

22 | NATURAL MONOPOLY

Purpose: To illustrate price determination in natural monopoly.

Computer file: **natmon.xls**

Instructions and background information:

THE RIDE is a bus transportation system that operates as a monopoly in Boulder, Colorado. The bus company sells monthly passes to its customers who then get to use the bus system by showing their passes, a system not very much different from that used on many college campus bus systems.

THE RIDE hires you as a consultant to help them try to improve their profits, and advise them on the best responses to changes in economic conditions. The company has already provided you with all of the demand and cost data contained in the graph and accompanying values in the spreadsheet. Current output is 50,000 passes. Average consumer income in the Boulder area is \$55,000 per year.

THE RIDE operates with economies of scale. That is, average cost falls as output increases.

In experimenting with different pricing and output scenarios you can change the current output, the tax (or subsidy) to the bus system, and the average income per consumer. Excel automatically computes all the other values in the tables.

As an economic consultant, you know that the firm's profits will be maximized at the output where marginal cost equals marginal revenue. On the other hand, you know that the socially best price to charge is the one where marginal cost equals price. As with any monopoly, THE RIDE will want to charge too high a price and sell too small a quantity from society's point of view.

Marginal cost pricing presents a unique problem in the case of THE RIDE because the firm operates with economies of scale. As output increases, average cost declines, which implies that marginal cost is always less than average cost. This means that setting price equal to marginal cost will result in *price less than average cost* -- the firm will earn losses.

Here are some things to watch for and learn as you do the problems:

- 1) Just as with other monopolies, a natural monopoly maximizes profit by choosing the output where $MC = MR$. And just as with other monopolies, the firm is inefficient -- it produces less than the socially best output.
- 2) From society's point of view, a firm should produce an output where marginal cost equals price. In the case of a natural monopoly, that production level will mean losses to the firm. This presents a regulatory dilemma. Either the firm must be subsidized, or some other output must be chosen.
- 3) Natural monopolies in the real world are often made to set price at the level of average cost. From society's point of view, this is inefficient in the sense that it leads to a deadweight loss. It also gives firms an incentive to keep costs high.

Here are some hints to help you get the answers quicker:

- 1) Finding the outputs in questions 8, 11, 14, and 17 can be tricky, especially if you use Goal Seek to find the answers. This is because the marginal and average cost curves each cross the demand and marginal revenue curves twice, giving two possible answers to these questions. Take care of this difficulty by starting Goal Seek at an output near the objective. Goal Seek, in trying to find where two curves intersect, looks for the closest intersection.
- 2) You'll need a hand calculator to make some of the computations.

MATH MAVEN'S CORNER: For the worksheet the problems on natural monopoly the average revenue curve is given by $AR = aI - b(Q)$, where I is income in dollars, and a and b are randomly chosen parameters. Test yourself by finding the marginal revenue curve. The average cost curve is given by $AC = (c/Q) + d(Q^f) + t$, where t is the tax per unit of output, and c , d , and f are random parameters. Again, see if you can find the marginal cost curve.

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Questions

Set all variables to their baseline values. Make sure output is set to 25,000 passes per month.

Record the values of these variables:

- 1) Average cost.
- 2) Price.
- 3) Profit per bus pass sold.
- 4) Total profit.

Keep output at 25,000 passes per month.

- 5) What is the cost of one more pass (MC)?
- 6) What's the added revenue from one more pass (MR)?
- 7) If one more pass is sold, what's the change in profits?

As a consultant you must advise THE RIDE on how to maximize its total profits. Be sure all variables are at their baseline values.

- 8) At what output is total profit maximized?
- 9) What price should be charged to maximize total profit?

Continuing on from the previous question:

- 10) What's total profit when profit is maximized?

THE RIDE is predicting that consumer incomes will fall next year to \$50,000. The company needs to know what this means for its pricing policies.

- 11) What's the best output for the firm when income is \$50,000?
- 12) What price should the firm charge?

Continuing on from the last question where income was \$50,000:

- 13) What's the amount of maximum profits?

Set all values to their baseline values. Find the values of the following variables:

- 14) Socially best output.
- 15) Socially best price.
- 16) Total profits at the socially best output.

Government regulators realize they may have to use a system of average cost pricing even if that is not socially optimal.

- 17) At what output is price equal to AC?
- 18) What's price at that output?

Now summarize your results. Enter values for each of the following prices:

- 19) Profit maximizing price.
- 20) Socially best price.
- 21) Price where profit is zero.