Chapter 8
Perfection Competition

Introduction

Most businesses face two realities: no one is required to buy their products, and even customers who might want those products may buy from other businesses instead. Firms that operate in perfectly competitive markets face this reality. In this chapter, you will learn how such firms make decisions about how much to produce, how much profit they make, whether to stay in business or not, and many others. Industries differ from one another in terms of how many sellers there are in a specific market, how easy or difficult it is for a new firm to enter, and the type of products that they sell. Economists refer to this as an industry's **market structure**. In this chapter, we focus on perfect competition. However, in other chapters we will examine other industry types: *Monopoly and Monopolistic Competition and Oligopoly*.

8.1 Perfect Competition and Why It Matters

Firms are in **perfect competition** when the following conditions occur: (1) many firms produce identical products; (2) many buyers are available to buy the product, and many sellers are available to sell the product; (3) sellers and buyers have all relevant information to make rational decisions about the product that they are buying and selling; and (4) firms can enter and leave the market without any restrictions—in other words, there is free entry and exit into and out of the market.

A perfectly competitive firm is known as a **price taker**, because the pressure of competing firms forces it to accept the prevailing equilibrium price in the market. If a firm in a perfectly competitive market raises the price of its product by so much as a penny, it will lose all of its sales to competitors. When a wheat grower, as we discussed in the Bring It Home feature, wants to know the going price of wheat, they have to check on the computer or listen to the radio. Supply and demand in the entire market solely determine the market price, not the individual farmer. A perfectly competitive firm must be a very small player in the overall market, so that it can increase or decrease output without noticeably affecting the overall quantity supplied and price in the market.

A perfectly competitive market is a hypothetical extreme; however, producers in a number of industries do face many competitor firms selling highly similar goods, in which case they must often act as price takers. Economists often use agricultural markets as an example. The same crops that different farmers grow are largely interchangeable. According to the United States Department of Agriculture monthly reports, in December 2021, U.S. corn farmers received an average of $5.47 per bushel. A corn farmer who attempted to sell at $6.00 per bushel would not have found any buyers. A perfectly competitive firm will not sell below the equilibrium price either. Why should they when they can sell all they want at the higher price? Other examples of agricultural markets that operate in close to perfectly competitive markets are small roadside produce markets and small organic farmers.

This chapter examines how profit-seeking firms decide how much to produce in perfectly competitive markets. Such firms will analyze their costs as we discussed in the chapter on Production, Costs and Industry Structure. In the short run, the perfectly competitive firm will seek the quantity of output where profits are highest or, if profits are not possible, where losses are lowest.

In the long run, positive economic profits will attract competition as other firms enter the market. Economic losses will cause firms to exit the market. Ultimately, perfectly competitive markets will attain long-run *equilibrium* when no new firms want to enter the market and existing firms do not want to leave the market, as economic profits have been driven down to zero.

8.2 How Perfectly Competitive Firms Make Output Decisions

A perfectly competitive firm has only one major decision to make—namely, what quantity to produce. To understand this, consider a different way of writing out the basic definition of profit:

$$\begin{aligned}\text{Profit} &= \text{Total revenue} - \text{Total cost} \\ &= (\text{Price})(\text{Quantity produced}) - (\text{Average cost})(\text{Quantity produced})\end{aligned}$$

Since a perfectly competitive firm must accept the price for its output as determined by the product's market demand and supply, it cannot choose the price it charges. This is already determined in the profit equation, and so the perfectly competitive firm can sell any number of units at exactly the same price. It implies that the firm faces a perfectly elastic demand curve for its product: buyers are willing to buy any number of units of output from the firm at the market price. When the perfectly competitive firm chooses what quantity to produce, then this quantity—along with the prices prevailing in the market for output and inputs—will determine the firm's total revenue, total costs, and ultimately, level of profits.

Determining the Highest Profit by Comparing Total Revenue and Total Cost

A perfectly competitive firm can sell as large a quantity as it wishes, as long as it accepts the prevailing market price. The formula above shows that total revenue depends on the quantity sold and the price charged. If the firm sells a higher quantity of output, then total revenue will increase. If the market price of the product increases, then total revenue also increases whatever the quantity of output sold. As an example of how a perfectly competitive firm decides what quantity to produce, consider the case of a small farmer who produces raspberries and sells them frozen for $4 per pack. Sales of one pack of raspberries will bring in $4, two packs will be $8, three packs will be $12, and so on. If, for example, the price of frozen raspberries doubles to $8 per pack, then sales of one pack of raspberries will be $8, two packs will be $16, three packs will be $24, and so on.

Comparing Marginal Revenue and Marginal Costs

The approach that we described in the previous section, using total revenue and total cost, is not the only approach to determining the profit maximizing level of output. In this section, we provide an alternative approach which uses marginal revenue and marginal cost.

Firms often do not have the necessary data they need to draw a complete total cost curve for all levels of production. They cannot be sure of what total costs would look like if they, say, doubled production or cut production in half, because they have not tried it. Instead, firms experiment. They produce a slightly greater or lower quantity and observe how it affects profits. In economic terms, this practical approach to maximizing profits means examining how changes in production affect marginal revenue and marginal cost.
Figure 8.3 presents the marginal revenue and marginal cost curves based on the total revenue and total cost in Table 8.1. The **marginal revenue** curve shows the additional revenue gained from selling one more unit. As mentioned before, a firm in perfect competition faces a perfectly elastic demand curve for its product—that is, the firm's demand curve is a horizontal line drawn at the market price level. This also means that the firm's marginal revenue curve is the same as the firm's demand curve: Every time a consumer demands one more unit, the firm sells one more unit and revenue increases by exactly the same amount equal to the market price. In this example, every time the firm sells a pack of frozen raspberries, the firm's revenue increases by $4. This condition only holds for price taking firms in perfect competition where:

$$\text{marginal revenue} = \text{price}$$

The formula for marginal revenue is:

$$\text{marginal revenue} = \frac{\text{change in total revenue}}{\text{change in quantity}}$$

Since a perfectly competitive firm is a price taker, it can sell whatever quantity it wishes at the market-determined price. We calculate marginal cost, the cost per additional unit sold, by dividing the change in total cost by the change in quantity. The formula for marginal cost is:

$$\text{marginal cost} = \frac{\text{change in total cost}}{\text{change in quantity}}$$

Ordinarily, marginal cost changes as the firm produces a greater quantity.
For a perfectly competitive firm, the marginal revenue (MR) curve is a horizontal line because it is equal to the price of the good, which is determined by the market. The marginal cost (MC) curve is sometimes initially downward-sloping, if there is a region of increasing marginal returns at low levels of output, but is eventually upward-sloping at higher levels of output as diminishing marginal returns kick in.

increase in production are greater than marginal revenues, and so profits would decline.
The profit-maximizing choice for a perfectly competitive firm will occur at the level of output where marginal revenue is equal to marginal cost—that is, where MR = MC. This occurs at Q = 80 in the figure.mBecause the marginal revenue received by a perfectly competitive firm is equal to the price P, we can also write the profit-maximizing rule for a perfectly competitive firm as a recommendation to produce at the quantity of output where P = MC.

Profits and Losses with the Average Cost Curve

Does maximizing profit (producing where MR = MC) imply an actual economic profit? The answer depends on the relationship between price and average total cost, which is the average profit or **profit margin**. If the market price is higher than the firm's average cost of production for that quantity produced, then the profit margin is positive and the firm will earn profits. Conversely, if the market price is lower than the average cost of production, the profit margin is negative and the firm will suffer losses. You might think that, in this situation, the firm may want to shut down immediately. Remember, however, that the firm has already paid for fixed costs, such as equipment, so it may continue to produce for a while and incur a loss

Where the marginal cost curve is crossing the average cost curve, the price the firm receives is exactly equal to its average cost of production. We call this the **break even point**. If the market price that perfectly competitive firm receives leads it to produce at a quantity where the price is greater than average cost, the firm will earn profits. If the price the firm receives causes it to produce at a quantity where price equals average cost, which occurs at the minimum point of the AC curve, then the firm earns zero profits. Finally, if the price the firm receives leads it to produce at a quantity where the price is less than average cost, the firm will earn losses

The Shutdown Point

The possibility that a firm may earn losses raises a question: Why can the firm not avoid losses by shutting down and not producing at all? The answer is that shutting down can reduce variable costs to zero, but in the short run, the firm has already paid for fixed costs. As a result, if the firm produces a quantity of zero, it would still make losses because it would still need to pay for its fixed costs. Therefore, when a firm is experiencing losses, it must face a question: should it continue producing or should it shut down?

The intersection of the average variable cost curve and the marginal cost curve, which shows the price below which the firm would lack enough revenue to cover its variable costs, is called the **shutdown point**. If the perfectly competitive firm faces a market price above the shutdown point, then the firm is at least covering its average variable costs. At a price above the shutdown point, the firm is also making enough revenue to cover at least a portion of fixed costs, so it should limp ahead even if it is making losses in the short run, since at least those losses will be smaller than if the firm shuts down immediately and incurs a loss equal to total fixed costs. However, if the firm is receiving a price below the price at the shutdown point, then the firm is not even covering its variable costs. In this case, staying open is making the firm's losses larger, and it should shut down immediately. To summarize, if:

- price < minimum average variable cost, then firm shuts down
- price > minimum average variable cost, then firm stays in business

Marginal Cost and the Firm's Supply Curve

For a perfectly competitive firm, the marginal cost curve is identical to the firm's supply curve starting from the minimum point on the average variable cost curve. To understand why this perhaps surprising insight holds true, first think about what the supply curve means. A firm checks the market price and then looks at its supply curve to decide what quantity to produce. Now, think about what it means to say that a firm will maximize its profits by producing at the

quantity where P = MC. This rule means that the firm checks the market price, and then looks at its marginal cost to determine the quantity to produce—and makes sure that the price is greater than the minimum average variable cost. In other words, the marginal cost curve above

As we discussed in the chapter on Demand and Supply, many of the reasons that supply curves shift relate to underlying changes in costs. For example, a lower price of key inputs or new technologies that reduce production costs cause supply to shift to the right. In contrast, bad weather or added government regulations can add to costs of certain goods in a way that causes supply to shift to the left. We can also interpret these shifts in the firm's supply curve as shifts of the marginal cost curve. A shift in costs of production that increases marginal costs at all levels of output—and shifts MC upward and to the left—will cause a perfectly competitive firm to produce less at any given market price. Conversely, a shift in costs of production that decreases marginal costs at all levels of output will shift MC downward and to the right and as a result, a competitive firm will choose to expand its level of output at any given price.

8.3 Entry and Exit Decisions in the Long Run

It is impossible to precisely define the line between the short run and the long run with a stopwatch, or even with a calendar. It varies according to the specific business. Therefore, the distinction between the short run and the long run is more technical: in the short run, firms cannot change the usage of fixed inputs, while in the long run, the firm can adjust all factors of production.

In a competitive market, profits are a red cape that incites businesses to charge. If a business is making a profit in the short run, it has an incentive to expand existing factories or to build new ones. New firms may start production, as well. When new firms enter the industry in response to increased industry profits it is called **entry**.

Losses are the black thundercloud that causes businesses to flee. If a business is making losses in the short run, it will either keep limping along or just shut down, depending on whether its revenues are covering its variable costs. But in the long run, firms that are facing losses will cease production altogether. The long-run process of reducing production in response to a sustained pattern of losses is called **exit**. The following Clear It Up feature discusses where some of these losses might come from, and the reasons why some firms go out of business.

How Entry and Exit Lead to Zero Profits in the Long Run

No perfectly competitive firm acting alone can affect the market price. However, the combination of many firms entering or exiting the market will affect overall supply in the market. In turn, a shift in supply for the market as a whole will affect the market price. Entry and exit to and from the market are the driving forces behind a process that, in the long run, pushes the price down to minimum average total costs so that all firms are earning a zero profit.

To understand how short-run profits for a perfectly competitive firm will evaporate in the long run, imagine the following situation. The market is in **long-run equilibrium**, where all firms earn

zero economic profits producing the output level where P = MR = MC and P = AC. No firm has the incentive to enter or leave the market. Let's say that the product's demand increases, and with that, the market price goes up. The existing firms in the industry are now facing a higher price than before, so they will increase production to the new output level where P = MR = MC.

This will temporarily make the market price rise above the minimum point on the average cost curve, and therefore, the existing firms in the market will now be earning economic profits. However, these economic profits attract other firms to enter the market. Entry of many new firms causes the market supply curve to shift to the right. As the supply curve shifts to the right, the market price starts decreasing, and with that, economic profits fall for new and existing firms. As long as there are still profits in the market, entry will continue to shift supply to the right. This will stop whenever the market price is driven down to the zero-profit level, where no firm is earning economic profits.

Short-run losses will fade away by reversing this process. Say that the market is in long-run equilibrium. This time, instead, demand decreases, and with that, the market price starts falling. The existing firms in the industry are now facing a lower price than before, and as it will be below the average cost curve, they will now be making economic losses. Some firms will continue producing where the new P = MR = MC, as long as they are able to cover their average variable costs. Some firms will have to shut down immediately as they will not be able to cover their average variable costs, and will then only incur their fixed costs, minimizing their losses. Exit of many firms causes the market supply curve to shift to the left. As the supply curve shifts to the left, the market price starts rising, and economic losses start to be lower. This process ends whenever the market price rises to the zero-profit level, where the existing firms are no longer losing money and are at zero profits again. Thus, while a perfectly competitive firm can earn profits in the short run, in the long run the process of entry will push down prices until they reach the zero-profit level. Conversely, while a perfectly competitive firm may earn losses in the short run, firms will not continually lose money. In the long run, firms making losses are able to escape from their fixed costs, and their exit from the market will push the price back up to the zero-profit level. In the long run, this process of entry and exit will drive the price in perfectly competitive markets to the zero-profit point at the bottom of the AC curve, where marginal cost crosses average cost.

The Long-Run Adjustment and Industry Types

Whenever there are expansions in an industry, costs of production for the existing and new firms could either stay the same, increase, or even decrease. Therefore, we can categorize an industry as being (1) a constant-cost industry (as demand increases, the cost of production for firms stays the same), (2) an increasing-cost industry (as demand increases, the cost of production for firms increases), or (3) a decreasing-cost industry (as demand increases the costs of production for the firms decreases).

For a constant-cost industry, whenever there is an increase in market demand and price, then the supply curve shifts to the right with new firms' entry and stops at the point where the new long-run equilibrium intersects at the same market price as before. This is the case of constant

returns to scale, which we discussed earlier in the chapter on Production, Costs, and Industry Structure. However, why will costs remain the same? In this type of industry, the supply curve is very elastic. Firms can easily supply any quantity that consumers demand. In addition, there is a perfectly elastic supply of inputs—firms can easily increase their demand for employees, for example, with no increase to wages. An increased demand for ethanol in recent years has caused the demand for corn to increase. Consequently, many farmers switched from growing wheat to growing corn. Agricultural markets are generally good examples of constant-cost industries.

For an increasing-cost industry, as the market expands, the old and new firms experience increases in their costs of production, which makes the new zero-profit level intersect at a higher price than before. Here companies may have to deal with limited inputs, such as skilled labor. As the demand for these workers rises, wages rise and this increases the cost of production for all firms. The industry supply curve in this type of industry is more inelastic.
For a decreasing-cost industry, as the market expands, the old and new firms experience lower costs of production, which makes the new zero-profit level intersect at a lower price than before. In this case, the industry and all the firms in it are experiencing falling average total costs. This can be due to an improvement in technology in the entire industry or an increase in the education of employees. High-tech industries may be a good example of a decreasing-cost market.

8.4 Efficiency in Perfectly Competitive Markets

When profit-maximizing firms in perfectly competitive markets combine with utility-maximizing consumers, something remarkable happens: the resulting quantities of outputs of goods and services demonstrate both productive and allocative efficiency (terms that we first introduced in (Choice in a World of Scarcity) .

Productive efficiency means producing without waste, so that the choice is on the production possibility frontier. In the long run in a perfectly competitive market, because of the process of entry and exit, the price in the market is equal to the minimum of the long-run average cost curve. In other words, firms produce and sell goods at the lowest possible average cost.

Allocative efficiency means that among the points on the production possibility frontier, the chosen point is socially preferred—at least in a particular and specific sense. In a perfectly competitive market, price will be equal to the marginal cost of production. Think about the price that one pays for a good as a measure of the social benefit one receives for that good; after all, willingness to pay conveys what the good is worth to a buyer. Then think about the marginal cost of producing the good as representing not just the cost for the firm, but more broadly as the social cost of producing that good. When perfectly competitive firms follow the rule that profits are maximized by producing at the quantity where price is equal to marginal cost, they are thus ensuring that the social benefits they receive from producing a good are in line with the social costs of production.

To explore what economists mean by allocative efficiency, it is useful to walk through an example. Begin by assuming that the market for wholesale flowers is perfectly competitive, and so P = MC. Now, consider what it would mean if firms in that market produced a lesser quantity of flowers. At a lesser quantity, marginal costs will not yet have increased as much, so that price will exceed marginal cost; that is, P > MC. In that situation, the benefit to society as a whole of producing additional goods, as measured by the willingness of consumers to pay for marginal units of a good, would be higher than the cost of the inputs of labor and physical capital needed to produce the marginal good. In other words, the gains to society as a whole from producing additional marginal units will be greater than the costs.

Conversely, consider what it would mean if, compared to the level of output at the allocatively efficient choice when P = MC, firms produced a greater quantity of flowers. At a greater quantity, marginal costs of production will have increased so that P < MC. In that case, the marginal costs of producing additional flowers is greater than the benefit to society as measured by what people are willing to pay. For society as a whole, since the costs are outstripping the benefits, it will make sense to produce a lower quantity of such goods.

When perfectly competitive firms maximize their profits by producing the quantity where P = MC, they also assure that the benefits to consumers of what they are buying, as measured by the price they are willing to pay, is equal to the costs to society of producing the marginal units, as measured by the marginal costs the firm must pay—and thus that allocative efficiency holds.

We should view the statements that a perfectly competitive market in the long run will feature both productive and allocative efficiency with a degree of skepticism about its truth. Remember, economists are using the concept of "efficiency" in a particular and specific sense, not as a synonym for "desirable in every way." For one thing, consumers' ability to pay reflects the income distribution in a particular society. For example, a person with a low income may not be able to purchase their own car because they have insufficient income.

Perfect competition, in the long run, is a hypothetical benchmark. For market structures such as monopoly, monopolistic competition, and oligopoly, which are more frequently observed in the real world than perfect competition, firms will not always produce at the minimum of average cost, nor will they always set price equal to marginal cost. Thus, these other competitive situations will not produce productive and allocative efficiency.

Moreover, real-world markets include many issues that are assumed away in the model of perfect competition, including pollution, inventions of new technology, poverty which may make some people unable to pay for basic necessities of life, government programs like national defense or education, discrimination in labor markets, and buyers and sellers who must deal with imperfect and unclear information. We explore these issues in other chapters. However, the theoretical efficiency of perfect competition does provide a useful benchmark for comparing the issues that arise from these real-world problems.