BOSTON UNIVERSITY
Global Development Policy Center
Economics in Context Initiative

Chapter 6: Market Structure

Appendix

Appendix to Chapter 6 of Essentials of Economics in Context, Second Edition

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APPENDIX
A1: A FORMAL MODEL OF PERFECT COMPETITION

In this appendix, we present a formal conceptual model of perfect competition. We start by introducing new material on production costs and then combine that with the production decisions of a price-taking firm.

Recall from Chapter 5 that the definition of average total cost (*ATC*) is total cost divided by the quantity produced. For example, if the total cost of producing 200 bushels of corn were $800, the *ATC* would be $4.00 ($800 ÷ 200) per bushel. *ATC* relates to marginal cost (*MC*) in the following manner:

- If *MC* < *ATC*, then *ATC* is decreasing.
- If *MC* > *ATC*, then *ATC* is increasing.
- When *ATC* = *MC*, *ATC* is at its lowest point.

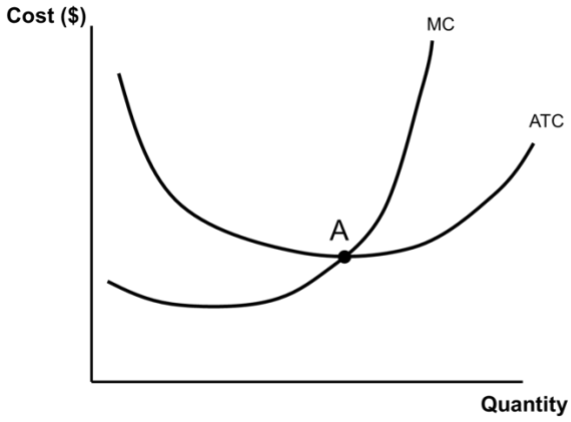
While this may seem difficult to grasp, consider the following analogy. Suppose that your current average grade in a class is a 90, and you get a new grade of 80 on a quiz. As your marginal grade (the quiz grade of 80) is lower than your average grade, your average grade will go down. However, if you instead score a 95 on the quiz, your marginal grade is higher than your average and your average will go up.

The relationship between *ATC* and *MC* is shown in Figure 6A.1. We see that *ATC* starts out relatively high because fixed costs (which are often relatively large) are divided by a relatively small quantity. As quantity increases, the average cost of production declines, even as marginal costs begin to rise (i.e., the reduction of *ATC* that is due to dividing by a larger quantity more than offsets the rising marginal production costs). Eventually, the marginal cost rises above *ATC*, and then *ATC* rises. The minimum *ATC* is at point A.

Next we introduce a new cost variable, **average variable cost** (*AVC*). *AVC* is equal to total variable cost divided by quantity. As *AVC* excludes fixed costs, it will always be less than *ATC*. Like *ATC*, the minimum *AVC* will occur where it intercepts the *MC* curve. Realize that all marginal costs are variable costs. So whenever *MC* < *AVC*, *AVC* is declining, and whenever *MC* > *AVC*, *AVC* will rise.

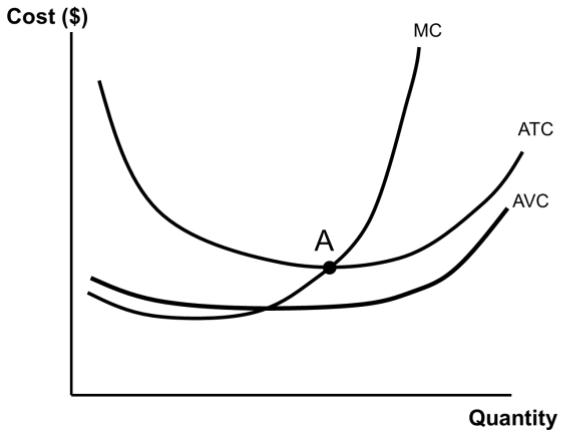
average variable cost (AVC): total variable cost divided by the quantity produced

Figure 6A.1 The Relationship Between Average Total Costs and Marginal Costs



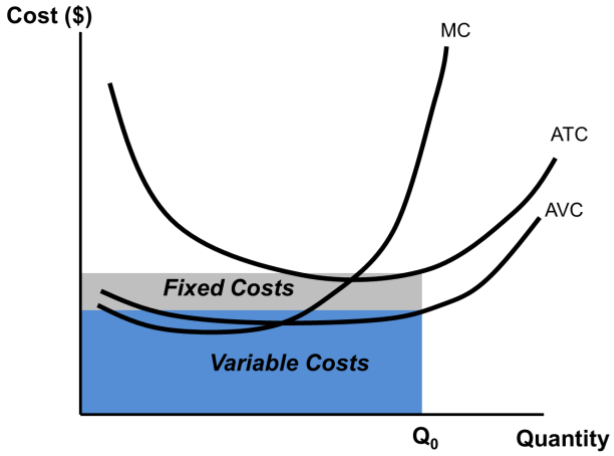
In Figure 6A.2 we have added an *AVC* curve to the graph shown in Figure 6A.1. Note that the distance between *ATC* and *AVC* is initially large because fixed costs are divided by a relatively small quantity. As quantity increases, fixed costs become less dominant in determining *ATC*, and *AVC* moves closer to *ATC*.

Figure 6A.2 The Relationship Between Average Total Costs, Marginal Costs, and Average Variable Costs



We can refer to this graph to determine the total costs of producing a given quantity, and also to separate total costs into fixed and variable costs, as shown in Figure 6A.3. Production quantity in this example is at Q_0. Total cost is the average per-unit cost (*ATC*) multiplied by Q_0, or the entire shaded area in the graph. The total variable costs are obtained by multiplying Q_0 by the average variable cost, which is the blue-shaded area in the graph. The difference between total and variable costs is fixed costs, the gray-shaded area. Note that the area of fixed costs must be the same for any level of production, as it does not vary according to production levels.

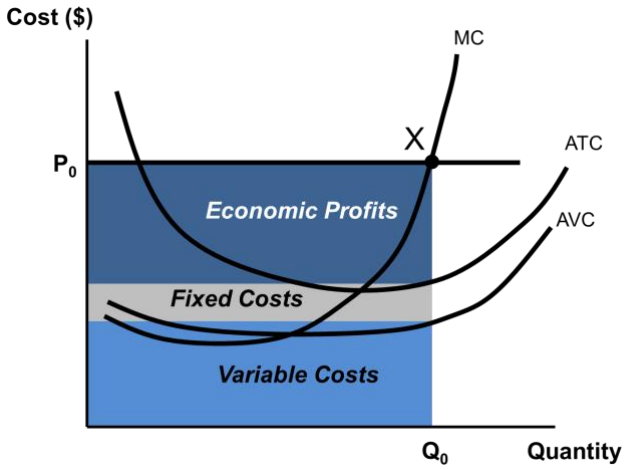
Figure 6A.3 The Relationship Between Cost Curves and Areas of Total Costs, Fixed Costs, and Variable Costs



Suppose that price is initially at P_0, as shown in Figure 6A.4. A perfectly competitive firm would produce where $P = MC$, or at point X in Figure 6A.4. Assuming the firm's costs include

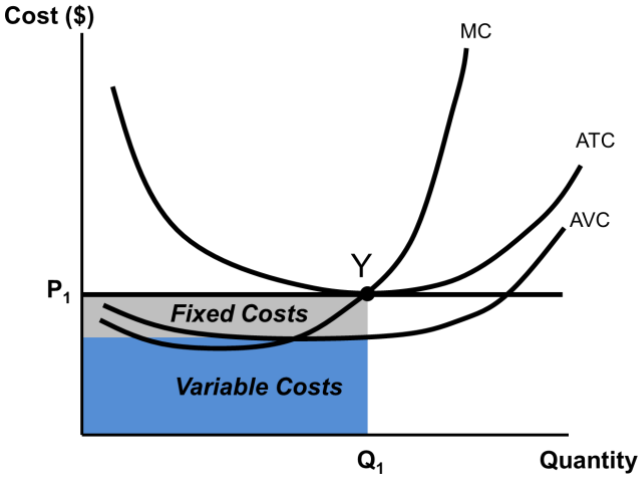
opportunity costs, in this case the firm is making an economic profit, as shown in the graph as the dark blue-shaded area above the firm's total costs. Note that total revenues would be P_0 multiplied by Q_0, or the sum of all shaded areas.

Figure 6A.4 Positive Economic Profits



As discussed in the chapter, the existence of economic profits creates an incentive for entry into the market. Assuming no barriers to entry, new firms will enter the market until economic profits are eliminated. This occurs when total revenues are just equal to total costs. As price falls, each perfectly competitive firm will reduce its production as the point where $P = MC$ moves to the left. The perfectly competitive market equilibrium is shown in Figure 6A.5, with each firm producing at point Y (a quantity of Q_1 at a price of P_1). At this point, each firm is earning a zero economic profit—a profit just equal to what they could be making with their next-best alternative.

Figure 6A.5 Zero Economic Profits—The Perfectly Competitive Market Equilibrium

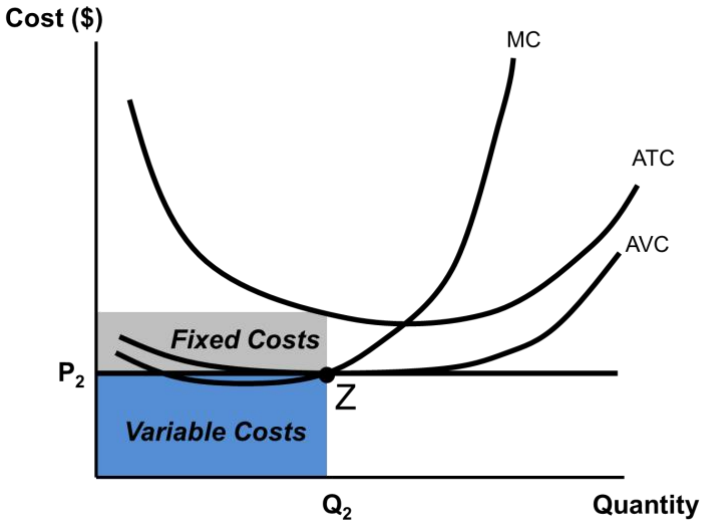


Finally, we consider the decision whether a firm should continue to produce in the short run while experiencing losses. As discussed in the chapter, perfectly competitive firms will continue to produce as long as they can recover their variable costs. If price falls a little below P_1 in Figure 6A.5, the firm will be making negative economic profits, but it will still be making

enough revenues to cover its variable costs as well as pay some fixed costs—which is still better than shutting down production, earning no revenues, and having to pay all its fixed costs.

Eventually, price could fall enough that the firm will not be able to cover its variable costs, and it is better off shutting down production and just paying its fixed costs, as illustrated in Figure 6A.6. At a price of P_2 the firm produces at point Z (where $P = MC$) and makes just enough in revenues to cover its variable costs. However, if price falls below P_2, the firm will not be able to cover its variable costs and it is better off shutting down production and just paying its fixed costs.

Figure 6A.6 The Decision to Produce with Losses



A2: FORMAL ANALYSIS OF MONOPOLY AND MONOPOLISTIC COMPETITION

1. The Assumptions

This appendix shows how monopoly and monopolistic competition market structures can be formally treated within a model of profit-maximizing firms that make static decisions based on solving complex problems. We assume that the firm is a hair dryer producer.

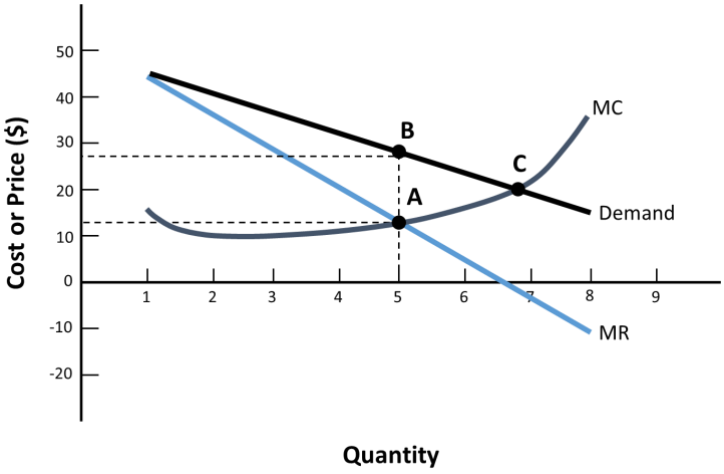
2. Monopoly

Suppose that our hair dryer producer is a monopolist, with the marginal revenue schedule shown in Table 6A.1 and Figure 6A.7 and with the marginal cost curve of our hypothetical hair dryer producer also shown in Figure 6A.7. As described in chapter 6, the monopolist maximizes profits by setting $MR = MC$. It produces 5 units, at a marginal cost of about $12, and sells them for a price of $28.

Table 6A.1. Total and Marginal Revenue for a Monopolist

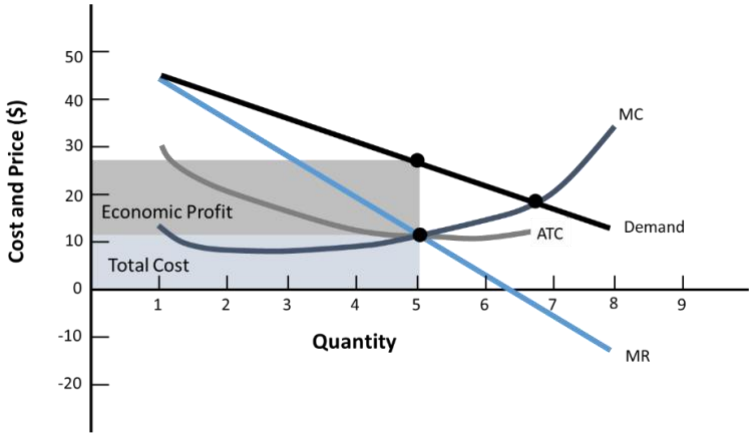
Quantity of output	Selling price ($)	Total revenue ($)	Marginal revenue ($)
1	44	44	44
2	40	80	36
3	36	108	28
4	32	128	20
5	28	140	12
6	24	144	4
7	20	140	-4
8	16	128	-12
9	12	108	-20

Figure 6A.7 Monopoly Profit Maximization



Adding in the average total cost curve of the firm enables us to identify the area of economic profit, as shown in Figure 6A.8. The firm's revenues include both shaded areas, whereas its costs are represented by the blue rectangle whose northeast corner lies on the *ATC* curve. The monopolist makes positive economic profits equal to the area of the gray rectangle whose southeast corner lies on the *ATC* curve.

Figure 6A.8 Monopoly Profits



3. Monopolistic Competition

The monopolistically competitive firm faces a downward-sloping demand curve. Yet, like a perfectly competitive firm, it also makes zero economic profits in the long run.

This case is illustrated in Figure 6A.9. Like the monopolist, the monopolistically competitive firm will choose to produce the quantity corresponding to point A, where *MR* = *MC*. It will charge a price corresponding to point B on the demand curve. Point B is also on the *ATC* curve. Thus the rectangle with its northeast corner at point B represents both total revenue (price × quantity) and total cost (average total cost × quantity). The firm makes zero economic profits.

How does this come about? Look back at Figure 6.6 in the textbook. If the price were above the *ATC* curve, the firm would make positive economic profits, and (because there is free entry) new firms would enter the industry. This causes the demand curve for this firm's differentiated product to shift downward. The demand curve would shift downward until it just touches the *ATC* curve, as shown in Figure 6A.9.

Figure 6A.9 Zero Economic Profits for a Monopolistically Competitive Firm