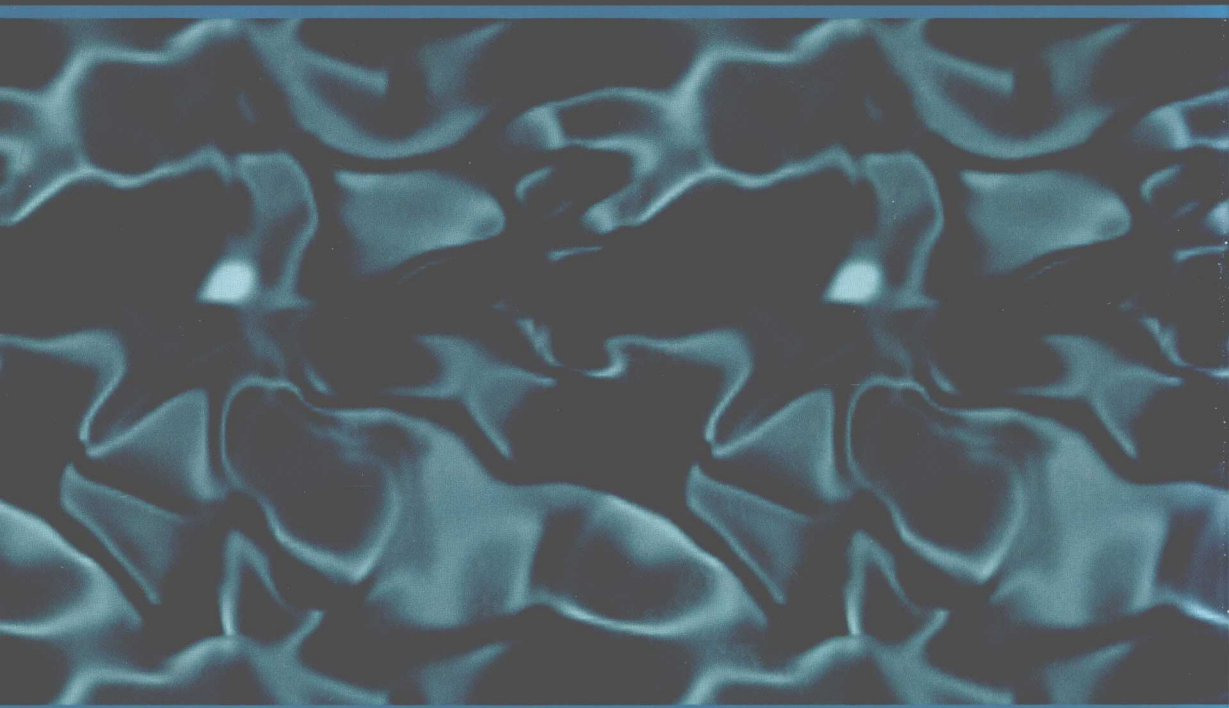
Law and Economics of Innovation

Edited by **Eli M. Salzberger**



ECONOMIC APPROACHES TO LAW 30

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Edited by

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Introduction

Eli M. Salzberger[*]

There is no doubt that innovation plays an increasing key role in the economy, as well as a pivotal role in society and culture, and thus laws relevant to innovation are becoming of immense importance. However, it is quite a challenge to publish a volume on the *law and economics of innovation*, as one can point to neither an established legal branch of *innovation law*, nor to a general, comprehensive and agreed upon economic theory of innovation, or even a systematic incorporation of technological change as an endogenous variable into the traditional macroeconomic and microeconomic theories.

This volume, therefore, ought to be read not as a celebration of the state of knowledge and writings about the law and economics of innovation, but rather as a collection of the few pioneering works in the field, as laying out the basic concepts and beginnings of a new direction in theoretical and empirical studies, and perhaps as setting the agenda for future research.

In the same spirit, this short introduction will open with a discussion on the basic concepts related to innovation, will continue with scrutinizing the major economic writings in the field, followed by summarizing what writings in law and economics of innovation have produced. It will conclude with a set of questions awaiting a more thorough and serious analysis.

Selecting the articles for this volume and their organization was done with the following considerations in mind:

1. For the main readership – the law and economics students and scholars – an overview of what has been written by economists in the field of innovation is an essential appetizer, especially in light of the fact that most issues discussed by economists have not yet found a corresponding literature in the law and economics arena.
2. Within the economics literature, my approach was to include diversified scholarship, some of which are pieces of survey with numerous references to additional materials. Thus the collection includes both theoretical articles and empirical ones; articles that analyze innovation from the perspectives of microeconomics, macroeconomics, institutional economics and industrial organization, based on both the neoclassical paradigm and the evolutionary tradition.
3. Likewise, although the law and economics literature in the field is very small, save in the area of intellectual property, the collection is meant to cover the broadest set of legal fields.
4. I tried to include in this volume articles that have not been published in previous Edward Elgar collections. Thus, for a fuller picture, the readers are invited to consult Freeman (1990) and Link (2008a) for economic analysis of innovation, Link (2008b) for the economics of innovation policy, Merges (2007) and Margolis and Newmark (2010) for law and economics of intellectual property law.

Basic Concepts

Scientific research is the search for knowledge based on observed facts and truths using theories and empirical findings in a systematic way. *Technology* is the application of scientific knowledge in the actual process of production or consumption. However, some technological changes (some argue that the greater share of technological change measured by micro and macro indicators) are the consequence of practical knowledge on the micro-level of firm production (*learning by doing*) and are unrelated directly to scientific research and discoveries or to purposive research and development (R&D) activities. Changes in technology enable the production of new products and a more efficient production of existing products, thus contributing to personal and aggregate (national and global) income, economic growth, progress and quality of life.

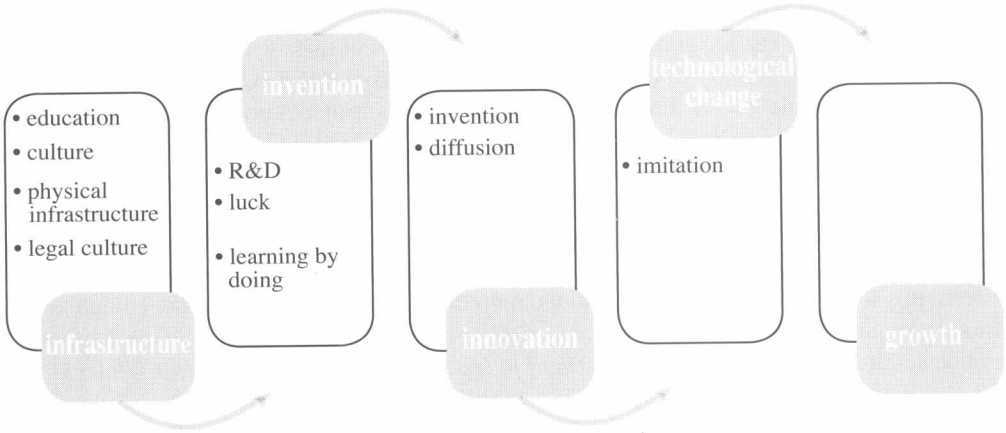
Inventions are the creation of something new. Many inventions are based on scientific findings, but some are the result of sheer luck. Inventions have very little effect on our lives until they are put to use; when they are first put to use they become *innovations*, which transforms the state of technology, enabling new products (*product innovation*) or better production of existing products (*process innovation*). This distinction (which cannot be presented in the real world as a clear-cut dichotomy) is relevant for policy questions as product innovation (unlike process innovation) might endure driving out of the market other earlier products, which has to be taken on board while designing socio-economic and legal policy. Economists offered an additional distinction between *drastic (or major) innovation* and *non-drastic (or incremental) innovation* because it was found that not only do the consequences of the two differ, but also their sources vis-à-vis the economic environment. The invention of the chip, for example, can be considered a drastic innovation, while the increase of its speed can be considered a non-drastic innovation.

The economics of innovation is, therefore, the inquiry into the sources and consequences of technological change. The law is of course one of the prime mechanisms to impinge on such changes. *Law and Economics of Innovation* is thus the inquiry into how current laws affect the innovation process, meaning the promotion of inventions and their application in the production process and the promotion of other sources of innovation (positive analysis), and what the desirable laws are to achieve an optimal level of technological progress (normative analysis).

While technological progress can be analyzed on the micro-level from a specific invention to a new or improved product, it has also significant macro aspects, as the likelihood of an innovative economy depends on the level of education, on the level of communication and information exchange, on infrastructure, on institutions and on the socio-economic and cultural environment in general. In other words, technology is not merely a specific physical, tangible or intangible good; it is a whole social process (Link 2008a: ix). Likewise, innovation, the source of which is learning by doing, depends on organizational structures, business methods, corporate governance and culture, on top of the general variables that contribute to an innovative culture. Most law and economics work so far has focused on the micro-level, ignoring the importance of macro-level analysis.

A related, though different, perspective which can assist in organizing theoretical and empirical studies of innovation is the Schumpeter characterization of technological change as comprising four phases: invention, innovation, diffusion and imitation. Each can be analyzed

separately or within a general framework of a theory of innovation. As mentioned above, the Schumpeterian characterization is only part of the grand picture of innovation. The figure below attempts to set up a more general description of the process of innovation.



The Economics of Innovation

Economists have always recognized the central importance of technological innovation to economic growth and collective welfare. Adam Smith's *Wealth of Nations* emphasizes 'improvements in machinery', and Karl Marx's model of the capitalist economy ascribes a central role to technological innovation in capital goods. Likewise, Alfred Marshall described knowledge as the chief engine of progress in the economy. However, until the second half of the twentieth century economists devoted very little attention to technological change or innovation as part of their theoretical models or empirical analyses. For example, Paul Samuelson, in his principal textbooks, has always acknowledged the importance of technological change, but then proceeded like all the other leading texts to largely ignore it. Others, like Solow (1957), incorporated technology to their models, but assumed technology to be an exogenous variable in market equilibrium analysis. This had brought Joseph Stiglitz (1987) to lament that 'while it is the dynamic properties of capitalism . . . that constitute the basis of our confidence in its superiority to other forms of economic organization, the theory – at least the version we teach our students – is based on a model that assumes an unchanging technology'. This is also true, as will be elaborated below, for the foundations of law and economics.

A bold exception was the writings of Schumpeter (1912, 1928, 1942) who placed innovation at the core of his economic theory, at the expense of abandoning the traditional neoclassical microeconomics equilibrium paradigm in exchange for a less rigid and less stylized evolutionary model with a strong emphasis on path dependency (Nelson and Winter 1982). One of Schumpeter's important early insights, which highlighted one of the differences between his analysis and the conventional neoclassical model, is that monopoly and oligopoly provide a more favorable environment to nurture innovation (Schumpeter 1928). Later on

Schumpeter himself changed his view, pointing to individual innovative entrepreneurs as the main vehicle to promote innovation (Schumpeter 1942). This point is still under heated debate in theory and empirical studies, as reflected by some of the publications included in this collection.

Things changed in the second half of the twentieth century when more and more economists made technological change and innovation a central focus of their writings, although there is still neither a general theory of innovation nor incorporation of technological change as a full endogenous variable to the traditional microeconomics and macroeconomics models. In addition, the role and functions of innovation highlight a 'sharp inconsistency between the macro-growth literature and the micro literature on technological change *per se* – that calls into question the basic tenets of neoclassical theory' (Nelson and Winter 1974: 886).

The first part of this collection on the economics of innovation includes two broad survey articles – Nelson and Winter's piece, which summarizes the literature up to the mid 1970s, and Freeman's survey, which brings us up to the mid-1990s. Both surveys show the complexity of innovation and the possible consequence of this complexity according to which there might not be an integral and comprehensive theory to analyze innovation. Nelson and Winter (1977: 38–40) in Chapter 2 emphasize the significant differences across sectors of the economy and the differences between markets of firms and consumers and non-market institutions (pp. 68–70). Following their agenda-setting survey, one can find a more systematic taxonomy of industrial sectors developed by Pavitt (1984), which has been widely used in neo-Schumpeterian literature. He classified industries into three categories: (a) supplier-dominated; (b) production-intensive; and (c) science-based. Pavitt argued that each category had a somewhat different pattern of external relationships to sources of knowledge, to in-house scientific and technical activities, to diversification behavior of industrial structure and to skill formation. In contemporary writings one can point to theoretical and empirical analysis based on the presupposition of 'demand-pull' motivation for innovation versus writings that are based on the presupposition of 'science and technology push' or 'market-led' theories of innovation.

In Chapter 7 Freeman (1994) emphasizes the different types of innovation – major and incremental, which ought to be analyzed separately as their sources and effects are different. For example, incremental innovations are mostly the result of workers themselves rather than the result of internal or external R&D activity and organizations. He also points to the importance of the national education and training system, which may have a considerable influence on firms' innovative performance, as well as the wide variety of research institutes, sources of technical information, consultancy services and government laboratories. However, he also asserts that most neo-Schumpeterians, following Lundvall (1992) and his colleagues, stress that a 'national system of innovation' is much more than a network of institutions supporting R&D; it involves interfirm network relationships and especially user–producer linkages of all kinds, as well as incentive and appropriability systems, labor relations and a wide range of government institutions and policies. Neo-Schumpeterian research has made a significant contribution in this field, by confirming the relatively limited role that patents play in protecting firms' new technology in most industries and by demonstrating the important contribution of other methods.

Within the neoclassical paradigm, the article by Dasgupta and Stiglitz (1980) in Chapter 3 constructs a traditional microeconomic model with endogenous analysis of innovation. The

authors find that competitive markets will not necessarily induce an efficient outcome vis-à-vis investment in R&D, portraying a more complex picture with regard to concentration and degree of monopolistic powers as correlated to an efficient level of innovation. While technical change is endogenous to market structure, they argue, it is also true that market structure is endogenous to technical change.

In Chapter 5 Romer (1990) peruses the endogenous analysis of innovation but argues that the Dasgupta and Stiglitz analysis does not go far enough because it does not recognize the unique characteristic of technological progress, which is partly excludable and partly non-excludable. Such an assumption leads to a model following Solow (1956) with the significant change in which the level of innovation becomes an endogenous variable of the basically neoclassical framework, and to the conclusion that decentralized equilibrium cannot be sustained. His model shows that human capital rather than Schumpeterian scale is an important predictor of growth. Romer's model is important for law and economics because it focuses on the positive public spillover of legally excludable private innovation and thus is an interesting framework to analyze different methods and breadth of intellectual property rights or other legal tools addressing rights in information.

Within the neo-Schumpetrian paradigm, the article by Teece (1992) in Chapter 6 highlights the importance of coordination, accomplished via non-market forms of cooperation, to a well-functioning national system of innovation. The article focuses on the relationship between technical innovation and aspects of industrial organization other than market structure and firm size. It points to an inverse relationship between the strength of intellectual property rights and the desirable, as well as the de facto, level of strategic alliances – implying a constellation of interfirm agreements and the ability to temper opportunistic behavior. This analysis should have a significant bearing on antitrust law and competition policy.

Another article within the neo-Schumpetrian approach is the one by Dosi (1997) in Chapter 8 who distinguishes between four (albeit interrelated) objects of analysis, namely: first, (the changes in) innovative opportunities (strictly speaking, the 'sources' of technical change pertain to this domain); second, the incentives to exploit those opportunities themselves; third, the capabilities of the agents to achieve whatever they try to do, conditional on their perceptions of both opportunities and incentives; and, fourth, the organizational arrangements and mechanisms through which technological advances are searched for and implemented. Dosi asserts that 'one lacks any convincing evidence that the intensity of search grows monotonically with the expected value of the rent streams: on the contrary, it seems, inter-sectoral and inter-temporal differences in the propensity of innovating are better accounted for, in a first approximation, by differences in opportunities and firm-specific capabilities rather than fine variations in profitability incentives (above a minimum threshold)'. He concludes that 'an interpretation of technological dynamics which significantly relaxes the commitments to equilibrium, rationality and inter-agent homogeneity is straightforwardly borne by the current evidence, and is also beginning to generate formalized theoretical tales – with implications well beyond technical change itself, addressing basic issues like how the future is linked to the past, how individual (possibly mistake-ridden) decisions aggregate into collective outcomes, and how problem-solving knowledge is accumulated in a society'.

The other economic pieces in the first part of this collection address narrower issues related to innovation. One such issue is diffusion, the first systematic analysis of which can be

attributed to Rogers (1962). In his 1976 article included here (Ch. 1) Nathan Rosenberg shows that previous literature ignored an important factor – expectations concerning the future pace of technological advancement. Thus a paradox may occur when a rapid expected rate of technological change may lead to a seemingly slow rate of adoption and diffusion. A decision to change firm machinery now, for example, 'may be, in effect, a decision to saddle oneself with the soon-to-be-obsolete technology' (Rosenberg 1976: 534). In contrast, when the pace of technological change is expected to be slow, one can expect the state-of-the-art technology to be adopted and diffused more rapidly. In his words: 'a lagged rate of adoption is the "price" paid by technologically dynamic economies for their technological dynamism'.

On the empirical side of the literature, Zoltan and Audretsch (1988) in Chapter 2 find that there is no significant difference between the contribution to innovation of large and small firms, that patents are a flawed measurement of the degree of innovation but that investment in R&D is significantly correlated with innovation level. Market concentration was found to be negatively correlated to innovation. In Chapter 9 Stock et al. (2002) find in an empirical study on the modem industries inverse relations between firm size and the level of dynamic innovation.

What emerges from the economic literature is that: (1) economists vary significantly in their analysis of innovation and technological change; (2) one can point to two grand frameworks within which innovation is analyzed: the neoclassical model which is a more rigorous theoretical framework but fails to capture various critical aspects of innovation, such as the role of education, infrastructure, firm interrelations and other factors; and the neo-Schumpeterian framework which is less rigorous, but captures these background and less formal variables which are significant sources for innovation. The later sub-paradigm challenges the neoclassical view that has a full trust in free competition and market equilibrium; (3) the ramifications of the economic literature to law and economics are very significant, as the Neo-Schumpeterian approach has a bearing on various legal fields that have been so far outside the radar of scholars writing on innovation, such as labor law, contract law, commercial law in general and public law. Many economists believe that the prime attention given to intellectual property law as the main vehicle to promote innovation is exaggerated.

Law and Economics of Innovation

The rest of this collection includes a selection of law and economics writings related to innovation. As will be noticed, the law and economics literature is less varied than the economics literature and the vast majority of it is within the traditional neoclassical approach. Most law and economics writings regarding innovation focus on intellectual property, and Part II of this collection is devoted to this legal field. Since many of the relevant law and economics articles in this area appeared in previous collections (particularly in Merges 2007) this volume should be read as complementary to the previous collections.

Intellectual property law is perceived by mainstream law and economics as the major legal tool to generate incentives to innovate (Salzberger 2011). Some economists, as elaborated above, have serious doubts about this major premise, and indeed a fierce debate has emerged among legal scholars as to the desirability of the expansion of intellectual property rights in recent decades. In contrast to traditional law and economics, which builds upon the neoclassical

microeconomic framework to justify a strong regime of intellectual property (e.g. Kitch 1977; Landes and Posner 2003), a counter – pro commons or public domain – movement emerged, arguing that the contemporary intellectual property rights regime in fact stifles innovation (e.g. Boyle 2003; Lemley 2004; Boldrin and Levine 2010).

This debate brought some law and economics scholars to examine alternatives to intellectual property rights within the general traditional microeconomic framework and a small representation of this literature is included in this volume. One of the most interesting such pieces is the Shavell and Van Ypersele (2001) article in Chapter 10. The authors construct a microeconomics model in which intellectual property rights (in particular patents) are compared to rewards as two alternative systems to generate incentives to innovate. They conclude that intellectual property rights do not possess a fundamental social advantage over rewards systems and that an optional rewards system – under which innovators choose between rewards and intellectual property rights – is clearly superior to intellectual property rights. The main contribution of the article, compared to most mainstream traditional law and economics writings about intellectual property, is the endogenization of the optimal degree of investment in R&D into the traditional analysis.

Weiser's (2003) article in Chapter 11 focuses on intellectual property in the age of the Internet and rejects both extreme perspectives – that of the propriety model and that of the commons. His article develops a 'competitive platforms model' to guide intellectual property policy in the Internet age. This model embraces proprietary development where there is competition between rival platform standards, but calls for an open standards (public domain) regime where a single platform standard wins out or where rival firms would not seek to invent a proprietary standard at all.

Mandel's (2005) article in Chapter 12 focuses on environmental innovation. Using the traditional neoclassical paradigm, it identifies a particular market failure with the existing patent system, which comes on top of the general monopoly deadweight loss of patents in general. This second market failure results from the positive externalities provided by an environmental innovation. Due to this second market failure, he concludes that the general patent system is not sufficient to drive environmental innovation to a socially optimal level. The article examines several policy changes to overcome this failure and concludes that the only efficient and viable policy change is to introduce an innovation reward system on top of intellectual property law.

Golden (2010), from a more practical, real recent cases perspective, addresses the question of remedies for patent infringement (Ch. 14). In the path of the ground-breaking Calabresi and Melamed (1972) theorem on property rules versus liability rules in the framework of transaction cost analysis, the author examines the optimal remedies for patent infringement vis-à-vis the goal to promote innovation. The major problem is the patent value, which is very difficult to calculate for the purpose of fixing the right amount of damages (i.e. liability rule), while injunction (i.e. property rule) might increase the deadweight loss created by patent monopoly. The article points to five considerations that ought to guide the enforcing authority in creating a flexible system of tailoring the efficient remedy.

The last article in this section is one of the few law and economics attempts to address intellectual property law not in the sole framework of the neoclassical paradigm. In Chapter 13, Tim Wu (2006) analyzes intellectual property rights in the framework of a Hayakian evolutionary model of economics. While most law and economics literature analyzed

intellectual property as a balance between the positive incentives to invent and create and the negative ramifications of monopolistic price deadweight loss, Wu asserts that: 'the most important economic effects of intellectual property may not be effects on price, but rather on industry structure'. According to this view, we must weigh the benefits of intellectual property assignments, which include subsidizing or making possible desirable economic activity, against the costs of the centralization of economic decision-making and the creation of barriers to innovation and market entry. The idea that patent or copyright can block competition is a familiar part of the classic model. Yet its effect has been understood as blocking price competition, leading to deadweight loss. What Wu's model suggests is slightly different. It emphasizes the blocking of decision-making capacity among potential competitors to the rights holder. That is, the relevance of an intellectual property grant is not only that competitors cannot compete on price, but that they cannot develop projects that they consider profitable without the permission of the rights owner. While broad rights or rights held by a limited number of parties promote a hierarchical decision architecture, diffuse rights or non-assignment of rights lead to the market default – polyarchical decision-making architectures, where any firm or individual may decide to undertake a new project. This distinction gives us a new perspective on when intellectual property rights should be assigned and their optimal scope.

Two particular industries are discussed in Part III of the volume – the software and the fashion industries. Although they are very different from each other, both industries have an interesting common character: they are very innovative and at the same time opted not to use intellectual property rights protection provided by the law, demonstrating an alternative model to the standard law and economics argument in favor of strong intellectual property as the main vehicle for innovation.

In Chapter 15, Kogut and Metiu (2001) focus on the open source software industry, which is one of the prime examples for innovation in an environment designed intentionally and ingeniously as lacking intellectual property rights. Scrutinizing two major examples, Linux and Apache, the authors show why the production model of open source is more efficient than in-house hierarchical models (and indeed a source for emulation, even without full realization of it, by its great antithesis – Microsoft – in the way it builds software teams and cultivates developers' networks within the company). There are essentially two sources of efficiency gain in the open source model. The first is the efficiency of implementing production in a distributed community of practice that permits frontier users to also be contributors. This gain is especially striking in light of von Hippel's (1988) finding that many innovations originate from users, not producers. The second source is concurrent debugging and design, which is a natural feature of open source and is blocked under an international property rights regime. Another advantage of open source pointed out by the authors is a broader geographical distribution of innovation successes.

The open source software communities are economically interesting because they constitute not only social exchange, but also a work organization that relies upon a distributed division of labor. The different governance structures influence the development of the code in at least two important ways. The first is that every open source software program runs the danger of 'forking', as seen in the case of Unix or in Java (neither Linux nor Apache have forked into competing versions). The second is that organization by which work is delegated influences the product design.

Raustiala and Sprigman (2006) analyze the fashion industry in Chapter 16. They show how a regime of low intellectual property protection, by permitting extensive and free copying, enables emerging trends to develop and diffuse rapidly, and, as a result of the positionality of fashion, to die rapidly. Together, induced obsolescence and anchoring help explain why the fashion industry's low intellectual property regime has been stable. These twin phenomena at a minimum reduce the economic harm from design copying; harm that is predicted by the standard account of intellectual property rights. At a maximum, these processes actually benefit designers and the industry as a whole.

The article compares the US and the EU legal regimes and shows that despite an EU regime that permits registration of designs, only few choose to register. If design protection were an important element of success for fashion firms competing in the European market, we would expect to see a higher rate of registration under the EU-wide scheme, both because registration in the EU database provides a unitary right that applies across all 27 member countries, and because the law of the EU provides patent-like protection that simply proscribes any subsequent design that is substantially similar to the registered design. As a result, if fashion firms competing in the EU would have valued design protection, the current legal system would strongly incentivize registration in the EU database. They conclude that the fact that firms in both the EU and the US engage in design copying suggests that the differences in legal rules has had no substantial effect on the real rules that govern innovation in either jurisdiction.

The positive analysis presented in Raustiala and Sprigman's article in Chapter 16 suggests at least that any change from a low protection intellectual property system to a high or mid-level protection will not have a dramatic effect on innovation. Nevertheless, it is also true that a move to a nominal high-intellectual property regime in the United States is more likely to result in significant litigation compared to the same move in Europe. The introduction of substantial legal risk may induce designers to avoid the 'referencing' that they engage in so freely now, and this may chill innovation.

Part IV of the collection includes three articles on competition law and innovation. Teece and Coleman (1998) in Chapter 17 articulate the unique characteristics of the high-tech industry and their implications on antitrust policy. These markets are very different from traditional markets in their dynamism, rapid paradigmatic changes and the relatively low advantages of incumbents. The authors distinguish between scarcity (Ricardian) rents and entrepreneurial (Schumpeterian) rents as opposed to monopoly (Porterian) rents, and observe that unfortunately, for the most part, courts are content to use past success as a proxy for future viability, aiming at static, instead of dynamic, efficiency. In many cases, doing so will overstate (or understate) the competitive forces at work in a market. The authors call for new definitions for market share, entry barriers, anticompetitive conduct and other tests employed by competition laws and enforcers, shifting the analysis from focusing on static efficiency to a dynamic one. The results of their analysis are very restrictive of antitrust authorities' intervention in high-tech markets.

Carrier (2008) in Chapter 18 focuses on the pharmaceutical industry vis-à-vis the long-lasting debate about concentration and monopoly versus competition as inducing innovation. His theoretical analysis and empirical findings are meant to provide guidelines for an antitrust policy in this sector. Carrier's main findings are that process innovation and non-drastic

innovation are linked with concentration as opposed to product innovation and drastic innovation which are linked with competition.

Finally, Spulber (2008) in Chapter 19 reviews the 2004 decision of the European Commission and the 2007 decision of The European Court of Justice against Microsoft and argues that these decisions, in which Microsoft was found to be in breach of European competition law, is a blow to innovation around the world. The EU ruled that Microsoft abused its dominant power by bundling its operating system with other products, like Media Player, and ordered unbundling and compulsory access. Spulber argues that this decision is expected to decrease innovation because it is an attack on intellectual property rights, which will reduce the incentive to innovate, it raises barriers to international trade by hardening the entrance of foreign firms into the European market, and it penalizes market outcomes rather than anti-competitive behavior.

Part V looks into torts and innovation. Law and economics literature has hardly looked at the principles of tort liability vis-à-vis the task of promoting innovation, or at aiming at dynamic efficiency. One of the few exceptions is the article in Chapter 20 by Parchomvsky and Stein (2008–09), which criticizes the US torts principle of courts' reliance on customs and conventional technologies as the benchmark for assigning tort liability (as, for example, is the basis rule for determining negligence, product liability, and medical malpractice). They argue that this doctrine chills innovation and distorts its path. This reliance taxes innovators and subsidizes users and replicators of conventional technologies. The authors propose two possible reforms. First, legal reform that will make tort law more welcoming to innovation by eliminating the privileged status of custom and moving to a pure cost–benefit system. Second, granting certain innovations, approved by special boards of industry experts, the same privileged status enjoyed by custom.

The last part of this collection (Part VI) is dedicated to the law and economics of regulation and innovation. Similä's (2002) article in Chapter 21 aims to evaluate the impact of regulation of the pulp and article industry in Finland, vis-à-vis the waste of water, on innovation and diffusion. This empirical study found that it is not the legal rules set by the legislature, but mainly the individual permitting practices that contributed to technological innovation and the progress of the analyzed firms. The later practice is characterized not only by its individual treatment of each pollution incident, but also by the segments of consensual procedure that have been employed by the Finnish authorities. In addition, the best available technology principle and the development of anticipation among firms to changes of regulatory standards managed to achieve a more active process of innovation diffusion. Thus, emission limit values based on constant technological assessment are an important instrument to foster diffusion of innovation. The transparent administrative process and the developed access to environmental information in Finland contribute to a stronger impact of the regulatory regime.

Eisenberg's (2007) article in Chapter 22 focuses on the Food and Drug Administration's (FDA) regulations of drugs and its interrelations with the patent system vis-à-vis innovation. The article challenges the standard story that it is the patent system that makes drug development profitable, and drug regulation that makes it costly, by showing how patents add to costs and how drug regulation works in tandem with patents to protect profits. Eisenberg observes that in recent years the clear distinctions between the functions of the two sets of laws has been blurring. While the role of the patent system in drug development has become more complex and ambiguous, drug regulation has become an increasingly important source

of market exclusivity for innovating firms. A major contribution to this change was the legislation in the US of the Drug Price Competition and Patent Term Restoration Act of 1984, commonly known as the 'Hatch–Waxman Act'. This law pervasively calls upon the FDA to track patents in administering its system of drug approvals, although without ever making substantive judgments about patent validity and infringement. At the same time, the Patent and Trademark Office (PTO) is called upon to track the FDA approval process in timing the expiration of patents.

Eisenberg justifies these changes, showing how regulation can supplement the patent system in promoting innovation. Her three key arguments are: first, the patent system is a one-size-fits-all legal regime, making it difficult to fine-tune the patent laws to meet the needs of the pharmaceutical industry without upsetting the balance of protection and competition in other industries. Second, the FDA provides product market exclusivity, while the patent system provides invention exclusivity. Since many inventions are used in the course of product development, strengthening patent protection is a double-edged sword for innovating firms. Third, FDA-administered exclusivities typically run while a product is on the market, while much or all of a patent term may run earlier than that. As a result, it may be easier for firms to time the period of FDA-administered exclusivity strategically to maximize profits. An additional important role of the FDA is generating information, which is essential to future innovation.

Setting the Agenda for Law and Economics of Innovation

In concluding this introduction, I would like to return to the grand picture, the framework of which can serve both as a reference mark for future works within the field and indeed as setting the agenda for future studies.

One of the differences between the general science of economics and law and economics is the latter's special emphasis on normative analysis (Salzberger 2008). The focus of law and economics is on the effects of law on real-life outcomes. The normative perspective is therefore only natural, as laws interfere with free market activities and thus, when such interventions are deemed necessary or desirable, it is crucial to define what they are meant to achieve. Mainstream law and economics works aim explicitly or implicitly to promote efficiency, whereas a significant body of literature addresses two key questions: (1) the goal of efficiency as opposed to other possible normative goals such as a just distribution or fairness; (2) what is meant by efficiency? Traditional literature within the second question confronted different definitions of efficiency, such as Pareto efficiency, utility maximization and wealth maximization, whereas some law and economics icons like Richard Posner advocated the latter as the best normative benchmark. However, these debates were conducted with the view of static efficiency; that is, how effective any set of legal norms (or other social and economic arrangements) is in generating maximum production of goods and services for any current level of inputs using existing technology. When innovation is the object of analysis, with the view that it is the major vehicle to promote economic growth, one cannot refer any more to static efficiency as the normative goal. The goal shifts to dynamic efficiency, which focuses on the sustainable and constant growth rate of the economy. This shift raises a new set of questions not addressed yet by the literature, which have some common ground with the

earlier debates about Bentham's moral principle of utility maximization, such as the time and geographical units for such maximization. Should we prefer laws that increase growth of 5 percent per year for the next five years with no guarantees for continued growth thereafter, or laws that are due to increase growth by 3 percent for at least the next ten years? Should we prefer laws that take into account the spread of growth in different sectors of the economy or society or nations, or take on board only the national gross domestic product (GDP) rate? Is growth a defendable normative goal in itself (as was argued regarding wealth maximization) or is it a proxy for wellbeing (does the fact, for example, that the average income in the US is greater today – approximately ten times more than 100 years ago – mean that the average American is ten times better off than an average American 100 years ago)? How should we account for the fact that today much more than in the past, due to the increasing pace of technical change, we are incentivized to change gadgets much more frequently? How does this affect the communication between generations and the technological divide which surely affects individual and thus collective wellbeing? To put this differently, progress might have an optimal level, and if this is the case, the normative goal ought to be optimization rather than maximization. All these philosophical questions have not been seriously addressed yet, making a normative analysis of innovation, which is the basis for prescribing the desirable laws regarding innovation, an impossible task.

In addition, innovation focuses on informational goods, the key nature of which is their borderless impact. This feature has a significant impact not only on the normative goal of whose wealth or utility we wish to maximize (local community, national, global) but also on the level of legal rules – state, federal, global. The internalization of intellectual property laws in recent decades is a direct reflection of the nature of information goods and, in combination with the normative questions raised above, law and economics work has to be done with regard not only to the substantive content of laws but also to their desirable political unit level.

A related set of questions arises regarding some pivotal positive foundations of law and economics, such as the Coase theorem (and its extension by Calabresi and Melamed). Coase, disputing the traditional externalities analysis of neoclassical theory, argued that in a world of zero transaction costs the legal rule does not matter as the different affected parties will bypass inefficient rules through contracts. But since in the real world transaction costs indeed exist, the optimal legal rule should be the one that minimizes them. The Coase theorem implicitly assumes a fixed or exogenous level of technology. In other words, it is true for achieving static efficiency. Relaxing this assumption and aiming at dynamic efficiency shakes the conclusions of the theorem, as the choice of the best legal rule has to take into account also the key consideration of the effect of the rule chosen on the likelihood of innovation and technological change. In order to incentivize innovation, entitlements, counter-intuitively, have to be allocated to the party that is less likely to innovate, and the same kind of considerations apply to second-order rules, opting between liability and property. The Parchomovsky and Stein article goes in this direction, but not to a full relaxation of the presuppositions of the Coase theorem. The shift from static to dynamic efficiency is bound to shake up traditional law and economics analysis of private law in general, contract, torts and property in particular.

Law and economics research has to address the relations between research and development, inventions, innovation, growth and individual as well as collective wellbeing. As I wrote in the opening of this introduction, technological change or innovation is usually a consequence of deliberate activity of research and development. However, on the one hand, some innovation