

3

Show Me the Money

The Law of Supply

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- 3.1 Explain why marginal costs are ultimately opportunity costs.
- 3.2 Define sunk costs and explain why they do not influence smart, forward-looking decisions.
- 3.3 Explain the law of supply and describe the roles of higher profits and higher marginal opportunity costs of production.
- 3.4 Explain the difference between a change in quantity supplied and a change in supply, and list six factors that change supply.



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MONEY IS THE MARKET'S REWARD

to individuals or businesses who give up something of value. Your boss rewards you with an hourly wage for supplying labour services. A business producing a top-selling product is rewarded with profits (as long as revenues are greater than costs).

What goes into decisions to sell or supply services or products to the market? What price do you need to get to be willing to work? How much money does it take before a business is willing to supply?

This chapter focuses on choices businesses make every day in producing and selling. Economists use the term *supply* to summarize all of the influences on business decisions. You will learn about influences that change business supply, which include new technologies like noodle-slicing robots!

Business decisions seem more “objective” than consumer decisions that seem to be based on “subjective” desires and preferences. After all, there is a bottom line in business with prices, costs, and profits. But business supply decisions are not as straightforward or objective as you might think.

3.1

What Does It Really Cost? Costs Are Opportunity Costs

Explain why marginal costs are ultimately opportunity costs.



Supply, like demand, starts with decision makers choosing among alternative opportunities by comparing expected benefits and costs at the margin.

How Much to Work?

It's Sunday night and your boss calls in a panic, begging you to work as many hours as possible next week. You normally work 10 hours a week, but the extra money would come in handy. The timing, however, couldn't be worse. You have two midterms the following week, and your out-of-town best friend is coming in next weekend for the only visit you will have in six months. How many hours then are you willing to work?

Of course you will make a smart choice, weighing the additional benefits and costs of working extra hours. The additional, or marginal, benefits are the \$15 per hour you earn. The additional costs are opportunity costs — the alternative uses of the time you have to give up.

You want to attend all your classes, keep time for studying for midterms, and definitely keep the weekend free. You are willing to give up the 10 hours a week you spend playing *World of Warcraft*. When your boss hears you are willing to work only a total of 20 hours, while she is hoping for 60 hours, she instantly replies, “What if I pay you double time for all your hours next week?”

Well, that changes things. At \$30 per hour, you will willingly give up your game time, skip a few classes where you are not having a test, but still keep the weekend free. You are up to 35 hours of work, but your boss is totally desperate and asks again, “What if I pay you triple time?”

At that price, you will also cut back on your sleep, reduce your study time, and try to reschedule your weekend visit. (Is the visit worth giving up \$700 for a weekend's work?) Your boss relaxes a bit when you promise 55 hours.

Notice that the quantity of work or time that you are willing to supply to your boss increases as the price she is willing to pay you rises. In order to get you to switch more of your time from alternative uses, she has to offer you more money (which increases her costs).

For your supply decision, there are always alternative uses of your time, and each use has a different cost to you. Your game time is worth the least to you, the weekend time the most. Your willingness to work changes with circumstances, depending on the price offered and the opportunity cost — the value you place on alternative uses of your time.

Marginal Cost The economist's term for the additional opportunity cost of alternative uses of your time is **marginal cost** — the additional opportunity cost of increasing the quantity of whatever is being supplied. For you, the opportunity cost, or marginal cost, of an hour of game time is less than the opportunity cost, or marginal cost, of an hour of weekend time. As you shift your time away from alternative uses to work, *the marginal cost of your time increases*. You give up the least valuable time first, and continue giving up increasingly valuable time as the price you are offered rises.

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Your willingness to work depends on the price offered and on the opportunity costs of alternative uses of your time.

marginal cost additional opportunity cost of increasing quantity supplied, changing with circumstances

How Demand and Supply Choices Are Similar There are similarities between the demand choices from Chapter 2 and your supply choices.

As a demander, think about products or services you might buy. There are always substitutes available, which is why consumers buy less of a product or service as the price rises — we all switch to cheaper alternatives. Willingness to pay depends on available substitutes and changes with circumstances — the marginal benefit of the first bottle of Gatorade is greater than the marginal benefit of the second bottle.

As a supplier, think about the number of hours you might work. There are always alternative uses of your time, with different values to you. Willingness to supply hours depends on those alternatives and changes with circumstances — the opportunity cost of giving up your gaming hours is less than the opportunity cost of giving up your weekend hours with your best friend. That is one reason why suppliers supply more as the price rises — higher prices are necessary to compensate for the higher opportunity costs as you give up additional time (or other resources).

How Demand and Supply Choices Are Different There are also important differences between smart demand and smart supply choices.

As a demander buying products and services, marginal benefit — the maximum you are willing to pay — decreases as you buy more. As a supplier of labour hours or other resources, marginal cost — the minimum you need to be paid — increases as you supply more.

For demand and supply, the comparison of benefits and costs is also reversed. As a demander of products and services, marginal benefit is your subjective satisfaction, and marginal cost is measured in dollars — the price you must pay. As a supplier of labour, marginal benefit is measured in dollars — the hourly wage rate you earn — and marginal cost is an opportunity cost, the value of alternative uses of the time that you must give up.

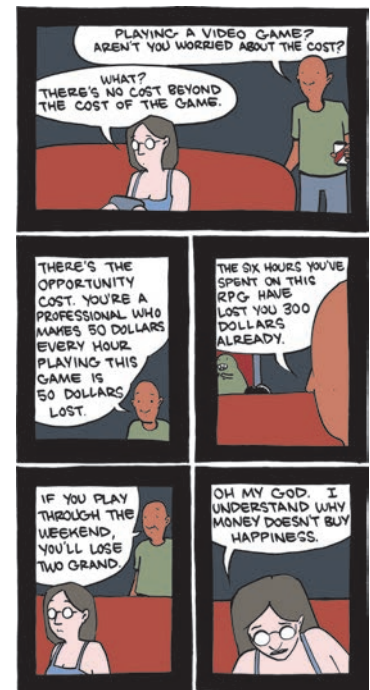
What Do Inputs Really Cost?

Any business supply decision involves the same smart choice between marginal benefit and marginal cost as your work decision. The marginal benefit or reward from selling is measured in the dollar price you receive, and all marginal costs are ultimately opportunity costs.

Let's look at a business: Paola's Parlour for Piercing and Nails. To supply her services to the market, Paola, like any businessperson, has to buy inputs (studs, tools, polish), pay rent to her landlord, and pay wages to her employees. What do those hard dollar actual costs have to do with opportunity costs? Which costs are *real* costs?

Take the nickel studs Paola buys for \$1 each from a stud supplier. If the world price of nickel rises because of increasing demand from China for the metal, Paola has to pay more for her studs. The stud supplier will sell to Paola only as long as she pays as much as the best price he can get from another customer, whether in China or Canada. Paola's stud cost has to cover the opportunity cost of the stud supplier.

The same goes for Paola's rent or the wages she pays to her employees. If Paola's landlord finds another tenant willing to pay more for the shop space, then once Paola's lease is up, she has to pay that higher amount or the landlord will rent to the other tenant. If Paola's employees, like you, have alternative uses of their time that they value more than what she pays, or if they can get job offers elsewhere at higher wages, Paola has to match the offers or start advertising for help wanted.



Zach Weiner

▲ There are always alternative uses of your time. You must decide how much your game time is worth to you.



▲ Paola's inputs include studs, polish and labour. Like all businesspeople, Paola must pay an input owners at least the best alternative price the input owner can get.

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The marginal cost a business pays for an input is ultimately an opportunity cost, the value of the best alternative use of that input.

Marginal Costs Are Ultimately Opportunity Costs To hire or buy inputs, a business must pay a price matching the best opportunity cost of the input owner. The real cost of any input is determined by the best alternative use of that input. All marginal costs are ultimately opportunity costs. Marginal costs can be measured in dollars, but they are an opportunity cost — the value of the best alternative use of that input.

As we will see in the next section, Paola's smart business supply decisions depend on whether the price (the marginal benefit) she receives for a piercing is greater than her marginal opportunity costs.

Refresh 3.1

MyEconLab

For answers to these Refresh Questions, visit MyEconLab.

1. Explain why marginal costs are ultimately opportunity costs.
2. In 2013, Microsoft released a limited supply of Xbox Ones with a list price of \$500. The units immediately started selling on eBay and other online auction websites for far more than \$500. What factors determined that increase in price of an Xbox One?
3. During a recession, it is much harder for workers to find better-paying jobs. Explain how a recession might affect Paola's labour costs.

3.2

Forget It, It's History: Sunk Costs Don't Matter for Future Choices

Define sunk costs and explain why they do not influence smart, forward-looking decisions.

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Past expenses are not marginal opportunity costs and have no influence on smart choices.

Paola bases her business supply decisions on her costs, which are ultimately opportunity costs. But some expenses are not opportunity costs. This is another part of supply decisions that is not as straightforward as you might think.

Past expenses that cannot be reversed or recovered are *not* opportunity costs. If Paola has signed a year's lease for her rent that she cannot get out of, then her rent becomes irrelevant for her future decisions. How can that be?

Paola's or your decisions are always forward looking. A smart decision about which fork in the road to take compares the expected future benefits and the expected future costs of each path. When Paola has to decide whether to supply more piercings or fingernail sets, or to choose between buying new tools or hiring more employees, the rent expense is the same, so its influence cancels out. The past expense of rent paid (or legally contracted for) is the same for either fork Paola chooses, so it shouldn't influence her decision.

These irreversible costs are called **sunk costs** — past, already-paid expenses that cannot be recovered. In other words, they are history — they can't be changed. Decisions that have already been made and can't be changed don't matter for forward-looking economic decisions.

Suppose you paid your tuition for this semester, and the refund date has passed. Your boss's request for extra hours comes at a time when you are finding it hard to balance work and school, and you are considering dropping out.

sunk costs past expenses that cannot be recovered

Your decision to drop out and work full-time (making your boss very happy), versus staying in school, depends on how you evaluate the expected benefits and costs of each fork in your career road. Dropping out and working more means more income right away, while staying in school means less income now but probably more in the future. (We will look at data connecting education and income in Chapter 12.) The tuition you paid is history. You can't get it back no matter which fork you choose — staying in school or dropping out — so it is not part of the opportunity costs of either choice.



Refresh 3.2

1. Why aren't sunk costs part of the opportunity costs of forward-looking decisions?
2. If you bought a \$100 textbook for a course, and then dropped out after the tuition refund date, is that \$100 a sunk cost? Explain your answer.
3. Suppose you have just paid your bus fare. A friend in a car pulls up and offers you a ride. Explain how you would decide between staying on the bus or taking the ride, and the influence of the paid fare on your choice.

MyEconLab

For answers to these Refresh Questions, visit MyEconLab.

More for More Money: The Law of Supply

3.3

Demand is not just what you want. It is your willingness and ability to pay for a product or service — putting your money where your mouth is. Similarly, the economist's idea of supply is not just offering things for sale. **Supply** is the overall willingness of businesses (or individuals) to sell a particular product or service because the price covers all opportunity costs of production.

Explain the law of supply, and describe the roles of higher profits and higher marginal opportunity costs of production.

Quantity Supplied

Let's look at how an economist would describe your supply decision about how many hours to work at your part-time job. Figure 3.1 combines price information — the lowest wage you are willing to accept — and the quantity of work you will supply at each wage.

supply businesses' willingness to produce a particular product or service because price covers all opportunity costs

Figure 3.1 Your Supply of Hours Worked

Price (minimum willing to accept per hour)	Quantity Supplied (hours of work at that price)
\$15	10 – 20
\$30	35
\$45	55

At a price of \$15 per hour, your quantity supplied of work could be anywhere between 10 and 20 hours. At \$30 per hour, your quantity supplied of work is 35 hours, and at \$45 per hour, your quantity supplied is 55 hours.

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Rising prices create two incentives for increased quantity supplied — higher profits and covering higher marginal opportunity costs of production.

quantity supplied the quantity you actually plan to supply at a given price

As your eye goes down the columns in Figure 3.1, note that as the price rises, the quantity supplied increases. (What happens to quantity demanded as price rises?) In general, when prices rise, individuals and businesses devote more of their time or resources to producing or supplying — more money stimulates more quantity supplied. The two reasons for this are the desire for profits (higher prices usually mean higher profits) and the need for a higher price to cover higher marginal opportunity costs — your weekend time is worth more to you than your *World of Warcraft* time.

Quantity supplied, as we will see, is not the same as supply. **Quantity supplied** is a more limited concept — the quantity you actually plan to supply at a given price, taking into account everything that affects your willingness to supply work hours.

Let's take the economist's idea of supply and apply it to Paola's willingness to supply a particular quantity of piercings at a particular price.

Body Piercings or Nail Sets?



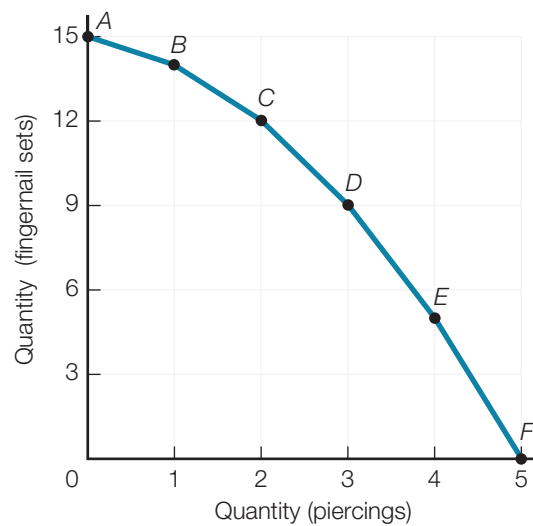
Businesses, like consumers, make smart choices based on Key 1 — Choose only when additional benefits are greater than additional *opportunity costs*.

Paola's first choice is *what to produce* with her resources — the labour and equipment she has in her shop. She can do body piercing, and she can also paint fingernails. Let's limit her choices to full body piercings and full sets of fingernails to allow the simple, made-up numbers below.

Paola's Parlour has special tools for piercing and for nail painting. There are four people working (including Paola). All four are equally skilled at piercing (the business started with just piercing), but their fingernail skills differ from expert (Paola) to beginner (Parminder). The table in Figure 3.2 shows the different combinations of fingernail sets and piercings that Paola's Parlour can produce in a day.

Figure 3.2 Paola's Parlour Production Possibilities Frontier

Combination	Fingernails (full sets)	Piercings (full body)
A	15	0
B	14	1
C	12	2
D	9	3
E	5	4
F	0	5



At one extreme (combination *A*) all four workers do fingernails only, so they produce 15 fingernail sets and no piercings. If Paola starts shifting some staff from fingernails to piercings, she moves to combination *B* (14 fingernail sets and 1 full body piercing). Shifting more staff and equipment out of fingernails and into piercing gives combination *C* (12 fingernail sets and 2 piercings), and then combinations *D* (9 fingernail sets and 3 piercings) and *E* (5 fingernail sets and 4 piercings). Combination *F* is the other extreme, where the Paola's Parlour produces only piercings — 5 piercings and 0 fingernail sets. As you will see, the pattern of numbers in the table in Figure 3.2 has a lot to do with differences in fingernail painting skills.

Paola's Parlour's Production Possibilities Frontier We can graph the table of numbers in Figure 3.2 as Paola's production possibilities frontier (*PPF*). The graph in Figure 3.2 shows Paola's Parlour's *PPF*, with daily output of piercings measured on the horizontal axis, and daily output of fingernail sets measured on the vertical axis. Each point (*A* – *F*) on the frontier corresponds to a combination in the table.

Increasing Marginal Opportunity Costs

The numbers and graph in Figure 3.2 don't make much business sense — they are just maximum possible combinations of piercings and nail sets that Paola's Parlour can produce. To use the numbers for Paola's business supply decisions, we must translate them into marginal costs. (And eventually into profits in Chapter 8.)

Remember that costs are ultimately opportunity costs. The cost of acquiring or producing products or services is the value of the best alternative opportunity we must give up to get them. To get more piercings, Paola gives up doing nail sets. Opportunity cost is what we give up divided by what we get:

$$\text{Opportunity Cost} = \frac{\text{Give up}}{\text{Get}}$$

Figure 3.3 (on the next page) shows, in the last column, the marginal opportunity costs to Paola of producing more piercings.

Figure 3.3 Paola's Parlour's Marginal Opportunity Costs

Combination	Fingernails (full sets)	Piercings (full body)	Marginal Opportunity Cost of Producing More Piercings (fingernail sets given up)
A	15	0	$\frac{(15 - 14)}{1} = 1$
B	14	1	$\frac{(14 - 12)}{1} = 2$
C	12	2	$\frac{(12 - 9)}{1} = 3$
D	9	3	$\frac{(9 - 5)}{1} = 4$
E	5	4	$\frac{(5 - 0)}{1} = 5$
F	0	5	

What is the marginal opportunity cost of producing the first piercing? To move from 0 to 1 piercing (from combination A to B), Paola gives up 1 fingernail set, because fingernail production drops from 15 to 14 sets as some staff time switches from fingernails to piercing. In exchange, she gets 1 piercing. So substituting into the formula, the marginal opportunity cost of the first piercing is

$$\frac{1 \text{ fingernail set}}{1 \text{ piercing}} = 1 \text{ fingernail set per piercing}$$

To produce a second piercing (moving from combination B to C), Paola gives up 2 fingernail sets (14 - 12 sets). The marginal opportunity cost of the second additional piercing is 2 fingernail sets given up per piercing. The third piercing (moving from combination C to D) has a marginal opportunity cost of 3 fingernail sets given up (12 - 9 sets) per piercing. In moving the last of her staff to piercing, for the fifth piercing she gives up 5 fingernail sets (5 - 0 sets). The marginal opportunity cost of the last additional piercing — the fifth — is 5 fingernail sets given up per piercing.

Opportunity Costs Are Marginal Costs If you are wondering what the difference is between opportunity cost, marginal cost, and marginal opportunity cost — since they seem like the same thing — good for you! You are not confused, you're right. *All opportunity costs are marginal costs, and all marginal costs are opportunity costs.*

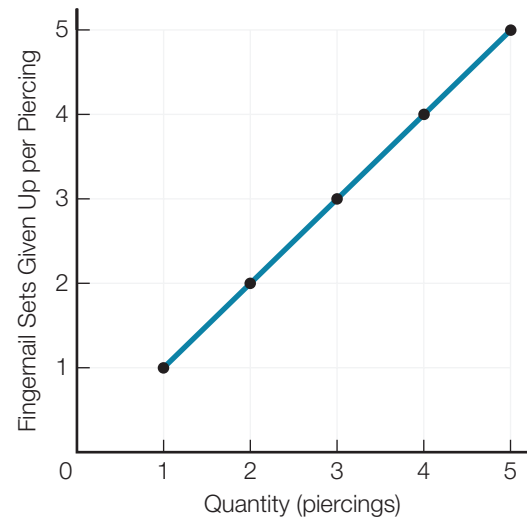
Opportunity cost and marginal cost are two sides of the same coin. Opportunity cost focuses on the value of the opportunity *given up* when you make a decision. On the flip side, marginal cost focuses on the *additional cost* of that decision. Paola must give up 5 fingernail sets in deciding to produce the fifth piercing. So the marginal opportunity cost of the fifth piercing is 5 fingernail sets. **Marginal opportunity cost** is the complete term for any cost relevant to a smart decision. We will usually use the shorter name — *marginal cost* — when describing supply decisions.

Figure 3.4a begins to illustrate the economic sense of these numbers. The numbers in the table for marginal opportunity costs and quantity of piercings come from Figure 3.3 (columns 4 and 3). Each point on the graph in Figure 3.4a shows the marginal opportunity cost measured in fingernail sets given up per piercing (along the vertical axis) for each quantity of piercings supplied (along the horizontal axis).

marginal opportunity cost
complete term for any cost relevant to a smart decision

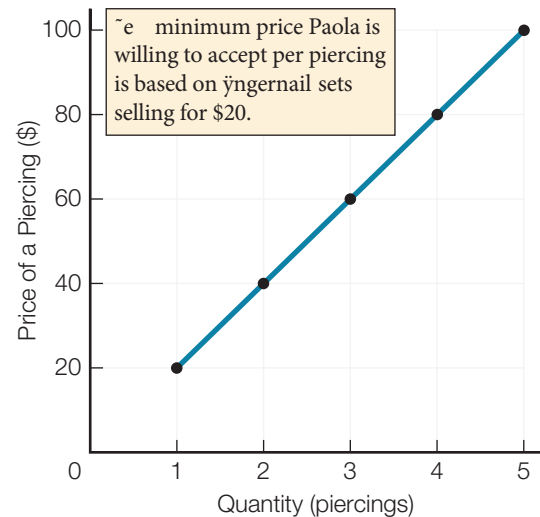
Figure 3.4 Increasing Marginal Opportunity Cost

Marginal Opportunity Cost of Additional Piercings (fingernail sets given up)	Quantity Supplied (piercings)
1	1
2	2
3	3
4	4
5	5



a) Marginal Opportunity Cost of Additional Piercings Measured in Fingernail Sets

Price (marginal opportunity cost or minimum willing to accept per piercing)	Quantity Supplied (piercings)
\$ 20	1
\$ 40	2
\$ 60	3
\$ 80	4
\$100	5



b) Marginal Opportunity Cost of Additional Piercings Measured in \$

Note in Figure 3.4a that as Paola increases her quantity supplied of piercings, her marginal opportunity costs increase, from 1 fingernail set given up for the first piercing to 5 fingernail sets given up for the fifth piercing. This is the same pattern in the decision to shift your time away from alternative uses to work more hours — the marginal cost of additional time given up increases as you give up increasingly more valuable uses of your time.

Paying for Opportunity Costs So far, the numbers in Paola's example are measured in piercings or fingernail sets. But Paola, as a profit-seeking entrepreneur, wants to make a smart supply decision based on dollar prices. Luckily, it is easy to convert body decorations to dollars. Suppose that fingernail full sets sell for \$20. Then the marginal opportunity costs for supplying additional piercings appear in the table in Figure 3.4b on the previous page.

The marginal opportunity cost of producing and supplying the first piercing is \$20 (the cost of 1 nail set given up); of the second piercing, \$40 (2 nail sets given up); all the way up to \$100 for the fifth piercing. So for Paola to be willing to supply 1 piercing, she needs to receive a price of at least \$20 to cover the costs of the alternative use of her inputs. To continue to supply more piercings, she needs to receive higher prices to cover her higher marginal opportunity costs. Paola won't supply the fifth piercing unless she receives at least \$100 for it, because that is what she would be giving up from the best alternative use of her inputs (5 fingernail sets at \$20 each).

The graph in Figure 3.4b shows, for each quantity of piercings supplied (along the horizontal axis), the minimum price Paola will accept to cover her increasing marginal opportunity costs (along the vertical axis). Because of increasing marginal opportunity costs, the minimum price rises as Paola's quantity supplied increases.

Why Marginal Opportunity Costs Increase Are the reasons for Paola's increasing marginal opportunity costs the same as for your work decision? And is there a connection between the increasing marginal opportunity costs of Paola's curved-shaped *PPF*, compared to the straight-line *PPFs* in Chapter 1 for Jill and Marie making bread and wood?

The answers to these important questions come from differences among inputs to production. Paola's increasing marginal opportunity costs arise because her staff and equipment are not equally good at piercing and painting. Paola is better (more productive) at doing fingernails than is Parminder, and the tools can't be easily switched between tasks — nail-polish brushes and emery boards aren't much help in piercing.

These differences in productivity cause increasing marginal opportunity costs. Think about Paola as she decides to reduce fingernail output and produce the first piercing. Remember that all staff are equally skilled at piercing. Who will she switch first to piercing? As an economizer, she will switch the person who is least productive for fingernails — Parminder. So her given up, or forgone, fingernail production is small (1 set). To increase piercing output more, she has to then switch staff who are slightly better at doing fingernails, so the opportunity cost is higher (2 fingernail sets). And who is the last person she switches when moving entirely to piercing? Of course, it is Paola herself — the best nail painter — so the opportunity cost of that fifth piercing is the highest, at 5 fingernail sets given up.

Increasing marginal opportunity costs arise because inputs are not equally productive in all activities. There are always opportunity costs in switching between activities because time spent on piercing can no longer be spent on fingernails. But *increasing* opportunity costs arise because of the differing skill levels of the staff being switched.

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Increasing marginal opportunity costs arise because inputs are not equally productive in all activities.

The reasons for Paola’s increasing marginal opportunity costs are not quite the same as the reasons for your decision to supply more work hours as the price rises, but there is much in common. For your work decision, increasing marginal opportunity costs arise from differences in the value of alternative uses of your time (from gaming to weekend fun). For Paola’s decision to supply additional piercings, increasing marginal opportunity costs arise from differences in employee skill levels and equipment in producing alternative services. The common reason is alternative uses (of time or inputs) with increasing opportunity costs.

When Marginal Opportunity Costs Are Constant If all of Paola’s staff and equipment were equally good at piercing and fingernail painting, the opportunity costs would always be the same, no matter what combinations of piercings and fingernails she produced.

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Marginal opportunity costs are constant when inputs are equally productive in all activities.

The *PPF* examples of Jill and Marie in Chapter 1 have such constant marginal opportunity costs. Jill’s straight line *PPF* means that as she switches between combinations of bread and wood, her marginal opportunity costs do not change. Jill’s skills don’t change as she switches between making bread and chopping wood. All that changes is the amount of time she spends on each task. The same is true for Marie. While Marie’s skills and abilities differ from Jill’s, Marie’s skills don’t change as she switches her time between tasks. For each person, marginal opportunity costs are constant as she switches between combinations of bread and wood.

In the real world, marginal opportunity costs may be increasing or constant. We will examine both cases in Chapter 9. Most businesses have inputs that are *not* equally productive in all activities, and so have increasing marginal opportunity costs. That is the case we will focus on here.

The Law of Supply

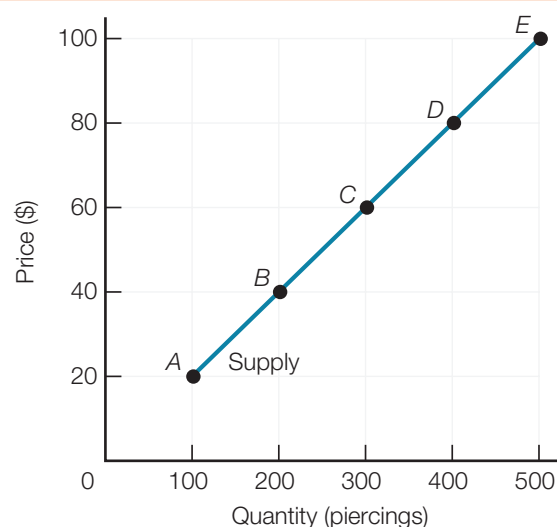
Just as you are willing to supply more hours of work only if the price you are paid rises, Paola’s business must receive a higher price to be willing to supply a greater quantity to the market. She needs the higher price to cover her increasing marginal opportunity costs as she increases production.

Market supply is the sum of the supplies of all businesses willing to produce a particular product or service. Suppose there are 100 piercing businesses just like Paola’s. The market supply of piercings is the sum of the supplies of all piercing businesses, and looks like the table in Figure 3.5.

market supply sum of supplies of all businesses willing to produce a particular product or service

Figure 3.5 Market Supply of Piercings

Row	Price (marginal opportunity cost or minimum willing to accept per piercings)	Quantity Supplied (piercings)
A	\$ 20	100
B	\$ 40	200
C	\$ 60	300
D	\$ 80	400
E	\$100	500



law of supply if the price of a product or service rises, quantity supplied increases

The positive relationship between price and quantity supplied (both go up together) is so universal that economists call it the **law of supply**: If the price of a product or service rises, the quantity supplied increases. Higher prices create incentives for increased production through higher profits and by covering higher marginal opportunity costs of production.

The law of supply works as long as other factors besides price do not change. Section 3.4 explores what happens when other factors do change.

Supply Curve of Piercings In Figure 3.5 on the previous page, if you take the combinations of prices and quantity supplied from the table and graph them, you get the upward-sloping supply curve.

For example, when the price of a piercing is \$20, the quantity supplied by all businesses is 100 piercings (point A). When the price is \$100, the quantity supplied is 500 (point E). Other points on the supply curve show the quantities supplied for prices between \$20 and \$100.

We draw the market supply curve for piercings by plotting these combinations on a graph that has *quantity* on the horizontal axis and *price* on the vertical axis. The points labelled A to E correspond to the rows of the table.

A **supply curve** shows the relationship between price and quantity supplied, when all other influences on supply besides price do not change.

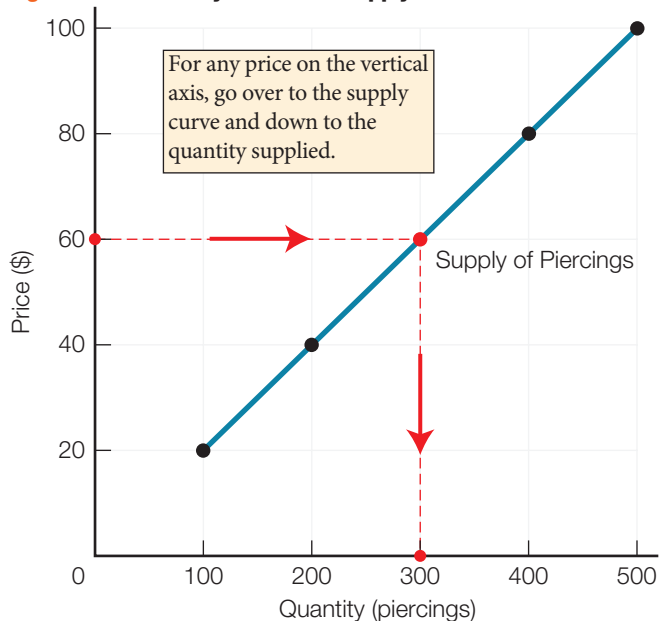
supply curve shows relationship between price and quantity supplied, other things remaining the same

Two Ways to Read a Supply Curve

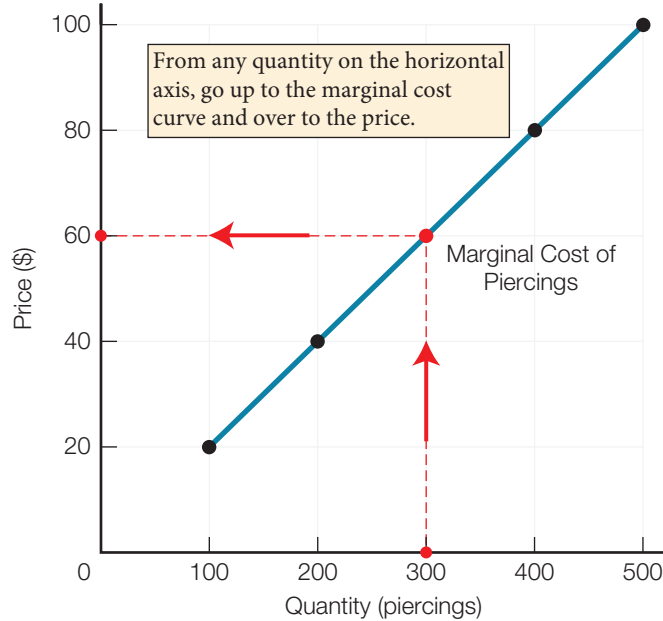
The supply curve shows graphically the relationship between price and quantity supplied, when all other influences on supply do not change. The supply curve is a simple yet powerful tool summarizing the two forces determining quantity supplied — the desire for higher profits and the need to cover increasing marginal opportunity costs of production.

Because there are two forces determining quantity supplied, there are two ways to “read” a supply curve — as a supply curve and as a marginal cost curve. Both readings are correct, but each highlights a different force. You can see the two readings in Figures 3.6a and 3.6b.

Figure 3.6 Two Ways to Read a Supply Curve



a) Reading the Supply Curve as a Supply Curve



b) Reading the Supply Curve as a Marginal Cost Curve

Supply Curve To read Figure 3.6a as a supply curve, start with price. For any price, the supply curve tells you the quantity businesses are willing to supply. For example, start with the price of \$60 on the vertical axis (Price). To find quantity supplied at \$60, trace a line from the \$60 price over to the supply curve and then down to the horizontal axis (Quantity) to read the quantity supplied, which is 300 piercings per day. You can do the same for any price — from any price, go over to the supply curve and then down to read the corresponding quantity supplied.

To think about how a price rise from \$60 to \$80 increases the quantity businesses are willing to supply, for each price, go over to the supply curve and then down to the quantity supplied. The rise in price of \$20 increases quantity supplied by 100 piercings per day (400 – 300).

Marginal Cost Curve To read Figure 3.6b as a marginal cost curve, start with quantity. For any quantity, the marginal cost curve tells you the minimum price businesses will accept that covers all marginal opportunity costs of production. Start with the quantity 300 piercings on the horizontal axis (Quantity). To find the minimum price businesses will accept to produce the 300th piercing, trace a line up to the marginal cost curve and over to the vertical (Price) axis to read the price, which is \$60. You can do the same for any quantity — from any quantity, go up to the marginal cost curve and then over to read the corresponding price, which is the minimum price businesses will accept for that last piercing.

To think about how an increase in quantity supplied from 300 to 400 piercings increases marginal opportunity cost and the minimum price businesses will accept, for each quantity, go up to the marginal cost curve and then over to the price. Sixty dollars is the lowest price a business will accept for the 300th piercing, and \$80 is the lowest price someone will accept for the 400th piercing. The increase in quantity of 100 units causes an increase in marginal opportunity cost of \$20 per unit (\$80 – \$60).

The Supply Curve Is Also a Marginal Cost Curve You read a supply curve over and down. You read a marginal cost curve up and over. While the supply curve has a double identity both as a supply curve and as a marginal cost curve, we generally refer to it as a supply curve. Sometimes, though, the marginal cost reading makes it easier to understand smart choices.

Both readings are movements along an unchanged supply curve. But what about the other influences on supply that we have been keeping constant? What happens if they change? The two ways to read a supply curve will help you answer that question.

Refresh 3.3

1. Explain why Paola needs a higher price to be willing to supply more piercings.
2. If you could spend the next hour studying economics or working at your part-time job, which pays \$11 an hour, what is your personal opportunity cost, in dollars, of studying?
3. Suppose Paola's Parlour was producing only piercings and no fingernail sets. If Paola wanted to start producing some fingernail sets, which staff person should she switch to fingernails first? Who should she switch last? Explain your answers.

MyEconLab

For answers to these Refresh Questions, visit MyEconLab.

3.4

Changing the Bottom Line: What Can Change Supply?

Explain the difference between a change in quantity supplied and a change in supply, and list five factors that change supply.

The average price of an ultrabook computer in Canada fell from around \$2000 in 2010 to under \$800 in 2013. But the quantity of ultrabook computers businesses sold *increased*.

Does that contradict the “law of supply”?

If nothing else changed except the price of ultrabooks, the answer would be yes. Why would ultrabook producers be willing to supply more ultrabooks at lower prices? Something is not right. But like evidence that appears to disprove the law of demand, a fall in price that increases quantity supplied is a signal that something else must have changed at the same time.

Economists use the term *supply* to summarize all of the influences on business decisions. In the examples of your work decision or Paola’s piercings, that willingness to supply depends on the value of alternative uses of time or inputs and on marginal opportunity costs.

As long as these factors (and some others that we are about to look at) do not change, the law of supply holds true: If the price of a product or service rises, quantity supplied increases.

But change happens, and economists distinguish two kinds of change:

- If the price of a product or service changes, that affects *quantity supplied*. This is represented graphically by moving along an unchanged supply curve.
- If anything else changes, that affects *supply*. This is represented graphically by a shift of the entire supply curve.

This distinction is the same as the distinction in Chapter 2 between quantity demanded and demand.

Economics Out There

Uncorking the Okanagan

In the Okanagan region of British Columbia. — an area known for its fruit production — large excavation machines are ripping out apple trees to make way for a new crop: grapes. Local landowners hope the switch will allow them to make more profits from their property by jumping into the province’s booming wine industry. Landowner Bryan Hardman says that in the past he has been a price taker, but is setting up his own winery because he “wants to be a price maker, and believes the wine business is the place to do it.”

- This story beautifully illustrates the law of supply. Higher prices and profits are creating incentives to increase quantity supplied of grapes and wine.

- It also illustrates how all inputs must be paid their opportunity costs. Even though the Okanagan Valley is a world-class area for apple-growing, landowners can make more money switching to grapes — more than covering their opportunity costs — so they do.
- If land is not equally productive for grape-growing, which apple orchards would you expect to be dug up and replanted with grapes first? Which would be replanted last?
- Consider Mr. Hardman’s comment about wanting to be a price maker instead of a price taker. We will use those exact terms in Chapter 8 when we discuss competition among businesses in an industry.

Source: Wendy Stueck, “Uncorking the Okanagan,” *The Globe and Mail*, October 7, 2006, p. B4.

Six Ways to Change Supply and Shift the Supply Curve

Only a change in the price of a product or service itself changes *quantity supplied* of that product or service. There are six other important factors that change market supply — the willingness to produce a product or service. They are:

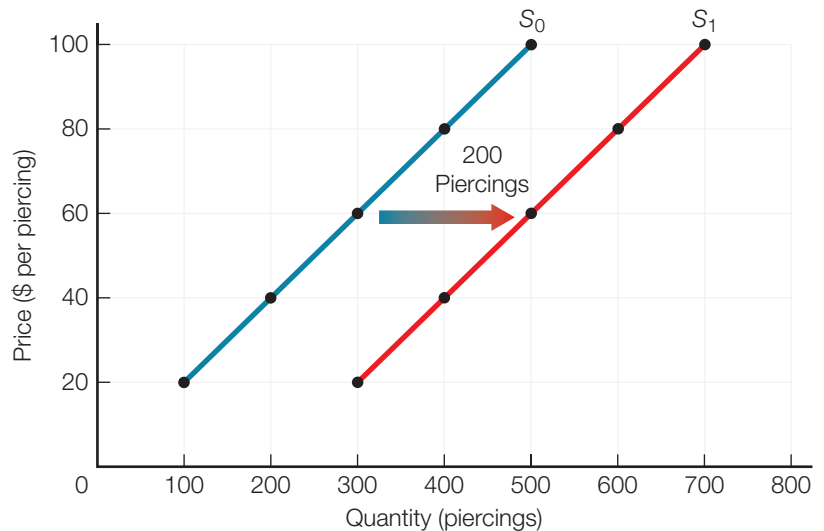
- Technology
- Environment
- Prices of inputs
- Prices of related products or services produced
- Expected future prices
- Number of businesses

A change in any of these six factors shifts the supply curve.

Technology Paola is overjoyed because she just bought a new piercing gun that allows her employees to do more piercings in a day. This increase in productivity from the new technology reduces her costs. Word spreads quickly, and all of the other piercing parlour owners realize that to stay competitive, they also must adopt the new technology. The result is an increase in market supply, which is shown in Figure 3.7 and can be described either by reading the supply curve as a supply curve or as a marginal cost curve.

Figure 3.7 Increase in Market Supply of Piercings

Price (marginal opportunity cost or minimum willing to accept per piercing)	Quantity Supplied (before technology improvement)	Quantity Supplied (after technology improvement)
\$ 20	100	300
\$ 40	200	400
\$ 60	300	500
\$ 80	400	600
\$100	500	700



Let's start with the supply curve reading, which begins with price and goes over and down to the quantity supplied. At a price of \$20 (the first row in the table), before the new technology, businesses were willing to supply 100 piercings (column 2). On the graph, from the price of \$20 on the vertical axis, go over to supply curve S_0 and down to the quantity of 100 piercings.

Still in the first row of the table, at the unchanged price of \$20, with the new technology, businesses will now supply 300 piercings (column 3). On the graph, from the price of \$20, go over to the new supply curve S_1 and down to the quantity of 300 piercings. That is an increase in supply of 200 piercings ($300 - 100$).

As you look down the rest of the rows of the table, at every price businesses will supply 200 more piercings with the new technology. Economists call this an **increase in supply** — an increase in business's willingness to supply at any price. This increase in supply is represented on the graph by a rightward shift of the supply curve, from S_0 to S_1 . The horizontal distance between S_0 and S_1 is 200 piercings.

The increase in supply can also be described by reading the supply curve as a marginal cost curve — up and over from quantity supplied to price. Before the new technology, to supply 300 piercings, businesses needed a minimum price of \$60 per piercing to cover marginal opportunity costs. On the graph, from the quantity 300 on the horizontal axis, go up to supply curve S_0 and over to the price of \$60. After the new technology, to supply 300 piercings businesses now need a price of only \$20 per piercing — from the quantity 300, go up to supply curve S_1 and over to the price of \$20.

The new technology lowers Paola's and other piercers' marginal opportunity costs, so they can accept a lower price while still covering all costs. For any quantity supplied, after the new technology, the minimum price businesses are willing to accept falls because marginal costs are lower.

Either way, whether you read the supply curve as a supply curve or a marginal cost curve, the result is an increase in supply — a rightward shift of supply curve.

increase in supply increase in businesses' willingness to supply; rightward shift of supply curve

Not e
An improvement in technology increases supply, and does not change quantity supplied.

Economics Out There

Army of Noodle-Shaving Robots Invades Restaurants

Chinese restaurant owner and entrepreneur Cui Runguan developed a robot (see photo on page 51) that hand-slices noodles into a pot of boiling water.

The robots "can slice noodles better than human chefs, they never get tired or bored, and it is much cheaper than a real human chef" says Liu Maohu, a noodle shop

owner. Each robot costs under \$2000, but replaces a chef costing \$4700 per year.

- This technological change decreases costs and increases supply.
- If I am a restaurant owner, noodle robots "show me more money," so I increase supply.

Source: Paula Forbes, "China Is Building an Army of Noodle-Making Robots," *Eater*, August 17, 2012, <http://eater.com/archives/2012/08/17/china-is-building-an-army-of-noodle-making-robots.php>; Raymond Wong, "Army of Noodle-Shaving Robots Invade Restaurants in China," *Dvice*, August 20, 2013, http://www.dvice.com/archives/2012/08/noodle_shaving.php.

Environment Extreme weather — droughts, storms, tornadoes, earthquakes — can have a powerful effect on supply. Extreme environmental events can reduce or destroy wheat crops, decreasing market supply, and shifting the supply curve for wheat leftward. The reverse is also true. Good weather conditions produce bumper crops, increasing wheat supply and shifting the market supply curve for wheat rightward.

Water temperature can affect fish stocks. A change in the temperature of water may lower reproduction rates, fewer fish are born, market supply decreases, and the supply curve for fish shifts leftward. If the change in water temperature encourages reproduction, fish supply increases, and the supply curve for fish shifts rightward.

Price of Inputs Paola and other businesses must pay a price for inputs matching the best opportunity cost of the input owner. If those opportunity costs and input prices fall, Paola's costs decrease. At any price for piercings, lower costs for studs or electricity mean Paola earns higher profits, so she will want to supply more. The effect of lower input prices on market supply is the same as a technology improvement. Lower input prices increase market supply and shift the supply curve rightward.

The reverse is also true: Higher input prices mean higher costs for Paola and, at any price, lower profits. Therefore, market supply decreases. The supply curve shifts leftward.

Prices of Related Products and Services Paola's Parlour produces both piercings and fingernail sets. What happens to Paola's supply of piercings when the price of fingernail sets falls from \$20 to \$10 per set? Since Paola wants to earn maximum profits, which service will she supply more of, and which less, when the price of fingernail sets falls? Take a minute to see if you can answer that question before reading on.

When the price of fingernail sets falls, Paola will supply more piercings and fewer fingernail sets. You probably reasoned that when the price of fingernail sets falls, they are less profitable to produce, so Paola will shift more of her resources to producing piercings. You are correct. A fall in the price of fingernail sets increases the supply of piercings. The supply curve of piercings shifts rightward.

Not e
A positive environmental change increases supply.

Not e
A fall in input prices increases supply.

Not e
Lower prices for a related product or service a business produces increase supply of alternative products or services.

You can also reason out the answer to the question of what happens to Paola's supply of piercings when the price of fingernail sets falls by thinking of the supply curve as a marginal cost curve. The lower price of fingernail sets lowers Paola's marginal opportunity cost of producing piercings. The real opportunity cost of producing more piercings is the fingernail sets Paola must give up. When those fingernail sets fall in price, Paola's marginal opportunity cost for producing piercings decreases. So the minimum price Paola will accept to supply any quantity of piercings falls. The supply curve of piercings shifts rightward.

decrease in supply decrease in business's willingness to produce; leftward shift of supply curve

In reverse, a rise in the price of fingernail sets decreases the supply of piercings. The supply curve of piercings shifts leftward. This is a **decrease in supply** — a decrease in business's willingness to produce.

A change in the price of related products or services supplied leads a business to reconsider its most profitable choices. A business will supply more of one product or service when alternative products or services it produces fall in price, and supply less when alternative products or services it produces rise in price.

Expected Future Prices What happens to the supply of a product or service when the expected future price of the product or service changes? In Chapter 2, you learned that consumer demand changes if consumers expect lower or higher prices in the future. The same is true for businesses. If Paola expects falling piercing prices in the future, she will try to supply more now, while the price is relatively high. When future prices are expected to fall, supply increases in the present. The supply curve shifts rightward.

Not e
A fall in expected future price increases supply today.

If Paola expects future prices to rise, she may reduce her current supply and increase her supply when prices and profits are higher. When future prices are expected to rise, supply decreases in the present. The supply curve shifts leftward.

Number of Businesses An increase in the number of businesses increases market supply and shifts the supply curve rightward. It is no surprise that at any price, more businesses will supply a greater quantity. The increased number of businesses increases supply, just as an improvement in technology or a fall in input prices increases supply. A decrease in the number of businesses decreases supply, just as a rise in the price of a related product or service or an increase in expected future prices decreases supply.

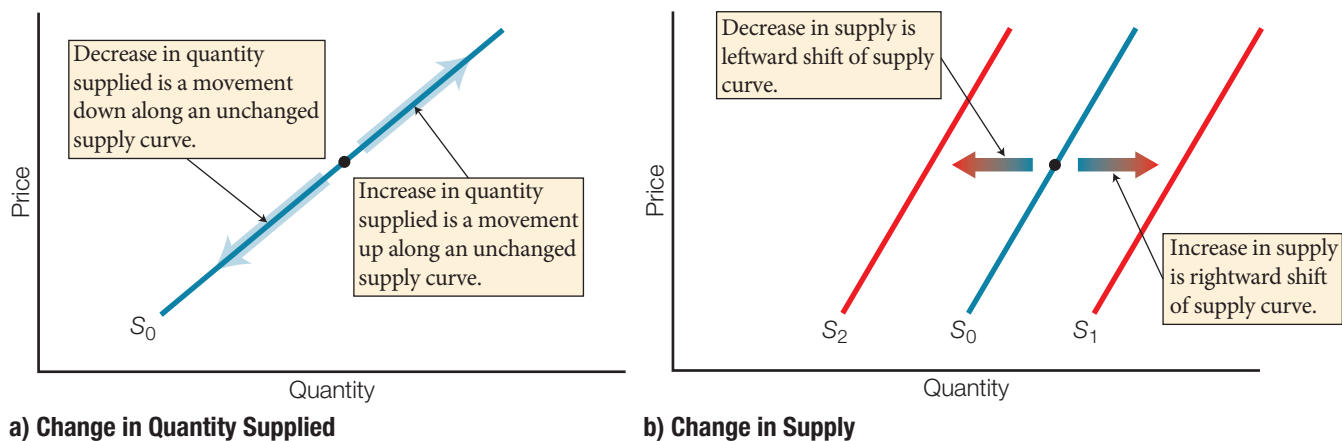
Not e
An increased number of businesses increases supply.

Why would businesses enter (increase supply) or exit (decrease supply) a market? Usually, when profits are high, new competitors enter a market, increasing market supply. If profits are lower than elsewhere in the economy, competitors exit from the market, decreasing market supply. Those exiting businesses search for more profitable uses of their resources. You will learn more about these entry and exit stories in Chapter 7.

Moving Along or Shifting the Supply Curve Any increase (or decrease) in supply caused by changes in any of the six factors discussed can be described in alternative ways. You can read the supply curve either as a supply curve or as a marginal cost curve.

- At any price, businesses will supply a larger quantity. This is the supply curve reading of an increase in supply.
- At any quantity supplied, businesses will accept a lower price because their marginal opportunity costs of production are lower. This is the marginal cost reading of an increase in supply.

Figure 3.8 Change in Quantity Supplied versus a Change in Supply



In both readings, an increase in supply is also called a rightward shift of the supply curve. A decrease in supply is called a leftward shift of the supply curve.

When none of the six factors change to shift the supply curve, we can focus on the relationship between price and quantity supplied. That is represented in Figure 3.8a as moving along the supply curve S_0 . If the price rises, and all other things do not change, that is a movement up along the supply curve to a larger quantity supplied. If the price falls, all other things unchanged, that is a movement down along the supply curve to a smaller quantity supplied.

Figure 3.8b shows an increase in supply, as the rightward shift from S_0 to S_1 . The leftward shift from S_0 to S_2 is a decrease in supply. These shifts in supply are caused by changes in any of the six factors — technology, environment, prices of inputs, prices of related products or services produced, expected future prices, or number of businesses.

Not e
An increase in supply is a rightward shift of the supply curve. A decrease in supply is a leftward shift of the supply curve.

Saving the Law of Supply

A change in quantity supplied (caused by a change in the price of the product or service itself) differs from a change in supply (caused by changes in technology, environment, prices of inputs, prices of related products or services produced, expected future prices, or the number of businesses). Can you now see why, when ultrabook computer prices fell from \$2000 to under \$800, the quantity of ultrabooks sold actually *increased*? Is the “law of supply” really a law?

If the price of a product or service falls, the quantity supplied decreases, *as long as other factors do not change*. The fall in ultrabook prices alone would *decrease* quantity supplied, not increase it. But other things changed. While a complete explanation involves demand factors as well as supply, major changes included technological improvements in computer chips and falling input prices. These *increased the supply* of ultrabook computers. Using the marginal cost reading of an increase in supply, at any quantity supplied, businesses were willing to accept a lower price because marginal opportunity costs of production were lower. The effect of the increase in supply outweighed the lower prices decreasing quantity supplied.

Figure 3.9 is a good study device for reviewing the difference between the law of supply and the factors that change supply.

Figure 3.9 Law of Supply and Changes in Supply

The Law of Supply <i>The quantity supplied of a product or service</i>	
Decreases if:	Increases if:
<ul style="list-style-type: none"> • price of the product or service falls 	<ul style="list-style-type: none"> • price of the product or service rises

Changes in Supply <i>The supply for a product or service</i>	
Decreases if:	Increases if:
<ul style="list-style-type: none"> • _____ • environmental change harms production • price of an input rises • price of a related product or service rises • expected future price rises • number of businesses decreases 	<ul style="list-style-type: none"> • technology improves • environment change helps production • price of an input falls • price of a related product or service falls • expected future price falls • number of businesses increases

Refresh 3.4

MyEconLab

For answers to these Refresh Questions, visit MyEconLab.

1. Explain the difference between a change in quantity supplied and a change in supply. In your answer, distinguish the six factors that can change supply.
2. Suppose you have two part-time jobs, babysitting and pizza delivery. After younger babysitters start working for less, babysitting clients pay only \$8 instead of \$10 per hour. What happens to your supply of hours for delivering pizzas? Explain.
3. When the price of nail sets falls, Paola’s hard dollar costs do not change. Will the quantity of piercings Paola supplies increase or decrease? Explain.



Study Guide

CHAPTER 3 SUMMARY

3.1 What Does It Really Cost? Costs Are Opportunity Costs

Businesses must pay higher prices to obtain more of an input because opportunity costs change with circumstances. The marginal costs of additional inputs (like labour) are ultimately opportunity costs — the best alternative use of the input.

- **Marginal cost** — additional opportunity cost of increasing quantity supplied, changing with circumstances.
 - For the working example, you are supplying time, and the marginal cost of your time increases as you increase the quantity of hours supplied.
- Differences between smart supply choices and smart demand choices:
 - For supply, marginal cost increases as you supply more.
 - For demand, marginal benefit decreases as you buy more.
 - For supply, marginal benefit is measured in \$ (wages you earn); marginal cost is the opportunity cost of time.
 - For demand, marginal benefit is the satisfaction you get; marginal cost is measured in \$ (the price you pay).

3.2 Forget It, It's History: Sunk Costs Don't Matter for Future Choices

Sunk costs that cannot be reversed are not part of opportunity costs. Sunk costs do not influence smart, forward-looking decisions.

- **Sunk costs** — past expenses that cannot be recovered.
- Sunk costs are the same no matter which fork in the road you take, so they have no influence on smart choices.

3.3 More for More Money: The Law of Supply

If the price of a product or service rises, quantity supplied increases. Businesses increase production when higher prices either create higher profits or cover higher marginal opportunity costs of production.

- **Supply** — businesses' willingness to produce a particular product or service because price covers all opportunity costs.
- **Quantity supplied** — quantity you actually plan to supply at a given price.
- **Marginal opportunity cost** — complete term for any cost relevant to a smart decision.
 - All opportunity costs are marginal costs; all marginal costs are opportunity costs.
- Increasing marginal opportunity costs arise because inputs are not equally productive in all activities.
 - Where inputs are equally productive in all activities, marginal opportunity costs are constant.
- **Market supply** — sum of supplies of all businesses willing to produce a particular product or service.
- **Law of supply** — if the price of a product or service rises, quantity supplied increases.
- **Supply curve** — shows the relationship between price and quantity supplied, other things remaining the same.
 - There are two ways to read a supply curve.
 - As a supply curve, read over and down from price to quantity supplied.
 - As a marginal cost curve, read up and over from quantity supplied to price. A marginal cost curve shows the minimum price businesses will accept that covers all marginal opportunity costs of production.

3.4 Changing the Bottom Line: What Can Change Supply?

Quantity supplied is changed only by a change in price. Supply is changed by all other influences on business decisions.

- Supply is a catch-all term summarizing all possible influences on businesses' willingness to produce a particular product or service.
- Supply changes with changes in technology, environment, prices of inputs, prices of related products or services produced, expected future prices, and number of businesses. For example, supply increases with:
 - improvement in technology
 - environmental change helping production
 - fall in price of an input
 - fall in price of a related product or service
 - fall in expected future price
 - increase in number of businesses
- **Increase in supply** — increase in businesses' willingness to supply. Can be described in two ways:
 - At any unchanged price, businesses are now willing to supply a greater quantity.
 - For producing any unchanged quantity, businesses are now willing to accept a lower price.
- **Decrease in supply** — decrease in business's willingness to supply.

TRUE / FALSE

Circle the correct answer. Solutions to these questions are available at the end of the book and on MyEconLab. You can also visit the MyEconLab Study Plan to access additional questions that will help you master the concepts covered in this chapter.

3.1 Costs Are Opportunity Costs

1. When higher-paying jobs are harder to find for workers, a business will pay more to hire labour. T F
2. Any smart business supply decision involves a choice between a business's marginal benefit (or reward) from supplying (or selling) its product and the business's marginal opportunity cost of producing the product. T F
3. Any smart worker supply decision involves a choice between a worker's marginal benefit (or reward) from supplying (or selling) her work and the worker's marginal opportunity cost of working. T F
4. Gordie's marginal opportunity cost of spending an extra hour on Facebook increases if he suddenly has the opportunity to go on a date with his high school crush. T F

3.2 Sunk Costs Don't Matter for Future Choices

5. Businesses should consider the monthly rent when deciding whether to produce more of a product or service. T F
6. Sunk costs are part of opportunity costs. T F

3.3 The Law of Supply

7. Businesses must receive higher prices as output increases to compensate for increasing marginal opportunity costs. T F
8. Opportunity cost equals what you get divided by what you give up. T F
9. As you shift time *away* from watching TV to working more hours, the marginal opportunity cost of working decreases. T F
10. All opportunity costs are marginal costs, and all marginal costs are opportunity costs. T F
11. To read a supply curve as a marginal cost curve, you start with price and go over and down to quantity supplied. T F

3.4 What Can Change Supply?

12. A rise in the price of inputs used by businesses decreases market supply. T F
13. A rise in the price of a related product a business produces increases market supply of the other product. T F
14. A rise in expected future prices shifts today's supply curve leftward. T F
15. Moving up along a supply curve is an increase in supply. T F

MULTIPLE CHOICE

Circle the best answer. Solutions to these questions are available at the end of the book and on MyEconLab. You can also visit the MyEconLab Study Plan to access similar questions that will help you master the concepts covered in this chapter.

3.1 Costs Are Opportunity Costs

1. Your opportunity cost of watching *The Big Bang Theory* increases if
 - a) it is your favourite TV show.
 - b) you have an expensive television.
 - c) you have an exam the next day.
 - d) all of the above.
2. The opportunity cost of going to school is highest for someone who
 - a) has to give up a job paying \$10 an hour.
 - b) has to give up a job paying \$15 an hour.
 - c) loves school.
 - d) has to give up a volunteer opportunity.
3. Which statement is *false*?
 - a) Marginal costs are opportunity costs.
 - b) Opportunity costs are marginal costs.
 - c) Sunk costs are marginal costs.
 - d) Marginal opportunity costs increase as quantity supplied increases.

3.2 Sunk Costs Don't Matter for Future Choices

4. Gamblers on slot machines often believe that the more they lose, the greater are their chances of winning on the next turn. However, the chances of winning on any turn are actually random — they do not depend on past turns. Therefore, the money lost on the previous turn is a(n)
 - a) total cost.
 - b) sunk cost.
 - c) smart cost.
 - d) opportunity cost.
5. Your friend Larry is deciding whether to break up with his current girlfriend, Lucy. He tells you that his number-one reason for staying with her is his tattoo, which says “I love Lucy.” Based on economic thinking, you advise him to ignore his tattoo because it is a(n)
 - a) opportunity cost.
 - b) marginal cost.
 - c) sunk cost.
 - d) total cost.

3.3 The Law of Supply

6. If all workers and equipment are equally productive in all activities, the opportunity cost of increasing output is always
 - a) increasing.
 - b) decreasing.
 - c) the same.
 - d) low.
7. The law of supply applies to an individual's decision to work because
 - a) as the wage rises, the quantity of hours a worker is willing to supply increases.
 - b) as the price workers receive rises, the quantity of hours a worker is willing to supply increases.
 - c) workers need to be compensated with higher wages to work more hours to cover increasing marginal opportunity costs.
 - d) all of the above.
8. When a fall in price causes businesses to decrease the quantity supplied of a product, this illustrates
 - a) the law of supply.
 - b) the law of demand.
 - c) a decrease in supply.
 - d) an increase in supply.
9. Suppose that all inputs in a business are equally productive at all activities. As the business increases its output, marginal opportunity cost
 - a) increases.
 - b) decreases.
 - c) is constant.
 - d) is zero.

3.4 What Can Change Supply?

10. Which factor below does *not* change supply?
 - a) prices of inputs
 - b) expected future prices
 - c) price of the supplied product or service
 - d) number of businesses

11. The supply of a product or service increases with a(n)
- a) improvement in technology producing it.
 - b) rise in the price a related product or service produced.
 - c) rise in the price of an input.
 - d) rise in the future price of the product or service.
12. The market supply of tires decreases if
- a) the price of oil — a major input used to produce tires — rises.
 - b) tire-making technology improves.
 - c) the expected future price of tires falls.
 - d) new tire businesses enter the market.
13. The furniture industry shifts to using particleboard (glued wood chips), rather than real wood, which reduces costs. This
- a) increases supply.
 - b) decreases supply.
 - c) leaves furniture supply unchanged.
 - d) effect on supply depends on demand.
14. Which factor below can change supply?
- a) income
 - b) environmental change
 - c) number of consumers
 - d) price of a complement
15. Popeye's Parlour supplies both piercing and tattoo services. Higher prices for piercings will cause Popeye's
- a) quantity supplied of tattoos to increase.
 - b) quantity supplied of tattoos to decrease.
 - c) supply of tattoos to increase.
 - d) supply of tattoos to decrease.

