

## SR Costs

1. Fuel costs are important inputs to any transportation activity. Suppose that real energy prices fall. Graphically depict the impact that this would have upon a firm's total short-run and long-run cost structure. Would you expect a firm's long-run response to a fall in energy to be greater, less, or equal to its short-run response to a fall in energy prices? What does this suggest about the firm's short-run input price elasticity of fuel relative to its long-run input price elasticity of fuel?
2. Critically evaluate the following statement: "All constraints on behaviour are costly, which explains why the short-run total cost curve lies above the long-run total cost curve."
3. Assume that, in the long run, a motor carrier firm produces transportation using labour, fuel, and capital (in the form of trucks). The firm is currently producing 100,000 ton-miles.
  - a. If the short-run cost of producing 100,000 ton-miles equals the long-run cost of producing this output, is the motor carrier firm currently using its inputs efficiently? If so, why; and if not, why not?
  - b. Explain why the motor carrier's long-run cost of producing output  $T$  depends upon the price of labour, the price of fuel, and the rental price of trucks, whereas the firm's short-run cost of producing  $T$  depends upon the price of labour, the price of fuel, and the *level* of trucks available to the firm.
4.
  - a. Define short-run average total cost, and short-run average variable cost, short-run average fixed cost, and short-run marginal cost. Explain why short-run marginal cost intersects short-run average variable cost at its minimum point.
  - b. What is the short-run supply curve of the firm? Why is a firm willing to offer more output when the price of the good increase?
5. According to the *Wall Street Journal* (November 1, 1995), net income for World Airways in the third quarter of 1995 was \$3.359 million, or 33 cents per share. This is a significant rebound from its 1994 third-quarter performance, in which World Airways' net income was -\$7.491 million, reflecting loss. Around this period, the per share price of World Airways stock was around \$12.
  - a. Use short-run average cost curves to explain why World Airways did not shut its operations down in the third quarter of 1994.
  - b. From the information provided, can you tell whether World Airways made an economic loss, an economic profit, or a normal return on investment in the third quarter of 1995?

6. Suppose that you are given the following information on All Around Airlines:
  - The average variable cost of producing airline trips varies between 11.5 cents a mile when 50,000 trips per year are produced and 16.7 cents per mile when 500,000 trips per year are produced. Its lowest value is 11.5 cents a mile when 250,000 trips are produced.
  - The average total cost of producing trips varies between 15.3 cents per mile when 250,000 trips are produced and 17.3 cents per mile when 500,000 trips are produced. The minimum short-run average total cost is 13.0 cents when 300,000 trips are produced.
    - a. Approximately, how many trips will be produced in the short run if the fare is 15.4 cents per mile?
    - b. Will any trips be produced if the fare is 12.1 cents per mile? If so, why; and if not, why not?
    - c. Will any trips be produced if the fare is 10 cents per mile? If so, why; and if not, why not?
7. Viton's 1981 study of urban transit costs found that urban transit firms operating in small cities (where fewer than 1 million vehicle-miles are produced annually) operate under increasing returns to scale, in medium-sized cities (which produce between 1 million and 5.5 million vehicle-miles annually) they operate under decreasing returns to scale.
  - a. Assuming that fares are set at marginal cost, what do these results imply about the possibility of small-scale profitable entry in small, medium, and large cities?
  - b. Based upon Viton's results, are there any benefits to decentralizing urban transit systems in the largest cities?
8.
  - a. Assume that, in the production of rail services, labour is the only variable input. Graphically depict a labour productivity curve. Identify the point at which diminishing returns to the fixed factor of production occurs.
  - b. Over time, there will be technological progress. Identify graphically the effect of technological progress on the labour productivity curve. Holding all else constant, suppose that the level of fixed capital increases. How will this affect the labour productivity curve? Is capital investment the same as technological progress?
  - c. Suppose that you are analysing total costs for a railroad between 1950 and 1970 using translog cost function framework. You collect information on the costs of production, input prices for labour, fuel, materials, capital, and route structure, and operating characteristics (such as average length of haul and average load). How would you account for technological progress in this study?

Can you be sure that you're identifying the effect of technological progress? Why, or why not?

9. The July 7, 1993 *Wall Street Journal* provides the following information: "Northwest Airlines averted – at least for now – a threatened federal bankruptcy-law filing after its pilots' union agreed to a last-minute pact to save the carrier \$365 million over three years." Using Northwest's short-run cost curves, depict where Northwest was operating before and after the agreement with the pilots' union.

10.

- a. Consider airline that produces passenger trips with capital  $K$  and labour  $L$ . Use isocost curves and isoquants to explain why this airline's long-run cost function will depend upon its output, the passenger-miles served, the prices of  $K$  and  $L$ , and the state of technology.
- b. Now suppose that capital is held fixed at  $\bar{K}$ . Again use isocosts and isoquants to explain why the airline's short-run total cost will depend upon the passenger-miles served, the price of labour, the fixed level of capital, and the state of technology.
- c. Suppose that airline is currently operating with capital held fixed at  $\bar{K}$ , but that it is contemplating increasing its capital investment. What condition must the airline satisfy in order to achieve an optimal level of capital given its current short-run position? Discuss the economic intuition behind this condition.

11. In a paper on public transit costs, Obeng (1985) reported following:

< 50 buses	50 – 149 buses	150 – 557 buses
Operate under diseconomies of traffic density	Operate under economies of traffic density	Operate under economies of traffic density

- a. Are these results consistent with the findings of Viton? Where would each type of firm be operating on its respective short-run average total cost curve?
- b. In an attempt to explain these short-run results on traffic density, Obeng reported the following regression results:

$$\begin{aligned} \text{Short Run Economies of Traffic Density} &= 0.1585 - \\ &\quad (1.45) \\ &- 0.022 (\% \text{ Capacity Utilized}) \quad R^2 = 0.39, \\ &\quad (3.80) \end{aligned}$$

where "% of Capacity Utilized" is defined as  $[(\text{passenger miles})/(\text{capacity miles})] * 100$  and the  $t$ -statistics are in parentheses.

- i. How well does capacity utilization explain short-run economies of traffic density?
- ii. What is the relationship between short-run average total cost and short-run economies of traffic density?
- iii. Interpret the sign and magnitude of the coefficient on capacity utilization. What impact would a 10% increase in capacity utilization have upon the short-run economies of traffic density?

12. On page 227, we reported the results of an analysis by Morrison and Winston (1995) on airline rates of return. In a previous study, Morrison and Winston (1986) undertook a similar analysis, with the results shown in table 6.8, where the cost of capital is a weighted average of debt and equity costs.

- a. Compare and contrast these findings with those in table 6.3.

**Table 6.8** A regression model for an airline carrier's short-run annual rates of return, 1981-3

Dependent variable – Annual rate of return

Regressor	Coefficient Estimate ( <i>t</i> -statistic)
Constant term	0.0805 (0.31)
Average Fare (dollars)	0.0017 (1.9) <sup>a</sup>
Average Compensation (thousand \$ per year)	-0.0064 (-2.4) <sup>b</sup>
Fuel Price (\$ per gallon)	-0.5665 (-2.4) <sup>b</sup>
Cost of Capital (%)	-0.0111 (-1.8) <sup>a</sup>
Average Length of Haul ('000 miles)	0.3877 (5.3) <sup>b</sup>
Average Load Factor (%)	0.9733 (3.7) <sup>b</sup>
Total Departures (millions)	0.1755 (2.7) <sup>b</sup>
 <i>R</i> <sup>2</sup> = 0.58	
Number of observations = 63	

<sup>a</sup> Significant at 0.01 level, one-tail test.

<sup>b</sup> Significant at 0.05 level, two-tail test.

Source: Adapted from Morrison and Winston (1986), table 3-14, p. 38

- b. What do these results suggest regarding the impact of route network versus size on a firm's financial success?
- c. What impact does a 1% increase in the cost of capital have upon a firm's short-run success?

13. Mohring (1976) reported the following estimated relationship between oil throughput, *T*, horsepower, and inside diameter of pipe (due to Cookenboo, 1955):

$$T^{2.735} = \frac{HD^{4.135}}{0.01046}$$

- a. Horsepower and inside diameter are two factors of production that determine throughput. Suppose that the oil company wants to

increase throughput, given that  $D$  is a fixed factor of production. What is the elasticity of throughput with respect to horsepower?

- b. For a given  $D$  and a constant unit of horsepower, what is the shape of the short-run average cost curve?
- c. Does the oil company experience economies of throughput with respect to inside diameter of pipe? What impact on throughput will occur from a 10% increase in the inside diameter of the pipe? Does this necessarily imply that there are economies of firm size?