1. Set up a diagram like Figure 8.6 and analyze the potential effects of the following:
   a. A reduction in the price of capital used to produce schooling.
   b. An increase in the price of labor used to produce schooling.
   c. A state law that forces small schools to consolidate with larger school districts.
   d. A state law that requires that schools have a pupil/teacher ratio of no more than 20.

Answer:

a. A reduction in the price of capital used to produce schooling produces a new isocost line (Isocost a) that intersects the Labor axis at the same point as the original isocost line (Isocost 1), but intersects the Capital axis farther from the origin. A possible outcome as illustrated is a greater quantity of schooling produced (Isoquant a) using more capital and less labor, although it is certainly possible that the preferences might be such that both more capital and labor are used in increasing the quantity produced.

b. An increase in the price of labor used to produce schooling produces a new isocost line (Isocost b) that intersects the Capital axis at the same point as Isocost 1, but intersects the Labor axis closer to the origin. A possible outcome is a reduced quantity of schooling produced (Isoquant b) using less labor and less capital, although it is possible the amount of capital used would increase, depending on the preferences.
c. A state law that forces small schools to consolidate with larger school districts is reflected in Isoquant 2, which is the amount of schooling that must be produced when the small schools join the original larger district (reflected by Isoquant 1). Isocost 2 reflects the total budget to provide that quantity of schooling. (It also assumes the prices for capital and labor remain the same.) Whether the average cost per pupil rises, falls, or stays the same depends on the proportional relationship Isoquant 2 has to Isoquant 1. The ratio of capital to labor inputs also will vary or stay the same depending on the relative position of Isoquant 2 to Isoquant 1. As shown, the expansion path is linear, indicating the ratio of inputs stays the same as output increases, but this need not be the case.
d. A state law that requires that schools have a pupil/teacher ratio of no more than 20 causes the isoquants to be L-shaped. No matter what the slope of the isocost curves, they will intersect the isoquants at the bend in the L, which represents the 20:1 student-to-teacher ratio.

2. Suppose that you serve on the city council of Larcenyland, a suburban community adjacent to the central city Burglarytown. Individual efforts to fight crime in both cities have been very expensive in the past. Both cities have come to the point where they are desperate to try something new in order to reduce crime. Write a policy proposal for a joint crime fighting effort of the cities, and support your proposal with evidence of economic advantages based on the work of Gyapong and Gyinah-Brempong (1988) based on the experience of cities in Michigan.

Answer:

Larcenyland and Burglarytown should combine their law enforcement agencies. A combined agency would do as well at combating crime in the cities as the separate departments do, but at a lower average cost. A study by Gyapong and Gyinah-Brempong indicates that the source of these cost savings in law enforcement is economies of scope. Thus, a merged department should expect to do better because its officers and other resources better coordinate their efforts in all aspects of fighting crime. On the other hand, the larger department should not expect that there will be any change in costs due to the change in scale. The same study found that average costs are constant over a large range of sizes for law enforcement agencies. Hence, a merged department would have as many officers as the sum of officers of the separate departments, but this force would be more efficient.

3. Use the information in Table 8-4 to construct a graph of the long-run average cost function for health insurance administration. Assume that a particular benefit costs $1,000 to provide. Use the total percentages in the table to compute the dollar cost of administering that coverage.
   a. Plot the administrative cost of coverage as a function of the number of employees. (Use the midpoints of the first eight cells. For the unbounded cell of 10,000 or more just plot the cost at 10,000.)
   b. Explain what the graph of administrative costs indicates regarding scale economies.
   c. Suppose that you are a state senator confronted with two policy proposals. Proposal A would shift health insurance coverage from being employment-based to being entirely individual. Proposal B would shift coverage to communities with each city of your state providing coverage for its residents. Compare the economic aspects of the two proposals in terms of the costs of administering insurance plans under the two options.
Answer:

a.

<table>
<thead>
<tr>
<th>Size</th>
<th>Cost %</th>
<th>Cost/$1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>40.0%</td>
<td>$400.00</td>
</tr>
<tr>
<td>7.00</td>
<td>35.0%</td>
<td>$350.00</td>
</tr>
<tr>
<td>14.50</td>
<td>30.0%</td>
<td>$300.00</td>
</tr>
<tr>
<td>34.50</td>
<td>25.0%</td>
<td>$250.00</td>
</tr>
<tr>
<td>74.50</td>
<td>18.0%</td>
<td>$180.00</td>
</tr>
<tr>
<td>299.50</td>
<td>16.0%</td>
<td>$160.00</td>
</tr>
<tr>
<td>1,499.50</td>
<td>12.0%</td>
<td>$120.00</td>
</tr>
<tr>
<td>6,249.50</td>
<td>8.0%</td>
<td>$80.00</td>
</tr>
<tr>
<td>10,000.00</td>
<td>5.5%</td>
<td>$55.00</td>
</tr>
</tbody>
</table>

The graph of the average cost per employee of administering insurance coverage as a function of company size is shown above. The calculations of the average cost are also shown.

b. The graph of administrative costs show there are enormous economies of scale in insurance administrative costs.

c. A state senator would find Proposal A to shift coverage from being employment-based to being strictly individual-based unattractive. The administrative costs per unit would rise greatly. Proposal B to shift the coverage to a community basis, on the other hand, offers mixed outcomes. For residents of cities with at least several thousand residents, the administrative costs per person would likely be smaller than in an employment-based system. Companies would have to employ more workers for the employer-based system to offer lower costs. For small towns, however, companies might very well offer the lower administrative costs.
4. The following table provides data on elementary and secondary school enrollment and the number of classroom teachers for each of five years in the U.S.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollment (thousands)</td>
<td>42,181</td>
<td>48,473</td>
<td>51,272</td>
<td>49,791</td>
<td>45,949</td>
</tr>
<tr>
<td>Classroom Teachers (thousands)</td>
<td>1,600</td>
<td>1,933</td>
<td>2,288</td>
<td>2,451</td>
<td>2,439</td>
</tr>
</tbody>
</table>

Source: Hanushek (1986, p. 1144)

a. Plot the five points on the total product curve where the variable input is classroom teachers and the output is enrollment.

b. Find the point at which the total product is maximum.

c. Plot the average and marginal product for classroom teachers.

Answer:

a. The total product curve is shown in the following graph.

b. Total product is at a maximum for 2,288,000 teachers, where it reaches 51,272,000 enrollments.

c. The average product and marginal product per teacher are plotted on the following graph..
Classroom Teachers
(thousands) 1,600 1,933 2,288 2,451 2,439
Enrollment (thousands) 42,181 48,473 51,272 49,791 45,949
Average Product 26.4 25.1 22.4 20.3 18.8
Marginal Product 18.9 7.9 -9.1 320.2

5. Does the university where you study charge the same tuition rate for students in all majors, or does it differentiate tuition according to major? Is there evidence of marginal cost pricing? Even if your university charges the same tuition rate for credit hours, does it charge other special fees of students in particular programs such as laboratory fees or computer fees? Analyze the pricing structure of your university in light of the marginal-cost pricing ideal and explain how the allocation of resources may be improved by more explicit marginal cost pricing.

Answer:

Answers will vary, but institutions that charge more for certain majors or for certain programs (e.g., higher graduate student tuition than undergraduate tuition), or add fees for majors or programs with special features are engaging in at least crude marginal cost pricing. The differences in tuition and fees may not reflect the true marginal cost differences of educating different students, but if they reflect real differences to some degree they will improve the efficiency of resource allocation. Enrollments in higher-cost majors will decline if the true cost is charged, while enrollments in lower-cost majors will increase as the true cost is charged. Resource allocation will follow the trend set by the enrollments, with the resource quantities more closely following the real costs if marginal-cost pricing is employed.
6. Suppose that the Department of Transportation has advanced a proposal to install scanners along roadsides and I.D.s on the sides of cars and trucks, much like universal product codes used in grocery and department stores. The scanners would sense the presence of cars and automatically charge the registered owner of the car or truck the appropriate congestion toll when congestion is present. In the absence of congestion no toll is charged.
   a. Use a diagram like Figure 8-9 to explain the nature of the congestion toll that should be charged.
   b. Explain how this proposal solves the problem of congestion.
   c. Discuss how you think this proposal would be received by drivers.
   d. Anticipate ways that drivers would try to avoid paying the congestion toll (both legal and illegal).

Answer:

a. A figure like 8-9 illustrates the difference between costs borne by a driver and costs a driver causes other drivers to bear. Thus, during periods when the overall demand for driving is low, the difference is small or nonexistent because the marginal social costs component is small. When there are relatively few drivers on the road compared to the capacity of the road, there are no marginal social costs. As congestion increases, these costs increase. At high levels of congestion, the marginal social costs are very high. If drivers do not pay for these costs they impose on others, the quantity of driving demanded will be too high relative to the quantity that will be demanded if drivers are required to pay for the marginal social costs, which a toll will do.

b. This proposal solves congestion by charging a price for driving during congested periods that reflects all the costs of such driving, the cost to the driver plus the marginal social costs to other drivers caused by the driver using roads during a congested period. The imposition of congestion tolls drives the cost up. The higher price will cause a reduction in the quantity of driving demanded during congested periods.

c. One response by drivers might be anger. There is a history of most roads being available without tolls in the United States and drivers would resent the imposition of tolls. Drivers feelings might change, however, with experience with the system as they adjusted their driving habits to reflect the presence of tolls. Drivers who had pressing engagements during congested periods would find they could move faster as traffic diminished, while others would find they are paying minimal tolls and merely shifting the time they drive, causing little hardship.

d. A legal method of avoiding the congestion toll would be to avoid driving when congestion is high. An illegal method of toll avoidance would be removing or disabling the I.D.s on vehicles so that travel during the congested periods is not registered.
7. For each of the following education production functions determine the returns to scale:
   a. \( q = (40) l^{0.8} k^{2} \)
   b. \( q = (40) l^{0.9} k^{0.15} \)
   c. \( q = (40) l^{7} k^{25} \)

   Answer:
   a. Constant returns to scale.
   b. Increasing returns to scale.
   c. Decreasing returns to scale. Why? Multiply both \( l \) and \( k \) by a constant \( t \), simplify the expression collecting terms involving \( t \) and see whether \( t \) is raised to a power equal to one (constant returns to scale), greater than one (increasing returns to scale), or less than one (decreasing returns to scale).

8. Suppose that the marginal cost of producing a public service is \( MC = 100 - 2q \) while the average total cost is \( ATC = 100 - (3/2)q \).
   a. If the optimal quantity of the public service is \( q = 20 \), compute the \( MC \) and the \( ATC \) at that quantity.
   b. Compute the revenue that would be generated by charging a price equal to marginal cost.
   c. Compute the total cost of providing \( q = 20 \) units of the public service.
   d. Compute the deficit that results from marginal cost pricing.

   Answer:
   a. \( MC = 100 - 2(20) = 100 - 40 = 60 \)
   \( ATC = 100 - (3/2)(20) = 100 - 30 = 70 \).
   b. Revenue = \((60)(20) = 120\)
   c. Total Cost = \((20)(70) = 140\)
   d. Deficit = Revenue - Total Cost = \(120 - 140 = -20\)