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Law and Growth Economics: A Framework for Research

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# Law and Growth Economics: A Framework for Research

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## **Abstract:**

Many law and economics models concern static efficiency and redistribution. The standard analysis of dynamic industries requires lawmakers to balance faster innovation against lower consumer prices. Sustained growth dominates these effects, so law and growth economics should focus on maximizing it. Law can increase the growth rate by making innovation more profitable. We distinguish innovation into phases -- discovering ideas, developing them with capital and labor, and marketing innovations. Strengthening intellectual property law and weakening antitrust law increases the costs of developing ideas, and also increases the revenues from marketing innovations. To maximize the profitability of innovation, law should balance these two effects. We use these ideas to develop a framework for law and growth economics.

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Robert Cooter and Aaron Edlin

## Introduction

Robert Lucas famously commented that once one thinks about growth it is hard to think about anything else. Compounded over a century, 2% annual growth (roughly the recent growth rate of the US economy) increases wealth more than 7 times, and 10% annual growth (roughly the recent growth rate of the Chinese economy) increases wealth by almost 14,000 times.<sup>1</sup> Differences in sustained growth cause one country's wealth to overtake another country faster than the mind can grasp. Generalizing, Cooter and Edlin [2010] have proved that a benevolent social planner, whose preferences for equality are not too extreme, will maximize welfare over time by maximizing sustained growth, and give no weight to static efficiency or redistribution. According to this proposition, law and economics scholars have mostly proceeded backward: Law and efficiency economics is well developed, and law and growth economics is underdeveloped.

This essay proposes a framework to develop law and growth economics. We begin by explaining why the welfare effects of growth dominate static efficiency and redistribution. We then discuss the possibility of sustainable growth through innovation. To promote sustainable growth, law and growth economics must focus on how law can increase the pace of innovation. For purposes of analysis, we separate innovation into phases. First, someone discovers a new idea; second, the idea is developed into something with economic value; and third, the innovation is marketed. We explain how law affects each phase -- the flow of ideas, the combination of ideas with capital and labor, and the marketing of innovations. Finally, we conclude with applications of law and growth economics to antitrust, intellectual property, and torts.

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<sup>1</sup> 1.02 to the power 100 equals 7.2; 1.10 to the power 100 equals 13,781. Note that, according to the CIA's [World Factbook](#), US population growth rate is roughly 1% (among the highest among developed countries), and China's population growth rate is .5%.

## I. Growth Overtaking Static Efficiency

Law and economics scholars often ask whether one legal rule, policy, principle, or institution is more efficient than another. A prescription to improve static efficiency, however, could have a positive or a negative influence on the growth of wealth. In many circumstances, efficiency complements growth, as when antitrust law increases competition, and competition promotes both static efficiency and sustained growth (Baker, 2007). In some circumstances, static efficiency substitutes for growth, as when patents slow diffusion of innovations (static inefficiency) and quicken their pace (growth).

Few scholars would disagree with these facts, but many will develop a comparative statics analysis and conclude that the efficient policy maximizes wealth, without addressing growth. This conclusion may be true formally within the model, but it misleads policy makers. To reach a helpful conclusion, the model needs to say whether the policy promotes or retards growth. When a researcher pronounces about wealth-maximization based on static efficiency alone, we say that they commit the *static efficiency fallacy*. For policy making in dynamic industries, the opposite approach is more helpful: Pronounce about growth maximization alone.

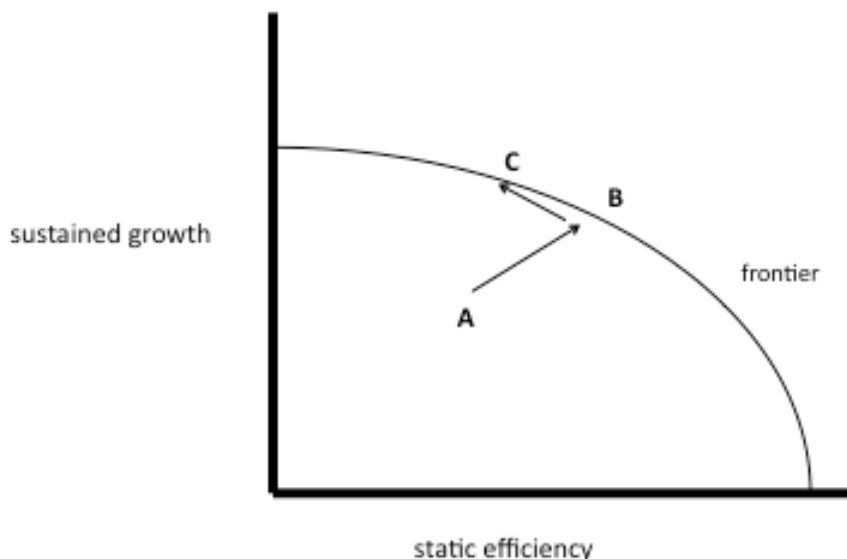
To illustrate gains from growth overtaking losses from static inefficiency, assume that decision makers can implement a policy that increases the sustained growth rate in consumption from 2% to 4% and decreases static efficiency by 10% in every period. 2% growth compounded over a century increases consumption by approximately 7 times, and 4% growth compounded over a century increases consumption by almost 50 times. By implementing this policy, consumption will be higher in years 6 through year 100. More important, the sums of consumption from year 1 through year  $n$  will be higher from the time  $n$  equals 10 years until the end of time.

Cooter and Edlin [2010] develop a formal model that establishes conditions under which growth overtakes static efficiency. Sustained growth has exponential effects on consumption in successive generations, whereas static efficiency has multiplicative effects. Exponential effects on welfare overtake

multiplicative effects whenever preferences for equality in the social welfare function are not too extreme. When static efficiency and exponential growth trade off, overtaking implies that exponential growth determines the welfare maximum. When they complement each other, welfare overtaking implies that static efficiency only matters to the welfare maximum in so far as it increases sustained growth. Thus welfare overtaking provides a strong reason for scholars to focus on law and sustained growth, rather than law and static efficiency.

Figure 1 portrays static efficiency on the vertical axis and sustained growth on the horizontal axis. Starting from point A, moving in the northeast direction towards B increases both efficiency and growth, as might be true when antitrust policy increases competition. After exhausting all feasible moves to the northeast, the two objectives tradeoff. Thus starting from B, moving to C in the northwest increases growth and decreases efficiency, as might be true when strong patents increase the pace of innovation and decrease the consumption of each individual innovation.

Figure 1: Efficiency versus Growth



The curved labeled “frontier” indicates the feasible tradeoffs under law and policy. (Note that this “frontier” differs from the usual one found in microeconomics textbooks.<sup>2</sup>) The move from A to B improves on both policy values, whereas the move from B to C improves on one and worsens the other. How can we choose between B and C? Consuming wealth creates welfare, which is an important objective -- sometimes the over-arching objective -- for laws and policies. To choose between B and C, we need to ask whether B produces more welfare than C, or C produces more welfare than B.

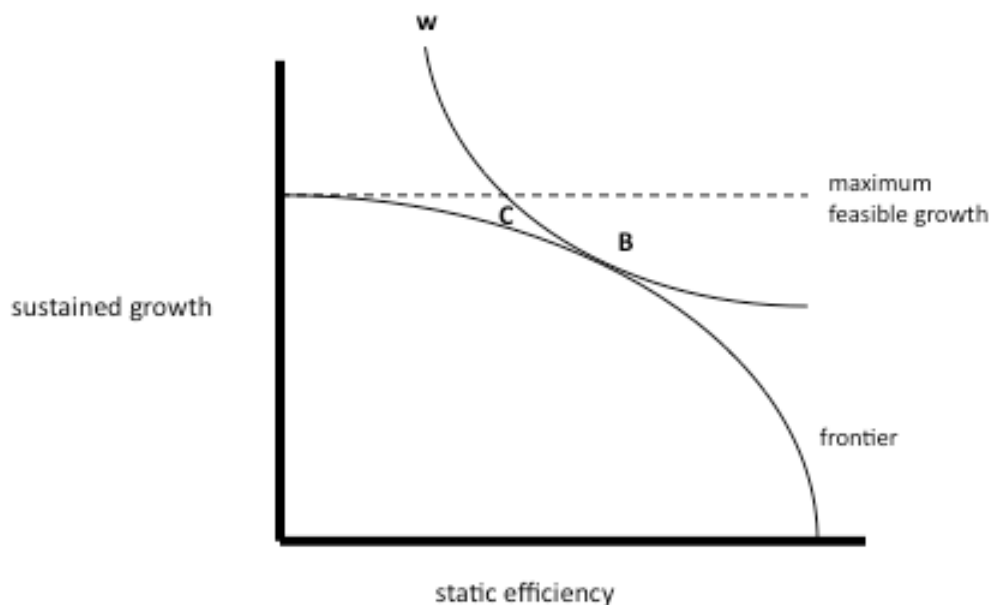
We relate consumption over generations to welfare. The consumption sequence  $c_1, c_2, c_3, \dots$  across generations 1, 2, 3, ... yields welfare  $W$  according to the function  $W = w(c_1, c_2, c_3, \dots)$ . At the frontier in Figure 1, an increase in static

<sup>2</sup> Static efficiency analysis often uses graphs resembling Figure 1 in which the decision maker applies a known technology to make choices with certain results. Figure 1 concerns sustained growth, which involves undiscovered technology. Thus Figure 1 simplifies innovation by representing its pace as a certain choice.

efficiency might increase consumption in generation 1 and decrease consumption in generations 2, 3, ... For example, shortening the legal life of patents might increase  $c_1$  by increasing the rate of diffusion in generation 1, and decrease  $c_2, c_3, \dots$  by decreasing the rate of innovation in future generations.

To be more specific, assume that consumption grows at the rate  $g > 1$  each generation. Normalize consumption of the present generation to be 1, so the consumption sequence for generations becomes:  $1, g, g^2, g^3 \dots$ . Assume that the move from B to C is caused by a change in the law that reduces static efficiency by  $s > 0$  and increases growth to  $g_s > g$ . The revised consumption sequence is then  $(1-s), (1-s)g_s, (1-s)g_s^2, (1-s)g_s^3 \dots$ . This consumption sequence yields welfare  $W = w\left((1-s), (1-s)g_s, (1-s)g_s^2, (1-s)g_s^3 \dots\right)$ , which we write in reduced form as  $W = w(s, g_s)$ . Lawmakers who seek to maximize welfare should prefer B to C if  $w(s, g_s) > w(0, g)$ .

Figure 2: Efficiency, Growth, and Welfare



To depict this possibility in Figure 2, we draw a curve of constant welfare  $w$  through  $B$  that lies above point  $C$ . Given the welfare function  $w$  depicted in Figure 2, lawmakers will maximize welfare by remaining at point  $B$  and not moving to point  $C$ .

Figure 2 depicts circumstances in which static efficiency and sustained growth tradeoff. The welfare function depicted in Figure 2 requires choosing an interior point on the frontier, rather than the point at the northwest corner that maximizes growth. However, a reasonable specification of the tradeoff between efficiency and growth often leads to a different conclusion. Specifically, the social optimum is often at the frontier's northwest corner, where maximizing welfare requires maximizing growth and ignoring static efficiency. These circumstances are common because the long run gains in welfare from sustained growth often overtake the short run gains in welfare from static efficiency. Consequently, any line of constant welfare like  $w$  in Figure 2 is horizontal, like the line labeled “maximum feasible growth”.



To illustrate concretely, assume that a change in policy that decreases static efficiency by 50% in the first period increases the sustained growth rate from 2% to 10% in subsequent periods. 2% growth compounded over a century increases consumption by approximately 7 times, and 10% growth compounded over a century increases consumption by almost 14,000 times. The long-run gain in welfare from faster growth presumably overtakes the policy's loss in welfare from static inefficiency. Thus welfare overtaking provides a strong reason for scholars to focus on law and sustained growth, rather than law and static efficiency.

## II. Growth Overtaking Equality

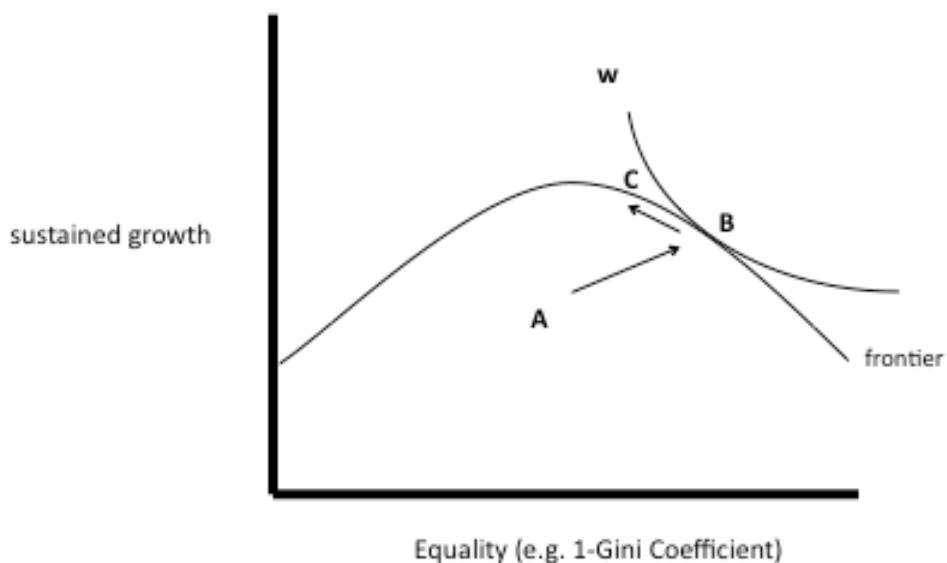
The same argument applies to overtaking the welfare gains from income redistribution. Law and economics scholars often ask whether one legal rule, policy, or institution produces greater equality than another. A prescription to increase equality, however, could have a positive or a negative influence on the growth of wealth. In some circumstances, equality complements growth, as when the state uses taxes to improve the education and health of the poor. In other cases, equality substitutes for growth, as when confiscatory taxes undermine entrepreneurship.

Few scholars would disagree with these facts, but many will develop a model comparing static efficiency and equality, and then conclude that one policy maximizes social welfare. While formally true within the model, this conclusion misleads decision makers because it does not explain the policy's effects on growth. Pronouncing on welfare maximization without considering growth is another form of the static efficiency fallacy.

The logic of growth and redistribution is essentially the same as the logic of growth and static efficiency. Redistribution can complement or substitute for sustained growth. Figure 3, portrays equality on the horizontal axis and sustained growth on the vertical axis. Here, we draw the frontier with a hump shape to suggest that some redistribution such as education and public health increase growth, while highly redistributive taxes retard growth. Starting from point A, a

move to B in the northeast direction increases both equality and growth, as might be true when the state taxes the rich to educate the poor. After exhausting complementarities, however, the two policy objectives trade off. Thus starting from B, a move to C in the northwest decreases equality and increases growth, as might be true when highly redistributive taxes discourage innovation. The curved labeled “frontier” indicates the feasible tradeoffs under law and policy.

Figure 3: Distribution versus Growth



How can we choose between B and C? As before, we draw a curve of constant welfare  $w$  in Figure 3 that goes through B and lies above C. Given this welfare function, lawmakers ought to maximize welfare by remaining at point B and not moving to point C. Figure 3 depicts circumstances in which equality and sustained growth tradeoff, and maximizing welfare requires sacrifices growth for equality.

In fact, the level sets of  $w$  are often horizontal lines, so that the social optimum is at the frontier's highest point. Sustained growth has exponential

effects on consumption in successive generations, whereas redistribution has multiplicative effects. Exponential effects on welfare overtake multiplicative effects whenever the utility function's concavity is not too extreme. In such cases, maximizing welfare requires maximizing growth and ignoring equality, as depicted in Figure 4. Redistributing wealth increases total welfare only when it increases growth.

Figure 4: Distribution, Growth, and Welfare



When exponential growth trades off with equality, overtaking implies that exponential growth determines the welfare maximum, not redistribution. When they complement each other, welfare overtaking implies that redistribution only matters to the maximum in so far as it increases sustained growth. Thus welfare overtaking provides a strong reason for scholars to focus on law and sustained growth, rather than equality.

Cooter and Edlin [2010a] show that maximizing the growth rate maximizes welfare, even if overall welfare only considers the well being of the poor.

Consider two series of consumption. The series  $\{r_t\}$  represents the consumption of the rich and  $\{p_t\}$  represents the consumption of the poor, with equal numbers of rich and poor, and  $r_t > p_t$ . Let  $s \in [0,1]$  represent the fraction of the rich's potential consumption that the rich actually consume, whereas  $(1-s)$  is the fraction of the rich's potential consumption that is redistributed to the poor. As before, consumption grows at the rate  $g$ , where  $g$  is a function of  $s$ . Normalized the poor's time 0 consumption to 1. Thus the consumption series become:

$$p_t(s) = g(s)^t (1 + (1-s)r_0)$$

$$r_t(s) = r_0 g(s)^t s,$$

Assume that redistribution lowers growth. If  $s = 1$  there is no redistribution and growth is maximized. If  $s < 1$ , a fraction  $1-s$  of the rich's consumption is given to the poor and growth rates are reduced. Should a benevolent planner redistribute a fraction  $1-s$  of the rich's wealth to the poor? If the redistribution from rich to poor decreases growth rates, additional redistribution will never improve overall welfare of the poor. Though the poor initially have higher utility with more redistribution, decreases in redistribution will lead to sufficient increases in the poor's utility over time to overtake the initial losses of utility. Consequently, any line of constant welfare like  $w$  in Figure 2 is horizontal, even if overall welfare only considers the well being of the poor.

Similarly, if redistribution decreases growth rates, additional redistribution will never improve overall welfare of the rich. Any line of constant welfare like  $w$  in Figure 2 is horizontal, regardless of whether overall welfare only considers the well being of the poor, or the rich, or a combination of the two.

This fact puts a twist on the usual prudential argument for the rich to be generous to the poor. The usual prudential argument is that the rich should be generous because they may be poor in the future or their children may be poor. Here, the argument is different. The rich should be as generous to the poor as required to maximize growth, because slower growth will make the rich worse off.

We have explained that exponential effects on welfare overtake multiplicative effects whenever the utility function's concavity is not too extreme.

When exponential growth trades off with static efficiency or equality, overtaking implies that exponential growth determines the welfare maximum, not static efficiency or redistribution. When they complement each other, welfare overtaking implies that static efficiency and redistribution only matters to the maximum in so far as they increase sustained growth. Ignoring static efficiency and redistribution is an extreme conclusion. No economic model should be taken too literally. In any case, the Cooter-Edlin theorems suggest that we should put up with static inefficiency or intra-generational inequality when doing so increase sustainable growth rates, where “sustainable” means “for a long time.” Welfare overtaking provides a strong reason for scholars to focus on law and sustained growth, rather than law and static efficiency or equality.

### **III. The Possibility of Sustained Growth and the Necessity of Innovation**

For over one hundred years, the United States and other Western capitalist countries have enjoyed sustained growth of two to three percent per year in per capita GDP. Is growth sustainable, or must it stop at some point because we exhaust our finite resources? Some physical resources are finite, but that does not mean that growth must stop. To see why, we contrast inexhaustible ideas and scarce resources.

Products of the mind like theorems, principles, designs, inventions, expressions, and compositions can be used without excluding their use by others. When one person uses an idea, just as much remains for someone else to use. Economists call this characteristic non-rivalry. Looking into the future, non-rivalry implies non-depletion: When the present generation uses an idea, just as much remains for future generations to use.

In contrast, scarce resources like capital, labor, land, and fuel have rival uses. When one person uses a scarce resource, it is unavailable for others to use. Some scarce resources renew like a forest, a river, or wheat. Use does not necessarily reduce their stock permanently, because the stock can be replenished. Other scarce resources deplete irrevocably, like oil and iron. As long as we do not know how to replenish them, their use reduces their stock.

Depletion is sustainable when its rate always decreases and exhaustion does not occur in finite time. With sustainable depletion, the stock of exhaustible resources decline each year, but an infinite number of years must pass before it reaches zero. Xeno made this same point in a paradox: If you travel half of the remaining distance to your destination each day, you will never arrive.

Growth economists who have performed extensive empirical analysis in the tradition of Robert Solow have concluded that technological innovation accounts for much growth. By making people richer, innovations cause them to consume more goods. Innovations also conserve resources, as when new automobile engines economize on fuel or electronic communication substitutes for paper publishing. Innovations can also substitute renewable resources for exhaustible ones, as when solar panels replace a coal-fueled electrical plant. If innovations enable the production of more consumer goods while depleting resources at a decreasing rate, then increased consumption is sustainable. If producing more consumer goods depletes resources at a constant or increasing rate, then increased consumption hastens resource exhaustion.

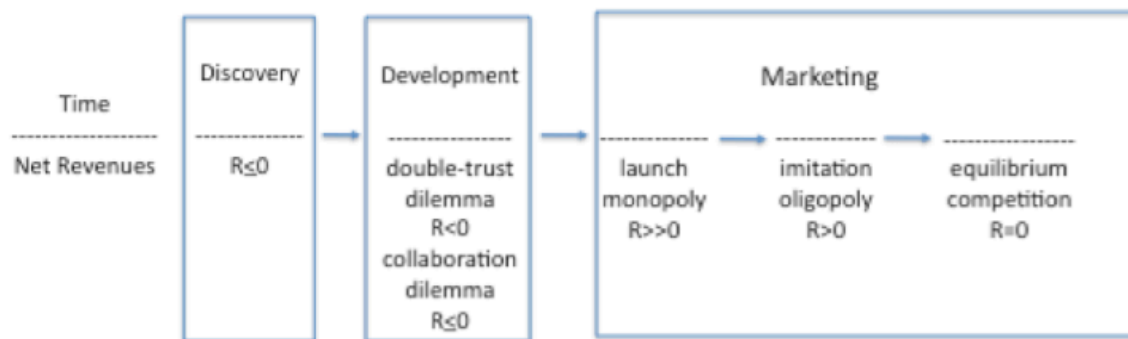
Many scholars believe that the world is depleting resources at an unsustainable rate. Correcting this dangerous situation requires faster innovation or reduced consumption. Policies that decrease consumption face fierce political resistance. Policies that increase the pace of innovation, especially innovations that conserve resources or substitute renewable for depletable resources, may be our only long-term hope.

#### **IV. Life-Cycle of Innovation: A Framework for analyzing the impact of law on the pace of innovation**

We have explained that growth overtakes other policy objectives, and sustained growth comes from innovation. We next development a framework to analyze the pace of innovation. The pace depends on the rate at which ideas are generated; the cost of developing them; and the profitability of marketing the innovation. Figure 5 depicts these three phases in the life cycle of an innovation.

For simplicity, we assume that the innovator is a single firm and we depict its net revenues  $R$  in each period of time.

Figure 5. Life-Cycle of an Innovation



Innovation begins with an idea that can be discovered over coffee or in a laboratory. As depicted, the net revenues in the discovery phase are 0 (discovery over coffee) or negative (discovery in an expensive laboratory). Newly discovered ideas seldom have economic value until they are developed, which usually requires capital and labor.<sup>3</sup> Capital and labor are expensive, so net revenues are negative in the development phase. Combining a new idea with capital requires the innovator to trust the financier not to steal the idea, and the financier to trust the innovator not to steal the money – the “double trust dilemma.” Combining the expertise of different people requires individuals to contribute to a joint product – the “collaborators’ dilemma.” Once the idea is

<sup>3</sup> In unusual circumstances, the capital and labor costs are negligible, as when developers freely contribute to public domain software. These unusual cases are unimportant compared to the usual cases that require venture capital.

developed into something of value, it has become an economic innovation, which needs marketing. Marketing a successful innovation usually results in high profits following the launch ( $R \gg 0$ ), declining profits when the innovation attracts imitators ( $R > 0$ ), and reversion to normal profits as the market eventually approaches perfect competition ( $R = 0$ ).

Summing across time periods, the higher the total rewards from the process depicted in Figure 5, the more eager people are to innovate. Law and policy impact the profitability in each phase, as we will explain.

### **A. Arrival Rate of Ideas**

New ideas come from people, especially when they are educated. All else equal, the more people a nation has (or the world has) and the better educated they are, the greater the number of ideas generated. Likewise, the easier it is for these people to communicate with each other, the more ideas they will have. These observations suggest the benefits of some kinds of policies. Education is heavily subsidized by governments and also mandated up to a point. Open immigration policies can stimulate innovation in a nation, especially policies that attract educated immigrants and students. The decline in Western European fertility assuredly reduces the number of idea generators. The effects of China's one child policy on the flow of new ideas are less clear. China concentrates educational expenditures on fewer children. If China's population policy mostly reduces the number of uneducated peasants and increases the number of educated people, then it will have positive effects on growth.

Besides education, communication is important to generating ideas. Communication networks of all sorts, from a popular café to the Internet, are instrumental for people to learn, compete, and cooperate with each other on innovation. The Incas built roads through the Andes and developed a communications code of knots in rope. Eventually, we developed highways and the post office. The centrality of communications to generating ideas may justify subsidizing communications infrastructure and technologies.



## ***B. Development of Innovations***

When someone discovers a better way to make something or something better to make, developing the new idea requires capital. It is a great coincidence when an idea comes to someone with the capital to develop it. Economic innovation usually requires uniting one person's new idea with someone else's capital. To combine new ideas with capital, the innovator must trust the financier with his idea, and the financier must trust the innovator with her capital.<sup>4</sup> To put the matter starkly, if the innovator tells his idea to the financier, what will stop the financier from developing the idea herself or selling it to others? And, if they get past this issue, what will stop the innovator from stealing the money contributed by the financier? This problem is what we call the double trust dilemma (see Cooter and Schaefer [2011]).

These stark problems have milder counterparts. Instead of stealing money, the innovator may waste it. During the dot-com boom in the late 1990s, venture capitalists in Silicon Valley showered billions of dollars on innovators with no management experience. In many cases one person with no management experience hired others with no experience, who hired still others, and money burned all the time. To guard against waste, investors may demand control of the firm's board of directors, so they can install experienced management if the

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<sup>4</sup> Contemporary theories of finance often begin with the principal-agent problem: "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?" A contract that solves this problem provides a rational basis for the investor to trust the manager. 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 where two parties each put something at risk. 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). 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 – 48 (2005). The phrase "double trust dilemma" was introduced by Cooter and Schaefer in Solomon's Knot: How Law Can End the Poverty of Nations.

innovator fails. Once investors have this power, however, they can abuse it by seizing profits flowing from the innovator's idea. Somehow, the innovator and investors must come to trust each other. Instead of blind trust, the parties need trust supported by contract, corporate, bankruptcy, securities, and intellectual property laws, among others. Each problem has a solution in law, and each solution has more problems. In the end, law can ameliorate the double trust dilemma, but not eliminate it. Minimizing the double trust problem is central to increasing the pace of innovation.

Next we consider combining an idea with labor. Developing an idea requires collaboration among individuals who work on complementary aspects of a joint product. Observing each other's work is difficult for the collaborators on innovations. In contrast, observing the joint product is relatively easy once it is developed. Creating a structure for collaboration in these conditions, which we call the *collaborators' dilemma*, confronts several familiar economic problems. First, collaborators must prevent slacking. A common labor contract in companies with stable, established businesses pays a salary of \$X per month. This contract compensates workers without much regard to their effort, as long as they come to work. A fixed monthly salary poses a severe problem of slacking when developing an innovation. Another common labor contract pays a fixed share of the value of a joint product. Thus a collaborator might receive  $1/n$  of the total shares of a startup firm. Such a collaborator bears the full cost of his own efforts and he receives  $1/n$  of the resulting increase in value of the joint product. Again, the problem of slacking is severe.<sup>5</sup>

Second, the joint product may have little or no value unless every collaborator does his part. When each of the key collaborators provides something that is necessary to develop the innovation, one collaborator may wait until the others have done their parts, and then demand a larger share of the joint

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<sup>5</sup> In a contract for fixed shares, each individual has an incentive to slack unless he receives 100% of the value of the joint product. The ideal contractual solution is described in Cooter and Porat, "Anti-insurance," 31 J. Legal Studies 203-232 (2002).

value in order to do his part. Collaborators need an incentive mechanism to prevent hold-up. Contract law solves this problem imperfectly but workably.<sup>6</sup>

Third, collaboration requires matching abilities to tasks. Most people know more about their own abilities than others can observe. Many collaborators may want a more important task than warranted by their abilities, so they may exaggerate their abilities. Solving the collaborators' dilemma requires incentives for potential participants to reveal their abilities to each other.<sup>7</sup> Generalizing, each collaborator often has valuable information that he can share or withhold from the collaboration at little or no cost, including information about his own skill. Perfect incentives require each collaborator to receive more from disclosing to the joint venture than from withholding information.

Compared to monthly salaries or fixed shares, more elaborate contracts can improve the solution to the collaborators' dilemma. Elaborate contracts often defer pay until effort and expertise are roughly known. If pay is deferred until a project's completion, however, the firm could gain by firing talented and hardworking collaborators at the last moment. The best incentives often require structured deferrals involving stock options, restricted stock, phantom stock or other law-intensive creations. One tolerably good solution is to give collaborators shares in the company that vest over time. If they slack off, they can be dismissed before the shares fully vest. Likewise, they can be dismissed if they don't have the expertise to do a good job. Once vesting commences, however, firing an employee saves only a portion of the payments due, so the firm will not want to fire a good worker whose performance reveals dedication

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<sup>6</sup> The issue in a contract dispute over an alleged holdup is whether threatening to withhold effort constitutes "duress" or an appropriate response to a change in circumstances. Thus the general contractor for a new airplane cannot deliver it to the military without a radar set. The subcontractor who is responsible for the building the radar lags behind the other subcontractors and then demands more money to complete his task on time. See Oren Bar-Gill and Omri Ben-Shahar, "The Law of Duress and the Economics of Credible Threats," *The Journal of Legal Studies* 33, no. 2 (2004): 391-430.

<sup>7</sup> To induce revelation of skills, employers often underpay employees in a test period and then subsequently overpay those who succeed. This strategy may explain tenure in universities and partnership in law firms. See Edward P. Lazear, "Performance Pay and Productivity," *American Econ.Rev.* 90 (2000): 1346-61.

and ability. A large literature generalizes this problem and shows why incomplete information leads to imperfect incentives.<sup>8</sup> Although a perfect solution is impossible, good laws make workable solutions easy and cheap; bad law makes solutions hard and expensive.

### ***C. Marketing of Innovations: Rewards and Incentives to Innovate.***

Recouping the cost of discovering and developing ideas requires successful marketing of the innovation. Marketing often occurs in three phases as depicted in Figure 5. In the initial phase, the firm has the advantage of bringing an innovation to the market first. A patent or a secret creates temporary monopoly for the innovator. Next comes the second phase of marketing: The innovator's high profits attract imitators, who invent a substitute for a patented good or discover the secret of an unpatented good. In the phase of imitation, the innovator and a few imitators enjoy oligopoly profits. In the third and final phase, the patent expires or the secret disperses, and competitors bid away the oligopoly profits. Perfect substitutes exist for the innovator's product, so the market settles into a perfectly competitive equilibrium where profits are zero.<sup>9</sup>

Figure 5 depicts the phases of an innovative business venture. The sum of the revenues and costs over all of the phases are what we call "venture profits." The higher the venture profits, the stronger is the incentive to innovate. Law has everything to do with the size of venture profits, as illustrated in the next section.

## **V. Examples**

A legal change can increase the rate of innovation by improving the flow, development, and marketing of new ideas. We give examples from three areas of law: intellectual property, antitrust, and accidents.

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<sup>8</sup> We refer to the vast literature on the problem of production in teams and the principal agent problem.

<sup>9</sup> When the cost of capital is subtracted from the net revenues of a perfectly competitive firm, its profits are zero.

### ***Intellectual Property***

Intellectual property determines whether the inventor owns the invention. According to the standard analysis, strong patents (wide breadth, long duration) increase the profitability of innovation, which causes faster growth. The increase in profitability, however, comes from higher prices paid by the innovation's consumers. The optimal strength of patents, according to the standard analysis, balances the social gain from faster innovation against the social loss from less consumption of each innovation.

The standard analysis frames the problem of law policy wrongly. By relying on the standard analysis, law and policy for intellectual property have built on the wrong foundation. As explained, growth overtakes the welfare effects of other objectives. Consequently, law and policy for intellectual property should maximize the rate of sustained growth, not balance growth against other values. In general, patents should have the strength that maximizes the rate of innovation. This is the correct measure of whether patents are currently too strong or too weak. For intellectual property, officials should worry much about incentives for innovation and little about static losses in welfare.

To maximize innovation, how strong should patents be? Innovation will be maximized when it is most profitable. The optimal intellectual property law maximizes innovators' profits, which requires balancing two considerations. Strengthening patents increases the revenues from marketing an innovation. However, many innovations are used to make follow-on innovations. Strengthening patents increases the cost of developing innovations from prior innovations. When optimizing the strength of patents, increasing costs in the development phase must balance against increasing revenues in the marketing phase of Figure 5. Thus a stronger patent on a new molecule raises its price, which raises the cost of deriving a new molecule from it. Similarly, a patent on DVD technology that raises its price will decrease the profitability of making a movie that plays on it.

In general, we advocate an intellectual property regime that worries little about static losses and worries much about incentives for foundational innovations. Since strengthening a patent raises revenues and costs of innovating, the strength of patent that maximizes the profitability of innovation is uncertain in theory. The optimum depends on facts. Some observers think that they know the answer for some technologies,<sup>10</sup> but much empirical research is undone.

### ***Antitrust Law***

An innovator often enjoys a temporary advantage over its imitators. Using the advantage to raise prices increases the innovator's profits and reduces consumption of the innovation. Antitrust law influences an innovator's ability to profit from his temporary advantage. According to the standard analysis of dynamic industries, the optimal antitrust law balances the social gain from faster innovation against the social loss from less consumption of each innovation.<sup>11</sup> For dynamic industries, the standard analysis of antitrust law is wrong for the same reason as the standard analysis of intellectual property law. Since growth overtakes the welfare effects of other objectives, antitrust law and policy should maximize the rate of sustained growth, not balance growth against other values. Maximizing the rate of sustained growth requires maximizing the profits from innovation. Higher prices for innovations increase the revenues of innovators, and also increase their costs in so far as prior innovations are inputs into subsequent innovations. Antitrust law and policy maximize innovation by balancing the higher revenues from selling innovations in monopolized markets and the higher costs from buying past innovations to make new ones.

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<sup>10</sup> In various publications Mark Lemley and Larry Lessig have argued that growth in computer technology industries would benefit from more common ownership and fewer property rights (less restrictive copyright and patent law).

<sup>11</sup> Richard Gilbert, a leading antitrust scholar in the field of innovation, provides a recent example of the use of this framework. See "Deal or No Deal? Licensing Negotiations by Standard Development Organizations," in *Berkeley Law and Economics Workshop*, 2010.

In our view, antitrust policy in markets for innovative industries should pursue the same goals as intellectual property law. We advocate an antitrust regime for dynamic industries that worries little about static losses and worries much about incentives for innovations. For intellectual property, innovation often flourishes from patents of moderate strength. Similarly, innovation will often flourish from moderate monopoly power in marketing innovations.

Neither American nor European competition law condemns monopoly per se. Rather, if a monopoly excludes competitors by a means other than producing better products at low prices, then both American and European law condemn its behavior. Our analysis would support that result, but not for the standard reason that today's consumer is worse off. Instead, our analysis would support that result to the extent (and only to the extent) that unfettered competition spurs innovation.

American and European law split on whether excessive pricing is monopolization – American law says “no,” while European law says “yes” or “sometimes.” Like a limited duration patent, the European rule has the disadvantage of lowering the rewards to the innovator. But if the monopoly's product is an input for the innovation of others, then the European rule could lower the cost of innovation. Which is the better rule becomes an empirical question with few general answers at this time.

We have discussed monopoly in marketing innovations. Now we turn to developing innovations. When the market to develop innovations is competitive, many innovators compete to find financiers and collaborators, and many financiers and collaborators compete to find the best ideas to develop. Competition will find workable solutions to the double trust dilemma and the collaborator's dilemma. In our view, competition among many parties is likely to result in more development of better ideas than a cartel or monopoly.

Schumpeter disagreed about financing the discovery of ideas and the development of innovations. According to Schumpeter, firms need extraordinary profit as a source of funds for research and development. Firms with ordinary

profits are unable or unwilling to bear the delays and risks of innovating. Perhaps this argument applied in Schumpeter's day before modern financing, but we do not think that it applies today. Modern contracts and business law provide workable solutions to the double trust dilemma without a pool of monopoly operating profits.

### ***The Bias Against Newness in Accident Law***

Our last example concerns the difference between tort liability's effects on efficiency and growth. Some tort scholars believe that community standards of negligence have an inherent bias against change. To illustrate, assume that a doctor who uses customary technology in an operation has a defense against tort liability. Adopting a novel technology strips away the doctor's customary defense in a tort suit. In general, anyone who changes technologies risks liability by losing the defense of doing what everyone else does.

The customary defense in tort law can cause static inefficiency. Imagine an economy with customary technology A that everyone in an industry uses. Alternative technology B that is safer for consumers, but no one uses. Efficiency requires shifting production from A to B, but doing so is risky because the first-mover will lose the customary defense. The change is particularly unattractive to firms in the industry if technology B costs more than A. The firm that shifts will bear the additional cost of buying technology B, but it will not enjoy the resulting saving in accident costs to consumers, because its liability is already zero when everyone uses technology A.

Thus the customary defense creates a status quo bias. This inefficiency has multiplicative effects. However, discouraging innovation is the larger problem with the bias against newness. The bias against newness reduces investments in improving safety technology, which presumably lowers the exponential growth rate. We already explained that legal policy should focus on innovation, not static efficiency, and this proposition applies to safety technology.

We have been discussing a bias against newness in the legal standard of care. A similar analysis applies to the level of damages. To illustrate, assume



that manufacturers in a particular industry are strictly liable for consumer injuries caused by manufacturing defects. However, the level of damages is too low, so the manufacturers take too little precaution relative to the efficient level. If an increase in damages causes them to increase their precaution, the benefit will often grow in each period as the industry grows. In other words, the increase in static efficiency increases the base to which growth applies. This is a multiplicative improvement. In addition, higher damages may cause entrepreneurs to invest more in innovations that improve safety. If investments in safety innovations have cumulative effects, the result may be an increase in the growth rate, which will lead to an exponential improvement in the consumption sequence. The increase in innovation from correcting under-compensation of victims overtakes the welfare effects from changes in the level of precaution.

## **VI. Conclusion**

Sustained growth overtakes many other causes of economic welfare. To maximize growth, law and policy should maximize the profitability of innovation. Innovations come from discovering, developing, and marketing innovations. The profitability of innovation depends on many laws that facilitate and regulate it. Developing an innovative idea requires combining it with capital (the double-trust dilemma) and labor (the collaborators' dilemma), which is what business ventures do. To solve these dilemmas, business ventures especially need law. Law and policy for dynamic industries in the United States currently fails to maximize growth because it fails to maximize the profitability of innovation. Thus intellectual property and antitrust law balance growth and the loss to consumers from higher prices. Instead, these laws should balance higher revenues from monopoly power and higher costs from buying past innovations to develop new ones. We believe that innovation will flourish from competition in the market for developing innovations and temporary monopoly in the market for sales.

## References

Arrow, Kenneth J., “The Economics of Agency: An Overview,” in *Principals and Agents: The Structure of Business*, ed. John W. Pratt and Richard J. Zeckhauser, 1985.

Baker, Jonathan B. “Beyond Schumpeter vs. Arrow: How Antitrust Fosters Innovation,” *Antitrust Law Journal* 74 (2007): 575.

Black, Bernard and Ronald Gilson, “Does Venture Capital Require an Active Stock Market?,” 11 *Journal of Applied Corporate Finance* 36 – 48 (2005).

Cooter, Robert and Edlin, Aaron, 2010, “Maximizing Growth vs. Static Efficiency,” Working Paper, UC Berkeley.

Cooter, Robert, and Hans Bernd Schaefer [2011] Solomon’s Knot: How Law Can End the Poverty of Nations (Princeton University Press, forthcoming).

Jones, Charles I. and Paul M. Romer, “The New Kaldor Facts: Ideas, Institutions, Population, and Human Capital,” NBER Working Paper, June 2009.

Kitch, Edmund W., “The Law and Economics of Rights in Valuable Information,” *J. Legal Studies* 9 (1980).