A bold ship’s captain in seventeenth-century England proposes to investors that they finance a voyage to Asia for spices. The voyage is inherently risky. Weather is uncertain, channels are uncharted, the Dutch prey on English ships, the English prey on Dutch ships, and other pirates prey on both of them. If the captain returns to the English port with a cargo of spices, however it will be worth a fortune. The ship’s captain needs a large ship outfitted for two to five years of travel. He talks to investors and discloses secrets about how to get to Asia and what to do when he arrives. The investors decide to entrust him with a ship and supplies. Unlike so many other ships that sail for Asia, this one returns safely after two years. The townspeople spot the vessel sailing toward the harbor and the investors rush to the dock to divide the cargo. The success of the venture attracts imitators. As years pass, the spice trade eventually becomes a normal business with moderate risk and ordinary profits.

Similarly, an engineer in Silicon Valley in 1985 has an idea for a new computer technology. The engineer cannot patent the idea until he develops it. Developing it requires more money than the engineer can risk personally. He drafts a business plan, meets with a small group of investors, and explains his idea to them. Developing the idea is inherently risky—someone might steal the idea before it is patented, an unknown competitor might patent the invention first, the invention might not work, or it might work but not sell. If the plan succeeds, however, the innovators will make a fortune. The investors agree to form a company and develop the product. Unlike so many other start-ups, this one succeeds after two years and the firm acquires a valuable patent. The company sells the product to an established firm and divides the proceeds between the engineer and the investors. The success of the venture attracts imitators. Production and sale of the invention eventually becomes a normal business with moderate risk and ordinary profits.

1 This chapter draws on Chapters 4 and 5 of Cooter and Schaefer, 2011.
Seventeenth-century spice voyages and twentieth-century technology start-ups involved up-front investment, high risk, and high return. Many business ventures have these characteristics. Discovering new ideas and developing them usually requires upfront investment. If development succeeds, the innovator has a temporary advantage over competitors until they catch up. While the temporary advantage lasts, the innovator enjoys extraordinary profits, which we call “venture profits.” In the end, the imitators catch up and profits fall to the normal level. The life-cycle of a business venture is this chapter’s subject.

**Life-Cycle of a Business Venture**

In efficiency economics, the production function and competitive equilibrium are fundamental tools of analysis. In growth economics, the business venture and its life cycle are fundamental tools of analysis.

A successful business venture has numbers like Figure 2.1. The venture begins with the development of a new idea in period 1, which costs 8. When the product is developed, the innovator has a valuable secret or patent, or perhaps a cluster of secrets or a portfolio of patents (more on that later). After development, the innovation is launched and marketed to buyers. When launched in period 2, the innovation has no competitors, so the innovator is a monopolist who receives a payoff of 7. In period 3, imitators develop competing products that substitute for the innovation, which reduces the innovator’s payoff to 4. In period 4, imitations improve and competition intensifies. Taking competition to its logical extreme in period r, the imitations become perfect in period 4, so the market is perfectly competitive and the innovator’s payoff is zero. (“Zero profit” is economist’s code for “ordinary rate of profit”.)

Summing over the life cycle, the venture’s net payoff equals +3.

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3 A production function determines outputs from inputs, such as $y=f(k,l)$ where the output is $y$ and the inputs are capital $k$ and labor $l$. In a competitive equilibrium, the price of output $y$ equals its marginal social value. So the marginal value product of an input, say capital $k$, equals $pf_k$. A business venture at time $t$ in its life-cycle has an expected profit function $\pi$, determined by the probable payoffs as a function of future investment of $k$ and $l$. As explain in Chapter 1, the social value of alternative business ventures is compared by the contributions to growth. According to the overtaking principle, one business venture that increases the sustained rate of growth relative to another business venture is much more socially valuable, perhaps infinitely so.

4 Perfect competition drives the prices of all goods to their cost of production. Profits are zero after including the cost of capital in the other costs of production. The cost of capital equals the ordinary rate of profit in alternative uses.
A successful innovation is like a horserace that pays handsomely to the winner, moderately to the near-winners, and nothing to the rest of the pack. A successful business venture earns extraordinary profits when launched, extraordinary profits when imitated, and ordinary profits when perfectly substituted. The industry eventually settles into equilibrium, like the crowd eventually stops yelling after horses cross the finish line.
Figure 2.1 indicates the benefits and cost of the venture to its owners. What about its benefits and costs to society? As conventionally measured, the net social benefits from a successful business ventures equal the sum of innovator’s profits, profits of other firms such as imitators’, and the consumer’s surplus.5 The innovator’s profits are a small fraction of the net social benefits. The richest innovators get less wealth for themselves than the value that their innovations convey to consumers and other producers. Thus the wealth that Apple investors obtained from the iPhone is less than the value of the iPhone to consumers and other firms that imitate it or create applications for it. In the appendix to this chapter, Tables 2.1 and 2.1 use numbers to illustrate the venture depicted in Figure 2.1,

Production of the improved widget will continue beyond time 4 under conditions approximating perfect competition until the product becomes obsolete. The product becomes obsolete when a new innovation destroys the old one’s value and the industry begins a new cycle of innovation. When ventures like the one in Figure 2.1 repeat themselves, one innovation follows another, and the path of net social benefits traces a gyre like the falcon on this book’s cover. In the appendix, Figure 2.4 traces the gyre of net social benefits from a numerical example.

**Imitators or Enthusiasts?**

Figure 2.1 depicts a profitable venture, but most ventures fail and lose money. Recent U.S. data suggests that 40% of new businesses survive and 60% disappear within four years.6 Figure 2.3 depicts a losing venture. The innovator in Figure 2.2 spends 8 in period 1 to develop the product. Many innovations fail before completing development and beginning production, without recouping any development costs. The innovator in Figure 2.3, however, is a little more successful and brings the product to market. When the innovation is launched in period 2, the innovator has no competitors and enjoys profits of 7. The only difference between Figures 2.1 and 2.3 is in pe-

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5 See appendix to Chapter 1. Recall that the consumer surplus equals the difference between what the good is worth to consumers and what they must pay for it, or the difference between the willingness-to-pay and the market price.

period 3. In Figure 2.1 the innovation yields a payoff of 4 in period 3 because it is better than the imitations. In Figure 2.2, however, the imitations in period 3 are just as good as the original – they are perfect substitutes. Perhaps the innovator cannot keep a secret or it has no patent. In Figure 2.2, the market reaches a competitive equilibrium in period 2, so the innovator’s payoff is 0 in period 2, as well as in period 3. Summing over the life cycle, the venture’s net payoff equals -1. The innovator in Figure 2.3 cannot recover the cost of developing the new idea.
The innovator sometimes has the advantage as in Figure 2.1, and the imitator sometimes has the advantage as in Figure 2.2. If the innovator in period 0 can foresee that the venture will have a net payoff of +3 as in Figure 2.1, it will launch the venture. The expectation of positive venture profits causes the development of innovations. If the innovator in period 0 can foresee that the venture will have a net payoff of -1 as in Figure 2.2, it will not launch the venture. The expectation of negative venture profits prevents the development of innovations.

The difference between a profitable venture in Figure 2.1 and an unprofitable venture in Figure 2.2 is the ease of imitation. Difficult imitation extends the innovator’s period of extraordinary profits in Figure 2.1, and easy imitation reduces the innovator’s period of extraordinary profits as in Figure 2.2. To slow imitators, an innovator often tries to keep the innovation secret. Some innovations reduce to explicit information that is easy to copy, like a recipe or a formula. Being easily copied, explicit information is intrinsically hard to keep secret. Thus developers of software need to understand parts of the core code in order to write new software Microsoft Windows. Microsoft will disclose parts of its core code to software developers, but not all of it.

Unlike a computer code, other innovations involve implicit information that is irreducible to simple communication. Implicit information is often imbedded in a practice or organization, like judgment in mixing chemicals, art in baking cakes, or methods to motivate salesmen. Information is implicit when someone knows how to do something that is hard to communicate. Because communication is hard, implicit information is easier to keep secret than explicit information. To steal another company’s implicit information, you need to hire its employees rather than readings its documents. (See Chapter _._)

The law of trade secrets helps innovators to keep their secrets private. A person who violates these laws by distributing proprietary information is liable for the harm done to the firm with the secret. When firms in Silicon Valley hire employees or discuss collaboration with other firms, they routinely sign non-disclosure agreements (NDAs) in which they promise not to reveal any secrets that they learn about the company. Sometimes trade secrets laws work -- the recipe for Coca Cola has remained a secret for decades. More
often, trade secret law is ineffective. Trade secrets laws are hard to enforce in Silicon Valley and they are unenforced in much of the world.\textsuperscript{7}

Instead of secrets, another route to extraordinary profits is patenting. To patent an invention, the innovator must reduce it to explicit information disclosed in the patent application. Any member of the public can read the patent and obtain essential information for producing the invention. However, producing the invention infringes the patent, which is illegal without the consent of the patent holder. The creator of a patentable invention must decide whether secrecy or a patent is more profitable.

A patent applies to an invention, not to a market. However, some patent portfolios industry standards that dominate markets, like the Windows operating system currently dominates desktop computing in business firms. The owner of a portfolio of patents that becomes an industry standard can collect royalties from an entire industry. Standards are a kind of natural monopoly created by a coordination problem, as explained in Chapter _ _. With industry standards as with pop stars, many volunteer and few are chosen.

An invention is likely to become a standard if its value for each user increases as the number of its users increases. The uncompensated benefit that one user conveys to another is a “positive externality.” The joint operation of the positive externalities is a “network effect.”

The three sources of extraordinary profits for innovators are secrecy, intellectual property, and natural monopoly. Some innovators enjoy extraordinary profits from all three sources. Thus Microsoft cloaks the core code of Win-

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In addition, patents and copyright give innovators a temporary monopoly by law. An effective patent gives the inventor monopoly profits until the patent expires or new inventions undermines its value. To illustrate numerically, consider how A’s profits in Figure 1.5 might change if A holds an effective patent to its innovation that lasts for periods 1 and 2. If A refuses to license the innovation to anyone, it enjoys monopoly profits of 10 in time 1 as indicated in Figure 1.5. Assume that the patent extends through time 2 and that competitors make little progress circumventing the patent by their own innovations. In time 2, A enjoys profits much like in time 1, say, profits of 9. Thus the patent increases A’s earnings net of development costs for all periods from 6 to 13. Later chapters contain more details about intellectual property, including patents and copyright.
dows in secrecy, protects parts of it by patents and copyright, and enjoys natural monopoly from network effects.

**Rate of Innovation**

The expectation of positive profits launches innovative ventures, and the expectation of negative prevents innovative ventures. Law affects the profitability of all phases of a venture -- finance, development, marketing, and competition. When better law makes innovations more profitable, the number of innovations increases. To see why, think of an array of new ideas that differ according to the expected profitability of developing them. Innovators develop the ideas that they expect to yield positive profits, and they do not develop the ideas that they expect to yield negative profits. If better law increases the expected profits for innovations, some ventures will tip from negative to positive expected profits, so innovators will develop more ideas.

Figure 2.3 depicts this fact. The horizontal axis indicates an industry’s array of possible innovations in order of profitability, with higher profit ventures farther to the left and lower profit ventures farther to the right. Figure 2.3 distinguishes between profits under bad and good law. An innovation’s profitability under bad law equals the difference between its revenues R and costs C over the venture’s life. To the left of I, revenues R exceed costs C, so the innovations will be developed. To the right of I, costs C exceed revenues R, so the innovations will not be developed. The revenue curve R intersects the cost curve C at point I where venture profits are zero (development costs before launch equal profits after launch). I is the tipping point that indicates the number of developed innovations under bad law.
Figure 2.3. Development of More Innovations with Better Law that Increases Venture Profits

Improving the law in this industry increases revenues from R to R* and decreases costs from C to C*. With improved law, the revenue curve R* intersects the cost curve C* at point I*. I* indicates the number of developed innovations under good law. I* is larger than I so better law causes higher venture profits, and higher venture profits cause more ventures.

Conclusion

Chapter 1 posed the first question of law and growth economics: “Which laws increase the pace of economic innovation?” Chapter 2 simply answers, “The laws that increase venture profits.” Fleshing out this answer requires the rest of this book. First we must look inside the business venture. The next
chapter explains how law enables individuals with different interests to give their ideas and money to innovative ventures with shared goals.
Appendix

Table 2.1 uses numbers to illustrate the business venture in Figure 2.1. Assume that the innovator develops an innovation that lowers the cost and improves the quality of a particular consumer good – say, a better widget. At time 0, before development of a better widget, widget makers earn zero profit and consumers enjoy a surplus of \( S_0 \). At time 1, development of the improved widget costs the innovator -8. At time 2 when the improved widget is launched, the innovator has lower production costs, so the innovator enjoys extraordinary profits of 7 temporarily. Informed consumers buy the improved widget and enjoy its higher quality, so the consumer’s surplus rises to \( S_0 + 10 \). At time 3, some imitators partially succeed in replicating the innovation. This competition drives the price down, the innovator’s profits fall to 4 at time 3, and the imitators enjoy profits of 2. The fall in price causes the consumer’s surplus to increase by 30, and the rise in average quality of widgets causes the consumer’s surplus to increase by 3. At time 4, competition drives the price down to the cost of production, so the innovator and imitators receive zero profits. The fall in price causes the consumer’s surplus to increase by 70, and the rise in average quality causes the consumer’s surplus to increase by 10. Summing over the life cycle in Table 2.1, the venture profits are 3 and the consumer’s surplus increases by 123. Consequently, the innovator enjoys less that 3% of the innovation’s total benefit to society.

Table 2.1. Net Benefits from Business Venture

<table>
<thead>
<tr>
<th>Phase in Cycle of Innovation</th>
<th>time 0 equilibrium</th>
<th>time 1 development</th>
<th>time 2 market power</th>
<th>time 3 imitation</th>
<th>time 4 equilibrium</th>
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<tbody>
<tr>
<td>venture profits</td>
<td>0</td>
<td>-8</td>
<td>+7</td>
<td>+4</td>
<td>0</td>
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<td>imitators’ profits</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>+2</td>
<td>...</td>
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<td>consumer’s surplus</td>
<td>( S_0 )</td>
<td>( S_0 )</td>
<td>( S_0 + 10 )</td>
<td>( S_0 + 30 + 3 )</td>
<td>( S_0 + 70 + 10 )</td>
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<tr>
<td>total net benefits</td>
<td>( S_0 )</td>
<td>(-8 + S_0 )</td>
<td>( S_0 + 17 )</td>
<td>( S_0 + 39 )</td>
<td>( S_0 + 80 )</td>
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The explanation of the following table shows that these numbers are reasonable.

<table>
<thead>
<tr>
<th>Time or Phase</th>
<th>Venture Profits</th>
<th>Imitators' Costs</th>
<th>Imitators' Profits</th>
<th>Venture's Profits</th>
<th>Venture's Revenues</th>
<th>Venture's Production</th>
<th>Price</th>
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Summary table of numbers underlying Figures 2.1 and 2.2.
The industry consists of, say, 10 firms and each of them supplies 100 units of the good for total production of 1,000. The unit cost of production under the original technology is 1, the market price of the good is originally 1 under perfect competition, and the consumer’s surplus is $S_0$. The innovator spends 8 to develop a new production method that reduces the cost to .93. Since the good’s price is 1, the innovator earns .7 per item for 100 items in the monopoly stage when the innovation is launched. The innovation also improves the good’s quality. 100 consumers know that the innovator’s good has higher quality, so their surplus increases by .1 x 100.

In the oligopoly phase, 2 imitators comprehend enough of the secret to lower their production costs from 1 to .96. Oligopolistic competition bids the market price down to .97. Each of the 2 imitators produces 100 units and earns profits of 1. When the price falls to .97, the increase in the consumer surplus from the fall in price equals 1,000 x .03. In addition, the 300 consumers who buy from the innovator or the imitators enjoy an increase in surplus by .1x300.

In the final phase of perfect competition, all firms learn the new production technique, the price falls to the cost of production .93, and all firms earn zero profits. Consumers buy 100 units from each of 10 firms. The original consumer surplus is $S_0$. When the price falls to .93, the consumer surplus increases by 1,000 x .07. In addition, the consumer surplus increases from the higher quality of the good by 1,000 x .01.

Notice that these calculations assume fixed market shares and perfectly inelastic demand, which eliminates the “welfare triangles” in a standard efficiency analysis. A more complete analysis that relaxed these assumptions would have larger total net benefits.

The product becomes obsolete when a new innovation destroys the old one’s value and the industry begins a new cycle of innovation. The graph of the net social benefits forms a gyre as depicted in Figure 2.4. The first cycle of innovation begins at time 0 when social benefits equal $S_0$ and ends at time 4 when social benefits equal $S_0+80$. The curve beyond time 4 suggests what the next cycle of innovation looks like.
Figure 2.4. Growth Gyre

Profits + Consumer’s Surplus

$S_0 - 8$

$S_0 + 8$

$S_0 + 17$

$S_0 + 39$

$S_0 + 80$

Phase

Competition

Development

Monopoly

Oligopoly

$x_0$

$x_1$

$x_2$

$x_3$

$x_4$

$x_5$