Chapter 6: Market Structure

Appendices

Appendices to Chapter 6 of *Essentials of Economics in Context*

APPENDIX A: 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 6 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 initially seem difficult to grasp, consider the following analogy. Suppose that your current grade average 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 6.8. 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.

Figure 6.8 The Relationship Between Average Total Costs and Marginal Costs
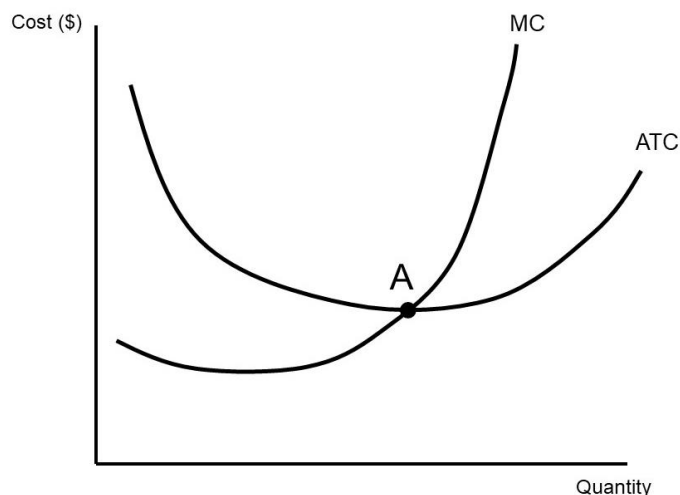
Next we introduce a new cost variable, **average variable cost** (*AVC*). *AVC* is equal to total variable cost divided by quantity. As *AVC* excludes fixed costs, it will always be less than *ATC*. Like *ATC*, the minimum *AVC* will occur where it intercepts the *MC* curve. Realize that all marginal 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

In Figure 6.9 we have added an *AVC* curve to the graph shown in Figure 6.8 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 6.9 The Relationship Between Average Total Costs, Marginal Costs, and Average Variable Costs
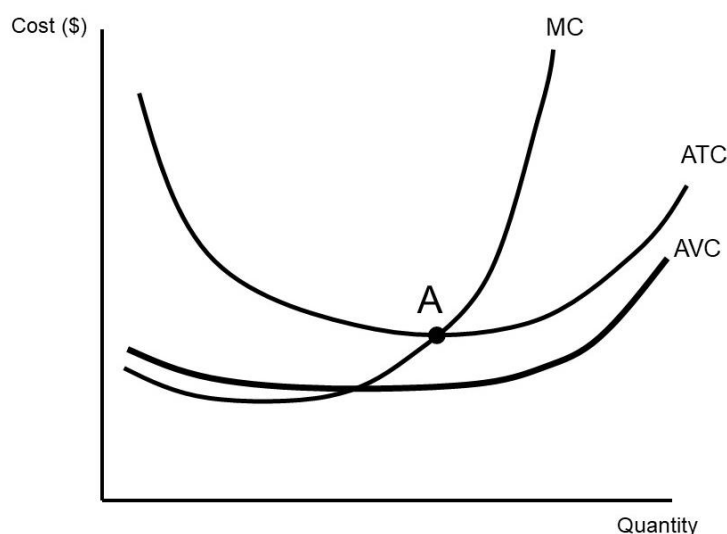

We can refer to this graph to determine the total costs of producing a given quantity, and also to separate total costs into fixed and variable costs, as shown in Figure 6.10. Production quantity in this example is at Q_0. Total cost is the average per-unit cost (*ATC*) multiplied by Q_0, or the entire 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 6.10 The Relationship Between Cost Curves and Areas of Total Costs, Fixed Costs, and Total Variable Costs

Cost ($)

MC

ATC

AVC

**Fixed Costs**

Variable Costs

Q_0 Quantity
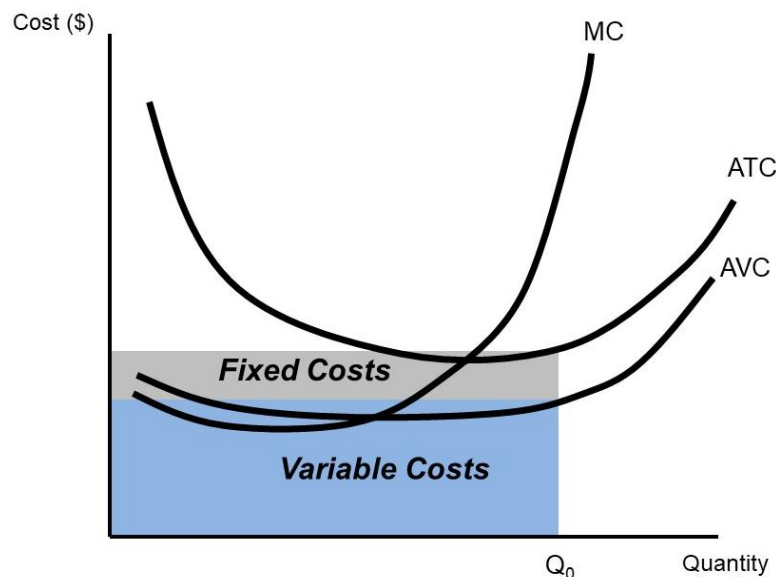
Suppose that price is initially at P_0, as shown in Figure 6.11. A perfectly competitive firm would produce where $P = MC$, or at point X in Figure 6.11. Assuming the firm's costs include opportunity costs, in this case the firm is making an economic profit, as shown in the graph as the dark blue-shaded 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 6.11 Positive Economic Profits

Cost ($)

MC

X

ATC

P_0

Economic Profits

AVC

Fixed Costs

Variable Costs

Q_0 Quantity
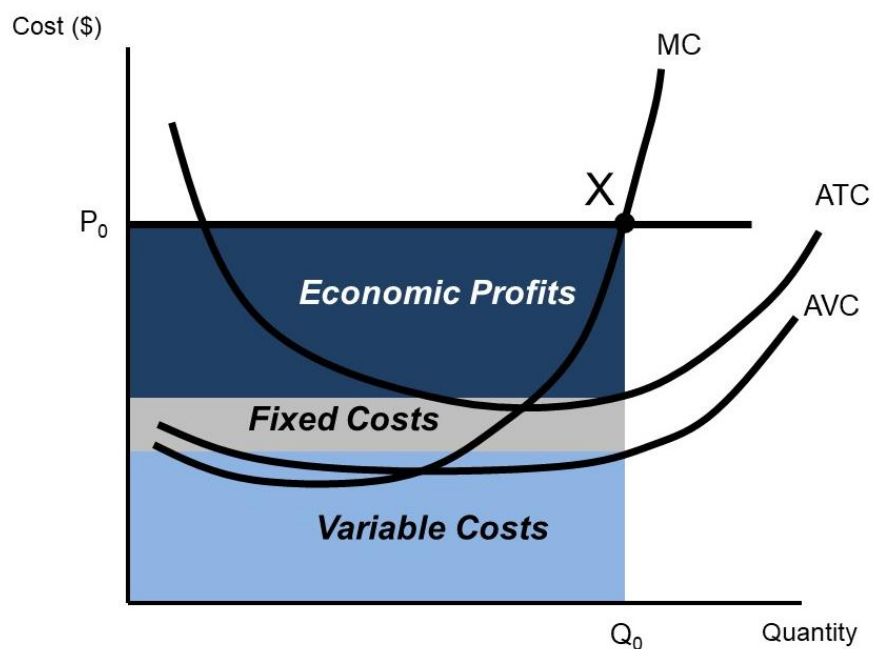
As discussed in Chapter 6, the existence of economic profits creates an incentive for entry into the market. Assuming no barriers to entry, new firms will enter the market until economic profits are eliminated. This occurs when total revenues are just equal to total costs. As price falls, each perfectly 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 6.12, 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 6.12 Zero Economic Profits – The Perfectly Competitive Market Equilibrium
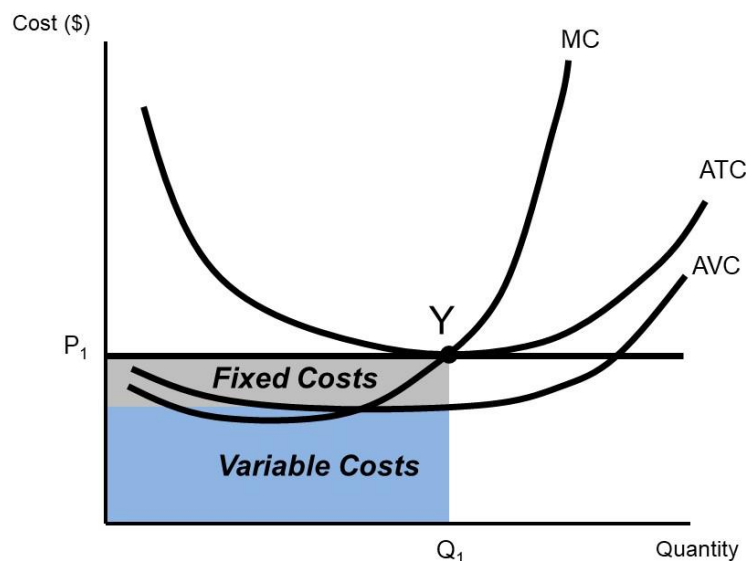
Finally, we consider the decision whether a firm should continue to produce in the short run while experiencing losses. As discussed in the chapter, perfectly competitive firms will continue to produce as long as they can recover their variable costs. So if price falls a little below P_1 in Figure 6.12, 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, the price will 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 6.13. 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 6.13 The Decision to Produce with Losses
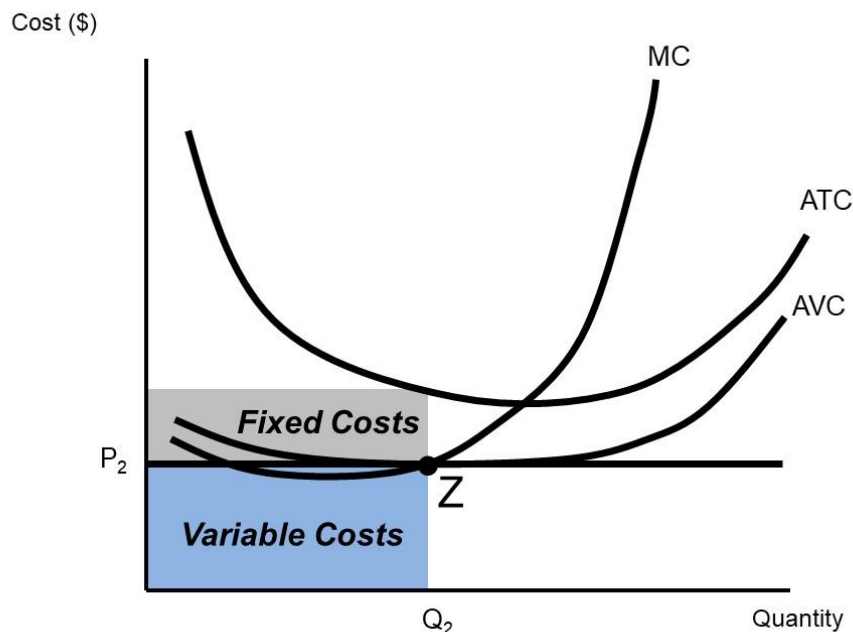
# APPENDIX B: FORMAL ANALYSIS OF MONOPOLY AND MONOPOLISTIC COMPETITION

A1. 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.

A2. MONOPOLY

Suppose that our hair dryer producer is a monopolist, with the marginal revenue schedule shown in Table 6.4 and Figure 6.5 and with the marginal cost curve of our hypothetical producer also shown in Figure 6.5. As described in this chapter, 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. Adding in the average total cost curve of the firm enables us to identify the area of economic profit, as shown in Figure 6.14. 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 profit equal to the area of the gray rectangle whose southeast corner lies on the *ATC* curve.

Figure 6.14 Monopoly Profits
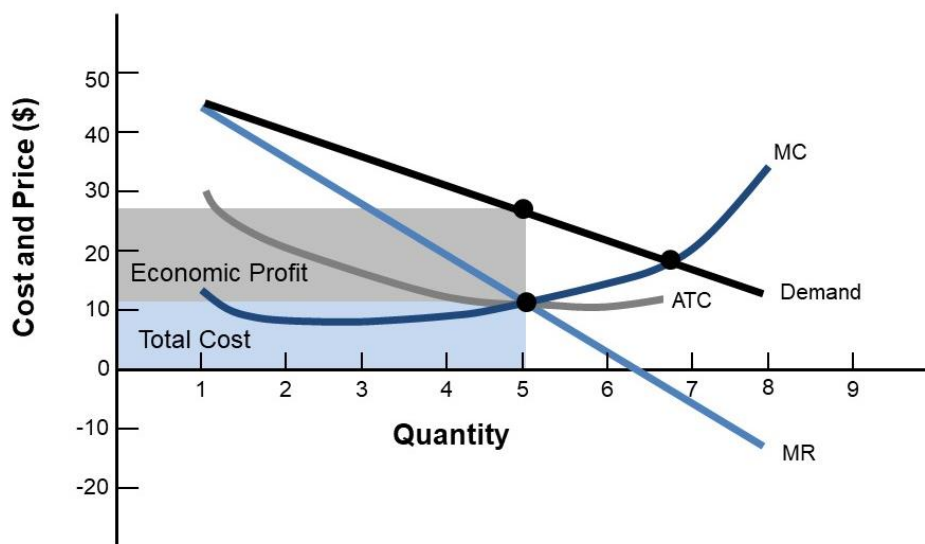
A3. MONOPOLISTIC COMPETITION

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 6.15. 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.

Figure 6.15 Zero Economic Profits for a Monopolistically Competitive Firm
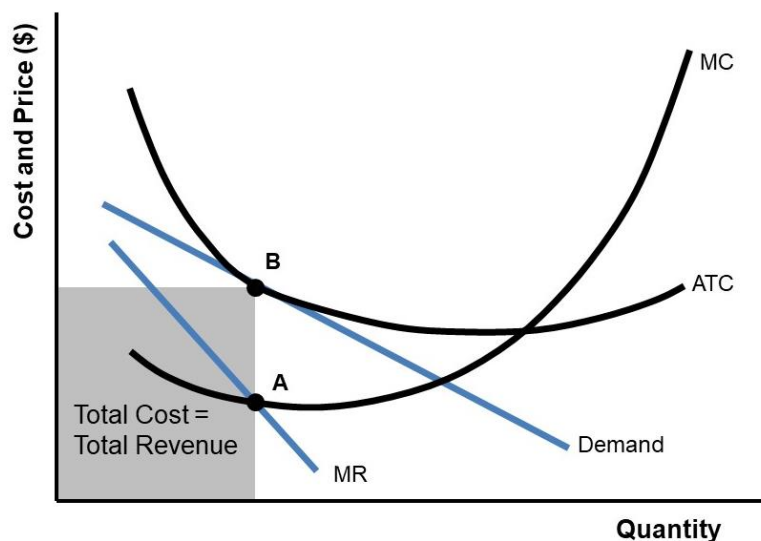
How does this come about? Look back at Figure 6.15. If the price were above the *ATC* curve, the firm would make positive economic profits, and (because there is free entry) new firms would enter the industry. This causes the demand curve for this firm's differentiated product to shift downward. The demand curve is imagined to shift downward until it just touches the *ATC* curve, as shown in Figure 6.15.