EXERCISE 7.1 CHANGES IN THE MARKET

Draw diagrams to show how the curves in Figure 7.5a would change in each of the following cases:

1. A rival company producing a similar brand slashes its prices.
2. The cost of producing Apple-Cinnamon Cheerios rises to $3 per pound.
3. General Mills introduces a local advertising campaign costing $10,000 per week.

To make sketching the curves easier, assume the demand curve is linear. In each case, can you say what would happen to the price and the profit?

Introduction

The aim of this question is to help students understand how changes in the parameters of the model – the degree of competition, cost, and preferences (willingness to pay) – affect the isoprofit and demand curves.

Answer

This is the figure the question refers to:

Figure 7.5a: The profit-maximising choice of price and quantity for Apple-Cinnamon Cheerios.

1. Given the existence of a rival product, the willingness to pay for Cheerios is lower for each quantity so the demand curve (feasible set) will shift inwards (the green curve below). The firm will lower its price and sell less. Its profit will be lower (for example, $23,000 as shown on the graph).
2. The isoprofit curve for each level of profit was estimated by plotting all price and quantity combinations which satisfied profit = \((P - $2) \times Q\). Now the equation will be: profit = \((P - $3) \times Q\). This means that the isoprofit curve for a given level of profit will shift up by $1 (shown by the green horizontal line below).

3. The most likely impact of an advertising campaign, as long as it is effective, is to drum up interest in the good. This will push demand up at each price, thereby shifting the demand curve upward (shown by the green curve below) and expanding the feasible set. This is the opposite to the effect in part 1: higher profit, higher price, sell more.
Marking guidance

A good answer should be able to:

- recognise that cases 1-3 in the question refer to a change in the degree of competition, the cost and the preferences of the consumer
- show on Fig 7.5a how the isoprofit and demand curve change, although using a linear demand curve.

Teaching ideas

The main activity in this question is manipulating the demand and isoprofit curves to see how the chosen price and quantity (and hence, profit) change when the parameters of the model change. The best way to teach this is to ask students to draw each case on the board.

A firm grasp of the isoprofit curve is important for this unit and recurs in Unit 9. Students need to understand why the isoprofit curve for zero profit is flat in the case in this example; why they slope down for other levels of profit, and why they shift up or down and what happens to the tangency with the demand curve when they shift.

Note that fixed costs have not yet been introduced. Some students may suggest an additional effect, which is that the advertising cost (a fixed cost) may lower the level of profit. Note that for a given demand curve, this will not affect the equilibrium price and quantity (for example, the equilibrium in 3) but will reduce profit.

In terms of the diagram, the isoprofit curves can be reinterpreted as indicating profit before fixed costs. Profits on the isoprofit curve would be reduced by the fixed cost (independent of the quantity sold).
EXERCISE 7.2 THE COST FUNCTION FOR APPLE-CINNAMON CHEERIOS

Of course, cost functions can have different shapes from the one we drew for Beautiful Cars. For Apple-Cinnamon Cheerios, we assumed the average cost was constant, so that the unit cost of a pound of cereal was equal to $2, regardless of the quantity produced.

1. Draw the cost function (also called the total cost curve) for this case.
2. What do the marginal and average cost functions look like?
3. Now suppose that the marginal cost of producing a pound of Cheerios was $2, whatever the quantity, but there were also some fixed production costs. Draw the total, marginal, and average cost curves in this case.

Introduction

The aim of this question is to give students practice in drawing cost curves with actual data so they can see what types of functions produce differently shaped curves. As this is a fairly straightforward question, it could be assigned as an in-class activity, or as a preparation for a more complex in-class activity involving cost curves with different shapes.

Answer

1. This total cost curve is clearly linear, as each unit increase in output increases total cost by the same amount. Note that the question does not ask for an equation.

   \[ TC = F + c*Q = 0 + 2*Q = 2Q, \]

   which is a straight line through the origin.

2. Average cost and marginal cost both look the same. It is a horizontal line at 2.

   \[ AC = TC/Q = 2Q/Q = 2; \ MC = \Delta TC/\Delta Q = 2 \]

   The average cost and marginal cost are equal to each other in this case because the additional cost of producing one more unit of the good does not depend on how much of the good is being produced currently.

3. The only difference in this case is that \( F = 0 \) is no longer true. So the TC will have the same slope, but a positive intercept of \( F \). MC is still a horizontal line at 2, but now \( AC = (F + 2Q)/Q = F/Q + 2 \). So, in this case, average cost is larger than marginal cost as each additional unit does not require a further fixed cost expenditure. As the quantity produced rises, the fixed cost is spread over more and more units and therefore the difference between the AC and the MC falls as well.

Marking guidance

A good answer should:

- draw the TC, MC and AC in each case
• explain why the MC and the AC are the same in the first case and different in the case with a fixed cost

Teaching ideas

This is a straightforward question, so it is an easy introduction for those unused to sketching curves. An extension would be to provide a more complex cost function than in 3 and have students plot graphs from data they tabulate from the function.

It also drives home the point that the existence of fixed costs leads to cost advantages as scale increases. One teaching idea is to have students figure out what kinds of things give rise to fixed costs for Cheerios. Then extend the discussion to what kinds of products are likely to have more substantial fixed costs (and therefore cost advantages of scale). This naturally leads to a discussion about what kinds of industries are more likely to be imperfectly competitive.

EXERCISE 7.3 COST FUNCTIONS FOR UNIVERSITY EDUCATION

Below you can see the average and marginal costs per student for the year 1990–91 that Koshal and Koshal calculated from their research.

<table>
<thead>
<tr>
<th>Students</th>
<th>Undergraduates</th>
<th>MC ($)</th>
<th>AC ($)</th>
<th>Total cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,750</td>
<td>7,259</td>
<td>7,659</td>
<td>21,062,250</td>
<td></td>
</tr>
<tr>
<td>5,500</td>
<td>6,548</td>
<td>7,348</td>
<td>40,414,000</td>
<td></td>
</tr>
<tr>
<td>8,250</td>
<td>5,838</td>
<td>7,038</td>
<td>60,749,000</td>
<td></td>
</tr>
<tr>
<td>11,000</td>
<td>5,125</td>
<td>6,727</td>
<td>73,997,000</td>
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<td>6,417</td>
<td>88,233,750</td>
<td></td>
</tr>
<tr>
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<td>3,706</td>
<td>6,106</td>
<td>100,749,000</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Students</th>
<th>Graduates</th>
<th>MC ($)</th>
<th>AC ($)</th>
<th>Total cost ($)</th>
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</thead>
<tbody>
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<td>6,677,000</td>
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</tr>
<tr>
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<td>9,454</td>
<td>10,339,400</td>
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<td>8,365</td>
<td>18,403,000</td>
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<td>8,249</td>
<td>22,684,750</td>
<td></td>
</tr>
<tr>
<td>3,300</td>
<td>7,945</td>
<td>8,228</td>
<td>27,152,400</td>
<td></td>
</tr>
</tbody>
</table>

1. How do average costs change as the numbers of students rise?
2. Using the data for average costs, fill in the missing figures in the total cost column.
3. Plot the marginal and average cost curves for undergraduate education on a graph, with costs on the vertical axis and the number of students on the horizontal axis. On a separate diagram, plot the equivalent graphs for graduates.
4. What are the shapes of the total cost functions for undergraduates and graduates? (You could sketch them using what you know about marginal and average costs.) Plot them on a single chart using the numbers in the total cost column.
5. What are the main differences between the universities’ cost structures for undergraduates and graduates?
6. Can you think of any explanations for the shapes of the graphs you have drawn?
Introduction

This is a more sophisticated version of the previous exercise, and as it relies on real-world data on a topic familiar to most students, it is a very interesting exercise. The question starts by asking students to perform tasks similar to the previous exercise, but then gets into a deeper discussion about the nature of the cost functions. As such, it might be a good idea to assign the previous exercise as preparation for this one, which might be done in class allowing for an extended discussion on real-life cost curves (and sources of cost advantages of scale).

Answer

1. Average costs fall as the number of student rises. For undergraduates, average costs seem to fall approximately linearly. For graduate students, average costs fall by less as the number of students rises above 1,000: the curve flattens.

2. Total cost is average costs multiplied by the number of students:
   - total cost for 8,250 undergrad students is $58,063,500
   - total cost for 1,650 graduate students is $14,308,800

3. Undergraduate students:
   ![Graph of M and A Costs for Undergraduates]

4. Graduate students:
   ![Graph of M and A Costs for Graduates]

4. Both total costs curves are upward sloping, but the undergraduate one has diminishing marginal costs throughout (is concave in shape) while the graduate one has marginal costs which rise with more students (is convex in shape). Although not detailed explicitly in the table, fixed costs seem to be a larger component of total cost for graduates than for undergraduates.
5. The figures above show that the university has linear average costs for undergraduate students. Therefore, if the university increases its intake of undergraduate students it would expect average costs to fall in a linear fashion. The average cost curve for graduate students is also decreasing as numbers rise but in a non-linear fashion. This reflects the diminishing marginal returns to adding more students. Marginal cost curves are also very different for graduates and undergraduates. The MC curve for undergraduates is decreasing meaning that adding more students increases the firm’s total costs but by smaller and smaller amounts. The increasing marginal cost curve for graduates means that adding extra students increases the firm’s total costs by a greater amount for each successive student.

6. The main difference between the costs of undergraduate and graduate education is that in the first case, the marginal cost falls with each additional student thereby leading to a downward sloping AC (and economies of scale) while for the second case, the marginal cost rises with each additional student. One reason for this might be that each additional graduate student requires individual attention. This may have increasing costs as each staff member has more and more advisees. Undergraduates, on the other hand, can be taught in large classes so that the marginal cost for additional students is very small.

Marking guidance

A good answer will:

- draw the MC, AC and TC for each case (extra credit may be given if the student can derive the shape of the TC from those of the MC and AC, rather than plotting it)
- include a well thought-out explanation for part 6
Teaching ideas

The costs of education (and tuition fees) are always in the news, so this exercise can be used as a way to start a discussion on how the form of teaching and learning affects the cost, and therefore, how the market price of different levels of education should differ.

**EXERCISE 7.4 LOOKING AT ISOPROFIT CURVES**

The isoprofit curves for Cheerios are downward-sloping, but for Beautiful Cars they slope downward when Q is low and upward when Q is high.

1. In both cases the higher isoprofit curves get closer to the average cost curve as quantity increases. Why?
2. What is the reason for the difference in the shape of the isoprofit curves between the two firms?

**Introduction**

This question uses the ideas about costs curves developed in the two preceding Exercises

**Answer**

1. Recall that isoprofit curves show the price and quantity combinations that yield a particular (absolute) profit level. As quantity sold, Q, increases, any given total profit is achieved by a smaller difference between the price (P) and average costs per unit sold. This causes the isoprofit curve plotting the (Q, P) combinations to tend towards the average cost curve as quantity increases.

2. In Figure 7.4 the isoprofit curves for Cheerios are downward sloping. This is because marginal costs are constant in this example, and therefore so are average costs (there are no fixed costs). Since average costs are constant, as quantity increases, in order for total profit to remain constant, profit per unit sold must fall, and hence the price on the isoprofit curve must fall.

   The isoprofit curves in Figure 7.10 display more of a U shape. This is due to the U-shape of the average cost curve. At first, the average cost is falling, so higher quantity is associated with lower costs and to keep total profit unchanged on the isoprofit curve, the price must fall. The isoprofit curve slopes down. At higher quantities, average cost begins increasing. Eventually, in order to prevent total profit from falling, price must increase. So the isoprofit curve begins increasing with quantity. The isoprofit curve is therefore U-shaped.

   The differences in the AC for the two products indicates that for cars, there is a limit to the cost advantages of scale. This may be because of limits on the economies of scale in the production process or for example, because the R&D costs of car production increase after a certain number of cars.

**Marking guidance**

A good answer will:
• show that the student understands the concept of the isoprofit curve
• explain why the shapes of these curves might be different, and make the connection between these curves and the average cost curves that they are provided with.

Teaching ideas

One of the tricky concepts in this unit is the isoprofit curve. For this reason, assigning this question is a good way to make sure that students get a grasp on the concept by thinking about the specifics of its shape and the space in which it is drawn. There are some difficulties for students common to the isoprofit curve and the indifference curve: a quantity is being held constant along the curve. Here it is profit and the aim is to get students to focus on what has to happen to price as quantity rises in order that (total) profit remains constant. It’s a good idea to remind them of the shape of the isoprofit curves when profits are zero, which is the average cost curve.

EXERCISE 7.5 CHANGING THE RULES OF THE GAME

1. Suppose that Beautiful Cars had sufficient information and so much bargaining power that it could charge each consumer, separately, the maximum they would be willing to pay. Draw the demand and marginal cost curves (as in Figure 7.14), and indicate on your diagram:
   a. the number of cars sold
   b. the highest price paid by any consumer
   c. the lowest price paid
   d. the consumer and producer surplus
2. Can you think of any examples of goods that are sold in this way?
3. Why is this not common practice?
4. Some firms charge different prices to different groups of consumers—for example, airlines may charge higher fares for last-minute travellers. Why would they do this and what effect would it have on the consumer and producer surpluses?
5. Suppose a competition policy has changed the rules of the game. How could this give consumers more bargaining power?
6. Under these rules, how many cars would be sold?
7. Under these rules, what would the producer and consumer surpluses be?

Introduction

This question is quite challenging as price discrimination is not introduced explicitly in the preceding material. At the same time, it is a natural extension of the earlier discussion on consumer and producer surplus, and therefore could be assigned before a class, with a full graphical discussion during the class.

Answer

1. The demand and marginal cost curves will look exactly like the ones in Figures 7.13 and 7.14. However, the point E will no longer indicate the equilibrium price and quantity as each unit of the good will be sold at the consumer’s willingness to pay (the corresponding point on the demand curve). The good will be sold until the point where the demand and MC curves intersect. Consumer surplus will be zero, while
the producer surplus will be the entire triangle between the demand and MC curves and the y-axis. The dead weight loss will be zero.

2. There are many examples of price discrimination (student discounts, for example) though not many of perfect price discrimination. Students may give the example of goods bought and sold on eBay or other auction settings.

3. Price discrimination may not be common because it is difficult in many contexts for the firm to collect the information on a potential consumer’s willingness to pay. A firm may also worry about consumer reaction to different prices being charged for the same product. It may be viewed as unfair.

4. Similar to perfect price discrimination, it allows firms to extract more consumer surplus from each group by pricing closer to their willingness to pay. The producer surplus increases by the amount the consumer surplus declines.

5. More bargaining power for consumers can come from competition policy, which could include prohibition of price discrimination.

6. If there is sufficient competition to prevent price discrimination, then the amount sold and the price of the last unit sold are the same at the Pareto efficient allocation (point F in Figure 7.14) and under perfect price discrimination. That is, both setups lead to Pareto efficient outcomes. The only difference is that under the latter, the consumer surplus is zero.

7. The producer surplus will go down under these rules. Overall consumer surplus will rise.

**Marking guidance**

A good answer will:

- be able to identify that in this case, each unit is sold at the price indicated by the demand curve
- be able to identify that this implies that the number of units sold is where the demand and MC curves intersect
- show that the entire surplus goes to producers (and consumer surplus is zero)
- present good examples of price discrimination

**Teaching ideas**

As this is a challenging question (and a new concept), it might be a good idea to ask students to first think about the fourth part of the question intuitively, before asking them to draw the perfect discrimination case. The word “discrimination” also is tricky, as students automatically think that there is something wrong with it. This question shows how perfect price discrimination is efficient, though very unequitable, thereby providing an introduction to the idea that efficiency and fairness may not go hand in hand and so there may be some interesting tradeoffs to think about.

- Be careful not to refer to ‘perfect competition’ as the case of price-taking firms is not introduced until Unit 8!

A good example for class discussion is the recent debate about why the price of pink razors is higher than blue ones, and whether there should be a policy addressing such practices. Policies to increase competition in the market will
help to reduce this problem; as will campaigns to raise consumer awareness such as requiring firms to quote the price for similar products.

**EXERCISE 7.6 ELASTICITY AND EXPENDITURE**

Figure 7.19 shows the spending per week in each category of a US consumer whose total expenditure on food is $80, with typical spending patterns across food categories. Suppose that the price of category 30, high-calorie milk products, increased by 10%:

1. By what percentage would his demand for high-calorie milk products fall?
2. Calculate the quantity he consumes, in grams, before and after the price change.
3. Calculate his total expenditure on high-calorie milk products before and after the price change. You should find that expenditure falls.
4. Now choose a category for which the price elasticity is less than 1, and repeat the calculations. In this case you should find that expenditure rises.

**Introduction**

This exercise is a straightforward numerical question to test students' understanding of the concept of elasticity.

**Answer**

1. By 17.93%, because $0.1 \times 1.793 = 0.1793$
2. $2.32/0.9 = 2.5778 \text{ kg before, and } 2.5778 - (0.1793 \times 2.5778) = 2.1156 \text{ kg after.}$
3. $\$2.32 \text{ before, and } 2.1156 \times 0.9 \times 1.1 = \$2.09 \text{ after.}$
4. Pasta, category 15, elasticity is 0.854. The quantity decreases by 8.54%.
   Quantity before is $2.96/3.8 = 0.77895 \text{ kg, and quantity after is } 0.77895 \times (1 - 0.0854) = 0.71243 \text{ kg.}$
   The spending is $2.96 \text{ before, and } 0.712436 \times 3.8 \times 1.1 = \$2.9779 \text{ after.}$

**Marking guidance**

A good answer will:

- compute the changes in quantity and expenditure to show that the student understands the definition of elasticity
- be able to choose a category with inelastic demand and complete the computations

**Teaching ideas**

This is a mechanical question but a good way to check for correct interpretation and use of estimated elasticities. Perhaps give different students different goods with the same price change (some with a price rise and some with a price fall) and ask them to answer parts 1-3.

Then, if the students are asked to share their computations with their classmates, they will see how the mechanism works with different elasticities, prices, and directions of price change.
EXERCISE 7.7 FOOD TAXES AND HEALTH

Food taxes intended to shift consumption towards a healthier diet are controversial. Some people think that individuals should make their own choices, and if they prefer unhealthy products, the government should not interfere. In view of the fact that those who become ill will be cared for at some public expense, others argue that the government has a role in keeping people healthy.

In your own words, provide arguments for or against food taxes designed to encourage healthy eating.

Introduction

This question is an application of the concept of elasticity to the topical issue of sin taxes, in particular, taxes on unhealthy foods.

Answer

There are numerous factors which policymakers should consider when thinking about whether to impose a tax on unhealthy foods:

- **Public health**: A major argument in favour of the sugar tax is the potential benefits that a tax could have for public health. Many argue that imposing a sugar tax will reduce consumption of goods which have a negative impact on people’s health. Improving people’s health will reduce the strain on health services. Furthermore, the money raised from the tax could be used to fund the treatment of diseases caused by excessive sugar consumption such as diabetes.

- **Negative impact on low-income groups**: Evidence suggests that those in low income groups may consume more sugary snacks than those in higher ones. Many politicians lack the political will to impose the tax as they fear that the tax will impact the poor the most. Such a tax would be termed “regressive”. Examples of countries whom have imposed a sugar tax include Mexico, France and Denmark. Unfortunately, these have all been imposed fairly recently therefore it is very hard to test the effectiveness of the tax as any public health benefits will be realised in the long run.

- **Effectiveness**: The final consideration is whether a tax like this is the best way to either (1) reduce consumption of such foods, and/or (2) raise tax revenue. Figure 7.18 shows that high/low calorie snacks and candies have a price elasticity of demand less than 0.3 meaning a 1% increase in price would only lead to a less than 0.3% fall in demand. But this also means that taxing such a good will raise tax revenue and these funds could then be used to e.g. subsidize healthier foods or lifestyles, or indeed to treat diseases caused by unhealthy foods.

Marking guidance

A good answer will:

- display an understanding of how the good’s price elasticity will define the effect of the tax on consumption
- discuss more broadly the considerations taken into account before introducing such a policy

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Evidence from countries which have adopted tax: Economist, The. 2015. Stopping Slurping, 26 November (http://tinyco.re/9948523).*
Teaching ideas

The linked readings are a great resource for getting students to think about how government policy may change behaviour, and the role of price elasticities in determining these responses. A classroom activity involving students reporting on their own consumption of various goods and how they might react if a tax or subsidy was imposed on the good is one way to solidify these ideas.

EXERCISE 7.8 MULTINATIONALS OR INDEPENDENT RETAILERS?

Imagine that you are a politician in a town where a multinational retailer is planning to build a new superstore. A local campaign is protesting that it will drive small independent retailers out of business, and thereby reduce consumer choice and change the character of the area. Supporters of the plan argue in turn that this will only happen if consumers prefer the supermarket.

Which side are you on?

Introduction

This question focuses on the effect of competition on the market. The specific context described in the question is one that many students will be familiar with, so that it is easier for them to relate to it.

Answer

A politician in this scenario will have to consider many factors when making this decision. There are many potential negatives for the town:

- **The effect on local employment:** A large supermarket may attract consumers away from small independent businesses because it is able to provide lower prices and/or conveniences like parking. This is due to the superstore benefiting from economies of scale and perhaps bargaining power (see Section 7.2 on economies of scale). This could drive small retailers out of the market as they will be unable to compete with the prices charged by the superstore and so will lose customers. This could have a negative impact on employment in the town if those previously working in the smaller stores are unable to find work in the supermarket or other local employers.

- **Monopoly power:** The multinational retailer will likely have a high degree of market power. This could be exacerbated in the future if small retailers leave the market leaving the superstore as a monopolist. The superstore could abuse its position by increasing prices or reducing the quality of the service it offers (section 7.9).

- **Maintaining the character of the local area:** The character of the local area is a public good. Exercise 4.6 in Unit 4 explicitly considers an example of this context.

There are also potential positives:

- **Benefits for consumers:** You have seen in section 7.8 how increased competition can lead to lower prices and better competitive outcomes. Consumers in the town may well benefit from lower prices in the superstore due to economies of scale and other cost advantages.

Exercises and references:

- BBC News. 2010. ‘Big four’ supermarkets get 577 stores agreed, BBC finds. 22 December (http://tinyco.re/0505541)
of scale. The competition provided by the superstore may lead to a reduction in prices by rival retailers or an increase in quality.

- **New investment in the area:** A supermarket could generate significant benefits for an area. This would normally be in the form of job creation which could benefit the local economy. There may also be additional job creation effects as increased employment in the town leads to locals spending more at other retailers or benefits such as an increase in revenue for construction firms hired to build the superstore.

Any decision made by the politician will need to be considered by weighing up all these options. It is clear that superstores can have a positive impact on a town but may also lead to downsides.

**Marking guidance**

A good answer will:

- recognize that the supermarket increases competition and can therefore lower prices
- recognize that these lower prices could drive local stores out of business thereby creating a monopoly
- recognize the public good character of the local area
- comment on employment and other effects of the supermarket on the local economy

**Teaching ideas**

A good way to start a class might be to use a newspaper clipping about a context similar to this (perhaps a restaurant chain or cinema), and discuss whether students feel the entry for such an entity is a good idea. Once these initial ("gut-feeling") ideas have been listed, the lecturer can focus on the specifics of competition, effects on prices and employment and so on. This helps make the point that some of the initial ideas students had will be borne out by economic analysis, while others perhaps don’t stand up to scrutiny.