Chapter 3. The Double Trust Dilemma
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When someone discovers a better way to make something or something better to make, developing the new idea usually requires capital. One person often has ideas and someone else has money. To launch an innovative venture, they must combine their assets, which require the innovator to trust the financier with his idea and the financier to trust the innovator with her capital. We call the problem of uniting capital and ideas the **double trust dilemma of innovation** -- a new name for an idea with a rich economics pedigree.¹

An economist who worked at a Boston investment bank received a letter that read: “I know how your bank can make $10 million. If you give me $1 million, I will tell you.” The letter captures concisely the problem of buying information: The bank does not want to pay for information without first determining its worth, and the innovator fears to disclose valuable information without first getting paid. In general, a person cannot evaluate an idea until after its disclosure, and after its disclosure she may not need to pay for it.² If you know information then you have it, whereas you can know a car, cow, or coffee without having it.

Combining this characteristic of information with investment creates the double trust dilemma. A Berkeley mathematician named Richard Niles invented bibliographic software called EndNote that many professors use on

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¹ The phrase “double trust dilemma” was introduced by Cooter and Schaefer in Chapter 3, “The Double Trust Dilemma of Development,” Solomon’s Knot: How Law Can End the Poverty of Nations, Contemporary (Princeton University Press, 2012). Theories of finance often begin with the question, “How can an investor, who puts his money under the control of a manager, write a contract so that the manager profits most when the investor profits most?” This is the “principal-agent problem.” This is a single-trust problem because the investor must trust the manager with his money, but the manager need not trust the investor. This single-trust problem is the building block for analyzing double trust problems. A good introduction to this vast literature is Kenneth J. Arrow, “The Economics of Agency: An Overview,” in Principals and Agents: The Structure of Business, ed. John W. Pratt and Richard J. Zeckhauser, 1985. For a pioneering paper on secrecy and investment, see Edmund W. Kitch, “The Law and Economics of Rights in Valuable Information,” J. Legal Studies 9 (1980). Two-sided trust problems have been investigated in game theory, such as two-sided moral hazard or principals-agent with two principals. For an example of how modern financial institutions combine ideas and capital, see Bernard Black and Ronald Gilson, “Does Venture Capital Require an Active Stock Market?,” 11 Journal of Applied Corporate Finance 36 – 38 (2005).

their computers. In the early stage of development, he hoped and feared receiving a call from large firm asking for an explanation of EndNote. Once the large firm understood the product, it might buy Niles’ company and make him rich, or it might develop its own version of his program and bankrupt him. Niles eventually got a call from a large publisher (Thompson) who bought the company.

A new idea collides with capital in Silicon Valley when an innovator presents a business plan to potential investors. Here is a simple example of how such a presentation might go:

“I have a new idea. I can use my time to develop it and sell it for $1 million, or I can explain it to you. I have no effective legal protection for my idea. Once you know it, you can use your capital of $3 million to develop it yourself and sell it for $5 million, and I will gain nothing. However, once you know the idea, I think that you will see that we can make a lot more money by working together. If you supply me with $3 million in capital, I can use my expertise to develop the innovation and sell it for $15 million. With $15 million, we can give you $5 million for not developing it yourself, and we can split the remaining $10 million.”

Figure 3.1 depicts this proposal as a decision tree. In step 1 the innovator can develop his idea without capital and earn 1, in which case the financier keeps her capital of 3. Alternatively, in step 1 the innovator can explain his idea to the financier and go to step 2. The innovator has no effective legal protection of his idea. In step 2 the financier can use capital of 3 to develop the idea herself and sell it for 5. Alternatively, in step 2 the financier can supply capital to develop the innovation in cooperation with the innovator and they can earn 15, with the innovator getting 5 and the financier getting 10. Each receives what he could get without cooperation plus an equal share of the surplus from cooperation. (This is the “Nash bargaining solution” in game theory.)

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Many business ventures begin with plans resembling this one. The plan in Figure 3.1 *proposes* payoffs of 5 to the innovator and 10 to the financier. To implement this proposal, the innovator and financier must make 5 and 10 into the *actual* payoffs from cooperating. Successful implementation implies that the innovator and financier will get the payoffs in Figure 2.1 if they make the decisions depicted in the figure. If the plan can be implemented, self-interest will motivate the parties to cooperate as envisioned in the proposals. The financier will decide in stage 2 to supply capital to the innovator to develop the idea, because the payoff from cooperation exceeds the payoff from non-cooperation: \( F_2 > F_1 \). Foreseeing this fact, the innovator will decide to cooperate in stage 1, because the payoff from explaining his idea exceeds the payoff from developing it on his own: \( I_2 > I_0 \). These two inequalities express the conditions for cooperating in a venture structured like Figure 3.1. Successful implementation of the plan satisfies these two conditions.

Implementing such a plan is remarkably difficult. Investing in a business venture requires confidence that strangers will not appropriate its profits. The innovator and financier will need protection against outsiders who might steal 15 from them. All ventures require protection from predators such as hoodlums, mafias, cheating accountants, Ponzi artists, conniving state regulators, oppressive tax collectors, and thieving politicians. Without effective property protection, people fear theft, so resources flow to protectors, not to
entrepreneurs. Families, clans, and gangs protected property historically, and they continue to do so today in some countries. However, an effective state is more reliable than private protectors. State protection of property is the legal foundation for investment in the future, including business ventures by families and friends.

If the innovator and financier are protected against outsiders, they still need to trust each other. At the final stage when the firm’s has 15, the plan calls for the financier to receive 10 and the innovator to receive 5. What prevents the innovator from grabbing all 15? Perhaps the innovator will take all 15 as salary and leave nothing for paying dividends to shareholders. Many business ventures never launch because the financier cannot trust the innovator to distribute the profits as promised.

If the final stage of Figure 3.1 cannot be implemented, then the whole proposal collapses. Assume that if venture were to reach the final stage, the innovator would grab all 15, as depicted in Figure 3.2. Foreseeing this fact, if the venture reaches stage 2, the financier will develop the innovation herself, so the financier’s payoff will be 5 and the innovator’s payoff will be 0. Foreseeing this fact, in stage 1 the innovator will develop the idea himself and receive a payoff of 1, instead of explaining the idea to the financier. The payoffs in Figure 3.2 fail to implement the plan in Figure 3.1 for sharing the gains from cooperation, so cooperation unwinds and noncooperation stifles an innovative business venture. (Notice that the payoffs in Figure 3.2 violate the two conditions for cooperation: $F_2 > F_1$ and $I_2 > I_0$.)
**Figure 3.2. Unsolved Double Trust Dilemma**

How can the innovator and financier implement a business plan as depicted in Figure 3.1, rather than collapsing as depicted in Figure 3.2? One way is to deal with trusted relatives. Loyalty within families is partly irrational and partly rational. Here’s how rationality prompts family members to cooperate with each other. Kinship is ascribed, not chosen. Your uncle is your uncle until death. Ascription provides a framework for repeat dealings. Through repeat dealings, people come to know whom to trust and whom to distrust. One reason to be trustworthy is fact that your relatives will find out if you are not trustworthy.

The logic of relying on relatives is depicted in Figure 3.3 by repeating the game in Figure 3.2 indefinitely many times. Each repetition is called a “round” and the rounds are numbered consecutively. In each round, the innovator can cooperate or appropriate. The financier (possibly a rich aunt) decides to reward cooperation and punish appropriation. This strategy by the financier gives the payoffs to the innovator as depicted in Figure 3.3. If the innovator cooperates in round t, then the financier cooperates with him
in the next round, and likewise for subsequent rounds. With cooperation, the innovator receives 5 in each round of the game. Alternatively, if the innovator appropriates 15 in any round, then the financier refuses future dealings with him, so the innovator will have to develop his ideas without capital in each subsequent round and earn 1.

### Figure 3.3. Innovator’s Payoffs in Repeated Game

<table>
<thead>
<tr>
<th>innovator’s choice</th>
<th>round</th>
<th>t</th>
<th>t+1</th>
<th>t+2</th>
<th>t+3</th>
<th>t+…</th>
</tr>
</thead>
<tbody>
<tr>
<td>cooperate</td>
<td></td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>appropriate</td>
<td></td>
<td>15</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Compare the payoffs from the two strategies. In round $t$, “appropriate” pays the innovator 15 and the innovator gains 1 in each subsequent round. In contrast, “cooperate” pays 5 in every round. Summing payoffs from round $t$ to round $t+3$, “cooperate” pays 20 and “appropriate” pays 19. Thus “cooperate” overtakes “appropriate” in round $t+3$, and the gap widens with each subsequent round. A rational player who values future payoffs will cooperate and not appropriate. Conversely, a rational player who highly discounts future payoffs will appropriate rather than cooperate. Specifically, the innovator in Figure 3.3 will cooperate who discounts payoffs by less than 40% per round, and the innovator will appropriate who discounts payoffs by more than 40% per round.

4. The financier’s strategy is called “grim” or “grim trigger.” Once the innovator cheats the financier treats him as untrustworthy forever. Another possible strategy with similar implications for cooperation is a variant of “tit-for-tat, in which the financier punishes an innovator for cheating and then resumes cooperating. The payoff matrix looks like this:

<table>
<thead>
<tr>
<th>round</th>
<th>t</th>
<th>t+1</th>
<th>t+2</th>
<th>t+3</th>
<th>t+5</th>
<th>t+6</th>
<th>t+…</th>
</tr>
</thead>
<tbody>
<tr>
<td>appropriate</td>
<td>15</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Experimental evidence indicates that tit for tat comes close to maximizing the party’s payoffs in a variety of circumstances.

5. To be precise, the discounted sum across rounds is the game’s “present value” to the player. The present value of “cooperate” exceeds the present value of “appropriate” if the game repeats itself enough times and the discount.

6. Cooperation yields $5 + 5\left(\sum_{i=1}^{\infty} \left(\frac{1}{1+n}\right)^i\right)$

and appropriation yields $15 + 1\left(\sum_{i=1}^{\infty} \left(\frac{1}{1-n}\right)^i\right)$

Setting them equal yields $5 + 5\left(\frac{1}{1+n}\right) = 15 + 1\left(\frac{1}{1-n}\right)$, whose solution is $n=.4$. 

3.6
Private Law

Family members can cooperate even if law cannot effectively enforce their promises to each other. However, entrepreneurs do not have enough family and friends to conduct business exclusively with them on the most profitable scale. Successful entrepreneurs look beyond relationships to strangers for money and ideas. Whereas kinship endures, strangers come and go. In business, friendships are often chosen for particular needs, not ascribed. The possibility that a business relationship will end poses an obstacle to cooperation.

In Figure 3.2, cooperation continues forever unless the innovator behaves badly and appropriates in one round. Even without bad behavior, the possibility that a relationship will end on its own can prevent cooperation. We already explained that solving the problem of cooperation by infinite repetition requires the actors not to discount future payoffs too much. If the game is likely to end, the players may discount future payoffs for uncertainty too much to cooperate in the present. Thus when communism began to collapse in Russia around 1990, production plummeted partly because producers could not cooperate when they lost confidence in future dealings with each other.

Whereas a possible end to a relationship increases the problem of cooperation, a definite end to a relationship makes cooperation even more problematic. Instead of assuming that the game in Figure 3.3 is repeated indefinitely, assume that t+3 is the game’s last round in Figure 3.3. As before, the financier adopts the strategy of rewarding cooperation and punishing appropriation, but the financier has no opportunity to punish appropriation that occurs in the last round. Therefore, the rational innovator will appropriate in round t+3 without fear of retaliation. “Cooperate until the last round and then appropriate” pays the innovator more than “always cooperate,” as shown in Figure 3.4.
The payoffs in Figure 3.4, however, do not reflect what each player will do if he foresees what the other player will do (“Nash equilibrium”). If the financier foresees that the innovator will appropriate in round \( t+3 \), she will change her strategy and not cooperate in round \( t+3 \). If the innovator foresees the financier’s behavior in round \( t+3 \), he will change his strategy and appropriate in round \( t+2 \). If the financier foresees the innovator’s behavior in round \( t+2 \), she will change her strategy and not cooperate in round \( t+2 \). By repeating this reasoning, cooperation unwinds all the way to the game’s beginning. With a definite end in sight, repeating the game provides no basis for cooperation. Every round looks like Figure 3.2, where the innovator and financier do not launch a joint venture. This is the “end-game” problem.

In a game with a definite end, cooperation may unwind back to the beginning. In a game with a likely end, cooperation may stop if uncertainty causes high discounting of future payoffs. Unlike relatives, strangers have more difficulty solving the problem of non-cooperation by repeating the double trust dilemma because they foresee an end to their relationship, or they discount future payoffs by the probability that the relationship will end. If the innovator and financier cannot cooperate, the business venture does not launch, the innovation is undeveloped, and the economy does not grow.

Where repetition fails, private law may succeed in solving the double trust dilemma. Here is one legal implementation often used in business ventures like Figure 3.1. The innovator and financier form a corporation to develop the idea. The financier loans the firm 3 for development (debt), and the innovator contributes his expertise to the firm. The firm issues 7 shares (equity) to the innovator and 5 shares (equity) to the financier. Shares are claims on profits left over after paying the firm’s debt. To implement the proposal, the law must effectively enforce the firm’s repayment of debt and an equal

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Experimental data shows that people are not so rational. In a repeated game with a definite end, experiments often find that players cooperate in the beginning and they stop cooperating near the end. Apparently people are partly logical and partly psychological.
distribution of profits per share. If law is effective, the corporation earns 15 from developing the innovation, repays its debts of 3 to the financier, and distributes dividends of 5 to the innovator and 7 to the financier, as depicted in Figure 3.1.

This implementation requires effective contract law to enforce repayment of the firm’s debts and effective corporate law to assure that profits get distributed equally to shares. The framework for finance by a small group of investors mostly comes from the law of contracts that belongs to “private law,” and the law of business organizations that belongs to “business law.” Ineffective contract or corporate law prompts chicanery, not cooperation.

Here is one way that weak corporate law could allow the innovator to appropriate all profits. Assume that the innovator is the corporation’s chief executive officer (CEO) who controls the company without effective legal constraints. After the firm earns 15, the innovator/CEO repays the firm’s debts of 3 to the financier, and then the innovator/CEO pays himself a salary of 12. Since all 15 go to pay debts and salary, no profits remain to distribute as dividends to shareholders. The financier gets nothing beyond the repayment of her debt of 3, and the innovator gets everything else. If the financier foresees this ploy by the entrepreneur, cooperation will unwind. (Similarly, another ploy transfers all profits to the financier instead of the innovator, which also causes cooperation to unwind.)

Public Law

In private finance of a business venture, the innovator and financier negotiate with each other over price and non-price terms and then use contracts and corporate law to implement their plans. In contrast, traders in public markets like the New York Stock exchange buy and sell stocks and bonds at

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8 In stage 2, the financier foresees that lending capital of 3 for the firm to develop the innovation will result in repayment of the loan and nothing more for her. Foreseeing this fact, the financier will choose to develop the idea without the innovator in stage 2, which pays the financier 5 and the innovator 0. Foreseeing this fact, the innovator will choose to develop the idea at stage 1 and earn 1, rather than explaining the idea to the financier and earning 0. Unless law can prevent the innovator’s chicanery at the end of stage 2, cooperation will unwind.

9 Assume that the financier is the Chairman of the Board who controls the company without effective legal constraints. After the firm develops the idea, the financier/chairman fires the innovator/CEO and sells the innovation for 15 to another firm that she owns. The selling firm uses 3 to repay its debts, and the buying firm distributes its profits of 12 to the financier/owner.
prevailing prices, without bargaining or negotiating. The stock exchange approximates the economist’s ideal of perfectly competitive markets. In perfectly competitive markets, the prices are public (the exchanges post the prices at which stocks are selling), everyone pays the same price, and the goods are standardized (one common share of Exxon is the same as another).

In developing innovations, relational and private transactions play the primary role, and public markets for stocks and bonds play a supplementary role. Supplementary by public finance especially occurs as a business venture matures. Thus assume that the innovator and financier in Figure 3.1 reach a private agreement to develop the innovation. To enjoy extraordinary profits, they must keep many details of their venture secret from competitors. Developing the innovation in stage 2 creates a temporary advantage over competitors, which might come from patenting the innovation or marketing it first. Patenting or marketing reveals the innovation to the public. At the venture’s end, the firm gets 15 by selling its stock in an “initial public offering” or by allowing a public company to acquire it.

The ability to sell securities to the public presupposes compliance with securities regulations that ideally protect buyers from chicanery. Members of the public who buy stocks or bonds have no direct control over how the firm uses their money. Instead, the firm’s managers and board of directors control it. Insiders have many opportunities to appropriate outsiders’ investments. For example, insiders may use accounting tricks to convert profits into salaries, thus depriving stockholders of their dividends. Protecting outsiders from insiders in public companies requires more than securing property and enforcing contracts. For public finance, the additional protection comes especially from corporate law and the law of securities. These laws ideally assure that outside investors get their share of a firm’s profits, rather than insiders appropriating all of it. Conversely, if these laws are ineffective, insiders will appropriate all of a firm’s profits, and outsiders who foresee this fact will be unwilling to invest.

If the firm gets 15 by selling itself to another firm or by selling its stock in an initial public offering, the founders often take the cash from the initial public offering and exit the business soon thereafter. A timely exit by the founders makes a business venture more profitable, which increases innovative activ-
ity. Profits increase because innovating and producing commodities are different specialties requiring different talents. By exiting, the founders leave others to produce commodities while they pursue the next innovation.

As explained in Chapter 2, a successful business venture begins with a disequilibrium caused by developing a novel idea. To gain a decisive advantage over competitors, development requires secrecy in order, which precludes public markets. After development builds a decisive advantage, the need for secrecy diminishes. The innovator has fewer secrets to hide and the double trust dilemma attenuates. In these circumstances, the firm may conduct an initial public offering of its stock or sell itself to a public company. Public finance approaches the economist’s ideal of a perfectly competitive equilibrium, where no one has valuable private information and everyone earns the same profit rate (“ordinary rate of return”). Like contentment, a perfectly competitive equilibrium is approached and never reached. Perfect competition is the end of an innovation, its irresistible and final fate, not the process of its creation.

Three Stages of Finance in Silicon Valley

Relational transactions require effective property law, private transactions require effective contract law and corporate law, and public transactions require securities regulations. The three stages of finance in Silicon Valley illustrate how these three types of laws support innovation. Relationships are especially important for many startup firms in Silicon Valley. First, someone has a new idea and obtains capital to develop it. At this point, the innovation’s economic value has not been established. To establish its value, the innovator needs funds from a few “angel investors.” Family and friends have confidence in the innovator invest, so they invest without fully understanding the innovation’s market value. Perhaps a few people invest who think that they can evaluate the innovation without understanding it. According to a popular quip, initial funding comes from “the 3 Fs”: Family, friends, and fools.


In the first stage, the entrepreneur develops the innovation sufficiently to prove its value to knowledgeable strangers. Most innovators, however, have too few personal relationships with wealthy people to finance an innovation’s full development. They must eventually turn to financiers. In Silicon Valley, the second stage of funding comes from “venture capitalists.” They are experts in evaluating undeveloped innovations, but they are not family, friends, or fools. Venture capital is private finance because it comes from a small group of investors with information unknown to a broad public. Most countries impose different laws on finance by a small group of investors than on finance by many investors.

Innovators and entrepreneurs have good reasons to distrust each other. Silicon Valley innovators sometimes expropriate the investments of their financiers. John P. Rogers convinced some prominent California investors to give him $330 million for a high-tech start-up named Pay By Touch that would “transform how America pays its bills” by using “biometric authentication technology” (e.g., fingerprints). In 2008 the company went bankrupt, and investors contend in lawsuits that Rogers burned through $8 million per month without producing anything of value.12

Similarly, the creative people who found a company often manage it badly. When the founders prove to be bad managers, the venture capitalists must replace them with good managers. In these circumstances, the venture capitalists seize the firm to increase its profitability. Alternatively, where the founders prove to be competent managers, venture capitalists may seize the firm to avoid sharing profits with the founders. Venture capitalists sometimes want to remove good managers with large claims to the firm’s future profits. The initials “v.c.” stand for “venture capitalists” and also “vulture capitalists.”

Innovators and venture capitalists use various legal devices to overcome their mutual distrust. The founders of the firm commit to performance goals implicitly or explicitly. If they fail to meet their goals, they may lose their investments and their jobs. Specifically, the venture capitalists often hold preferred shares of stock, unlike the common shares held by the founders. Preferred shareholders may have special powers of governance that common shareholders lack, as well as other advantages. The financing contract may say

that preferred shareholders can demand repayment of their investment after three years. Such a contract reassures the venture capitalists that the founders will do their utmost to perform as promised. The contract also reassures the founders that the venture capitalists have an interest in keeping the firm’s secrets.\footnote{Instead of issuing preferred shares to venture capitalists, firms could create much the same result by selling them bonds and common shares. However, preferred shares have a tax advantage. The valuation of common shares affects the tax liability of managers and employees who are partly paid in common shares or options to buy them. Since preferred shares are different from common shares, selling preferred shares to venture capitalists does not necessarily affect the price at which the firm can value its common shares for tax purposes. The firm can raise money at the relatively high of preferred shares while claiming that common shares are worth much less.}

Corporate governance provides another device to solve the double trust problem in Silicon Valley. The firm’s bylaws may stipulate that common shareholders (founders) and preferred shareholders (venture capitalists) appoint an equal number of directors to the company’s board, plus an independent director accepted by both sides. If the founders and venture capitalists disagree, the independent director holds the decisive vote. Thus the independent director will decide whether or not the venture capitalists can replace the founders with new management.

In the third stage of finance in Silicon Valley, a successful start-up sells itself to the public, either directly through an initial public offering of its stock, or indirectly when a publicly traded company acquires it. In order to sell stock to the public in the United States, a firm must comply with disclosure rules of the Securities Exchange Commission. Brokers disseminate the firm’s disclosed information to potential investors. After disclosures, many people understand the innovation sufficiently to decide whether or not to invest in its further development. The investors in stock markets are a large group of people – the “public.” Regulatory law, which belongs to “public law,” especially controls finance by a large group of investors.

**Small and Large Firms**

The double trust dilemma afflicts individual innovators and financiers. Does it also afflict large firms? In a large firm, the innovators and financiers are employed by one organization. They proceed something like this. Executives sift through proposals from the research divisions, choose the most
promising ones, and order the finance division to pay the research division to develop the innovations. Perhaps you think that hierarchical authority solves the problems of trust that afflict negotiations between individual innovators and financiers.

If that is what you think, consider the following. When an employee has a new idea, he understands its worth better than others. If he gives a valuable idea to his employer, he may get a bonus and the firm may get richer. A typical employee, however, would rather enrich himself than his firm. Instead of giving the idea to his firm, the employee may quit, form a startup company, develop the idea on his own, and try to get rich. Various contracts and laws restrain employees from quitting firms and taking creative ideas with them. The more large firms can claim legal ownership of employees’ discoveries, the less people who are creative will work for them. Large firms often cannot prevent employees from quitting and taking creative ideas with them, and large firms often cannot hire the most creative innovators to work for them. That is why many innovations in Silicon Valley begin in small, startup firms, where innovators own a significant share of the firm.

The double trust dilemma persists in large firms. The employee in the research division asks, “Can I trust the firm to reward me if I give it my innovative idea?” The employee in the finance division asks, “Can I trust the research division to develop this innovative idea as planned?” Each one fears that the other party is withholding crucial information. Perhaps the innovator-employee keeps secret a potentially fatal obstacle to development, or perhaps the financier-employee keeps secret his intention not to pay a bonus to the innovator-employee.

The problem of trust favors innovation in small firms. Why do large firms innovate? The amount of money required to develop an innovation often exceeds the innovator’s wealth. The innovator is reluctant to risk all his wealth on an innovation with an uncertain future. In a startup firm, the innovator shifts much of the financial risk to the financier. If they form a business venture with the innovator in charge, the innovator risks another’s money, not his own. This fact creates incentive problems that we discuss later. To improve incentives, the innovator usually retains substantial risk of failure.

14 See Chapter __ trade secrets law and Chapter __ on non-competition clauses in employment contracts.
Compared to a startup firm, the innovator-employee in a large firm shifts almost all of the risk of financial failure to the employer.

Creative people differ in their appetite for risk taking. Creative people who are risk-lover form startup firms, and creative people who are risk-averse find employment in the research division of large firms. The main advantage of developing innovations in large firms is risk spreading. Different tastes for risk contribute to the distribution of innovations by firm size.

**Ontogeny Recapitulates Philogeny**

Firms in Silicon Valley often pass through all three stages of finance – relational, private, and public. Similarly, the three stages of finance for a start-up firm in Silicon Valley resemble three stages of historical evolution in capital markets for countries. The industrial revolution in England, which was the world’s first, went through these stages. In the early eighteenth century, inventors mostly relied on their personal assets and loans from family and friends (relational finance). As industrialization proceeded, loans from wealthy investors and banks became available more readily to new industries. Finance of industrial companies by sales of stocks and bonds to the general public came later. Public financing of industrial companies originally concerned infrastructure like canals, docks, and railways, where private business and the state intertwine. As the law became more reliable, public finance spread to manufacturing firms.¹⁵

Like 18th century England, the poorest countries today have weak capital markets, so businessmen mostly borrow from family and friends. Starting from a condition of lawlessness, imposition of secure property rights can cause a spurt of growth based mostly on relational finance, as in China’s new industries after the 1980s. Some peoples, notably the Chinese and the Jews, have family networks that extend business relationships beyond the usual boundaries. However, the conditions of trust among relatives do not reach the scale of modern businesses. Relational finance keeps business small and local. No modern country became wealthy by relying exclusively on relational finance.

To increase the scale of business, an economy must augment relational finance with private finance, especially bank loans. In countries where banks dominate, an elite of wealthy insiders often lend to business ventures based on private information. Thus bank finance in some developing countries performs a similar role to venture finance in Silicon Valley. As countries become affluent, they increasingly augment private finance with public finance, which means selling stocks and bonds to the general public. Stocks and bonds compete with banks and wealthy individuals to finance economic growth.

Compared to debt, equity financing requires a superior legal framework. Debt involves a fixed schedule of repayment specified in a contract, whereas equity involves sharing future profits. Enforcing a fixed schedule of repayment is easier for courts than enforcing profit sharing. Consequently, loans and bonds often flourish in countries where stock markets languish. When weak law shrinks local stock markets, businesses are deprived of equity capital needed to launch innovative ventures.

Biologists sometimes say, “Ontogeny recapitulates phylogeny,” which means that a single organism’s development from conception to maturity resembles an entire species’s evolution. The same applies to solving the double trust dilemma. Startup companies in Silicon Valley and all companies in lawless countries tend to rely on relationships more than formal law to solve the double trust dilemma. With better law, finance expands from relational to private, and from private to public. The expansion supplements earlier forms without replacing them. All three forms of finance—relational, private and public—remain important in the richest countries. The extent of public finance varies significantly among countries, including rich countries. Japan and northern Italy have achieved affluence mostly through relational and private finance, with relatively little public finance, whereas the United

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17 Each animal begins life as a single cell containing genetic instructions for how to grow into a complex organism. For animals in different species with a common evolutionary ancestor, the path of individual growth suggests the older, evolutionary forms found in the fossil record. While the pattern of individual growth does not strictly recapitulate the evolution of the species, comparing them provides useful clues about the genes that control the development of individuals and species. For a book that finds the origin of the human fetus in fish, see Neil Shubin, Your Inner Fish: A Journey into the 3.5-Billion-Year History of the Human Body (New York: Pantheon Books, 2008).
States and Great Britain rely mostly on public finance for mature industries. Germany appears to be shifting from the former to the latter.\textsuperscript{18}

Expanding the basis of finance requires effective law that controls behavior, not aspirational law that expresses lofty ideals. What makes a law effective? Not just writing it down. Written law in a poor country often resembles written law in a rich country. Property and contract law-on-the-books in India and Nigeria resemble English common law, and property and contract law-on-the-books in Peru resemble the Spanish civil code. Writing down a law, however, does not make it effective. The written laws are less effective in Nigeria or Peru than in England or Spain.

\textbf{Conclusion}

New business ventures begin with secrecy, risk, and high profit expectations. All three decrease as the venture matures. Sea routes from Europe to Asia were eventually mapped and secured, trade between them became commonplace, and middle-class Europeans could buy spices. In Silicon Valley, competitors work around patents and ferret out secrets, thus converting today’s technological breakthroughs into tomorrow’s commodities. However, an innovative economy never settles into a permanent condition without secrecy, risk, or extraordinary profits. For economic growth, new business ventures must repeatedly confront and solve the double trust dilemma. To solve the double trust dilemma, entrepreneurs, financiers, courts, and regulators have worked out contracts, laws, and institutions over years and centuries. One cannot understand these creations without studying them as legal scholars do. That is how law dispels some mysteries of growth that baffle economists.

Where law is weak, innovators and financiers cannot rely on formal law for much more than protecting property from predators. They must deal mostly through relationships. This is true for most business in some undeveloped countries, and it is true for startup firms in developed countries where no law can protect fragile secrets and implicit financial agreements. In developing countries and startup firms, good law cannot do all of the work of creating trust. When the effective law of contracts and corporations improves, finance expands from relational to private. This is true in undeveloped countries that improve their legal institutions, and it is true in startup firms after

\textsuperscript{18} For details on finance in different countries, see...
they can demonstrate an innovation's promise. When institutions improve further in underdeveloped countries, or when a startup firm develops an innovation sufficiently to acquire a decisive advantage against competitors, more effective securities laws allows, finance to expands from private to public. In general, improved law allows more ideas to combine with more capital so the economy grows faster.