,}000}$, where P is the price and Q is the number of sales per day.

(a) Find the profit-maximizing output for Gargantuan. (Hint: Use the production function to find the labor input requirements for any level of output. Make substitutions so you can write the firm's total costs as a function of its output and then its profit as a function of output. Solve for the profit–maximizing output.) 10,000.

(b) How much labor does it use? 1,000. What is the wage rate that it pays? \$110.

(c) What is the price of antimacassars? \$31. How much profit is made? \$200,000.

26.2 (0) The residents of Seltzer Springs, Michigan, consume bottles of mineral water according to the demand function $D(p) = 1{,}000 - p$. Here $D(p)$ is the demand per year for bottles of mineral water if the price per bottle is p.

The sole distributor of mineral water in Seltzer Springs, Bubble Up, purchases mineral water at c per bottle from their supplier Perry Air. Perry Air is the only supplier of mineral water in the area and behaves as a profit-maximizing monopolist. For simplicity we suppose that it has zero costs of production.

(a) What is the equilibrium price charged by the distributor Bubble Up? $p^* = \frac{1{,}000+c}{2}$.

(b) What is the equilibrium quantity sold by Bubble Up? $D(p^*) = \frac{1{,}000-c}{2}$.

(c) What is the equilibrium price charged by the producer Perry Air? $c^* = 500$.

(d) What is the equilibrium quantity sold by Perry Air? $D(c^*) = 250$.

(e) What are the profits of Bubble Up? $\pi_b = (500-250)(750-500) = 250^2$.

(f) What are the profits of Perry Air? $\pi_p = 500 \cdot 250$.

(g) How much consumer's surplus is generated in this market? $CS_e = 250^2/2$.

(h) Suppose that this situation is expected to persist forever and that the interest rate is expected to be constant at 10% per year. What is the minimum lump sum payment that Perry Air would need to pay to Bubble Up to buy it out? 10×250^2.

(i) Suppose that Perry Air does this. What will be the new price and quantity for mineral water? $p^* = 500$ and $D(p^*) = 500$.

(j) What are the profits of the new merged firm? $\pi_p = 500^2$.

(k) What is the total amount of consumers' surplus generated? How does this compare with the previous level of consumers' surplus? $CS_i = 500^2/2 > CS_e$.

Calculus **26.3 (0)** Upper Peninsula Underground Recordings (UPUR) has a monopoly on the recordings of the famous rock group Moosecake. Moosecake's music is only provided on digital tape, and blank digital tapes cost them c per tape. There are no other manufacturing or distribution costs. Let $p(x)$ be the inverse demand function for Moosecake's music as a function of x, the number of tapes sold.

(a) What is the first-order condition for profit maximization? For future reference, let x^* be the profit-maximizing amount produced and p^* be the price at which it sells. (In this part, assume that tapes cannot be copied.)

$$p(x^*) + p'(x^*)x^* = c.$$

Now a new kind of consumer digital tape recorder becomes widely available that allows the user to make 1 and only 1 copy of a prerecorded digital tape. The copies are a perfect substitute in consumption value for the original prerecorded tape, and there are no barriers to their use or sale. However, everyone can see the difference between the copies and the orginals and recognizes that the copies cannot be used to make further copies. Blank tapes cost the consumers c per tape, the same price the monopolist pays.

(b) All Moosecake fans take advantage of the opportunity to make a single copy of the tape and sell it on the secondary market. How is the price of an original tape related to the price of a copy? Derive the inverse demand curve for original tapes facing UPUR. (Hint: There are two sources of demand for a new tape: the pleasure of listening to it, and the profits from selling a copy.) If UPUR produces x tapes, $2x$ tapes reach the market, so UPUR can sell a single tape for $p(2x) + [p(2x) - c]$. The first term is the willingness-to-pay for listening; the second term is profit from selling a copy.

(c) Write an expression for UPUR's profits if it produces x tapes.

$$[p(2x) + p(2x) - c]x - cx = 2p(2x)x - 2cx.$$

(d) Let x^{**} be the profit-maximizing level of production by UPUR. How does it compare to the former profit-maximizing level of production?

From the two profit functions, one sees that $2x^{**} = x^*$, so $x^{**} = x^*/2$.

(e) How does the price of a *copy* of a Moosecake tape compare to the price determined in Part *(a)*? The prices are the same.

(f) If p^{**} is the price of a copy of a Moosecake tape, how much will a *new* Moosecake tape sell for? $2p^{**} - c$.