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## Innovation Policy and the Economy: Introduction to Volume 9

This volume is the ninth annual volume of the National Bureau of Economic Research (NBER) Innovation Policy and the Economy (IPE) group. The appreciation of the importance of innovation to the economy has increased over the past decade. There is an active debate regarding the implications of rapid technological change for economic policy and the appropriate policies and programs regarding research, innovation, and the commercialization of new technology. This debate has only intensified as policy makers focus on innovation, new technologies, and the promise of new markets in seeking to address economic and security challenges.

The IPE group seeks to provide an accessible forum to bring the work of leading academic researchers to an audience of policy makers and those interested in the interaction between public policy and innovation. Our goals are as follows:

- To provide an ongoing forum for the presentation of research on the impact of public policy on the innovative process
- To stimulate such research by exposing potentially interested researchers to the issues that policy makers consider important
- To increase the awareness of policy makers (and the public policy community more generally) concerning contemporary research in economics and the other social sciences that usefully informs the evaluation of current or prospective proposals relating to innovation policy

This volume contains revised versions of the papers presented in the group's meeting in Washington, DC, in April 2008.

In "What If Congress Doubled R&D Spending on the Physical Sciences?" Richard Freeman and John Van Reenen provide a timely evaluation of the prospective impact of a significant and sudden increase in funding for research in areas such as physics, engineering, and materials

science. The analysis takes advantage of the rapid increase (and subsequent deceleration) in federal funding for the life sciences that occurred over the last decade. While federal funding for the National Institutes of Health (NIH) increased by more than 75% in inflation-adjusted terms between 1998 and 2003, funding has decreased in constant dollars over the past 5 years. While the rapid boost in NIH funding was hailed by most science policy analysts (and advocates), Freeman and Van Reenen highlight several troubling lessons from the NIH experience. First, the rapid rate of increase engendered significant adjustment costs: the ability of the system to productively allocate the new funds was lower than might have been achieved with a more even pattern of funding growth. Second, the nominal deceleration (and real decline) over the past 5 years has left many institutions and researchers facing significant challenges as they attempt to fulfill long-term research projects or infrastructure initiatives. Finally, the funding increase did not address several long-standing problems that discourage entry by young researchers into scientific careers. Indeed, over the past decade, there has been a significant increase in the “average age” of recipients of R01 grants, the main NIH funding program for university-based research. The authors suggest that, because research simultaneously produces knowledge and adds to the human capital of researchers, the effectiveness of public funding may be enhanced if agencies tilt their awards to younger researchers.

The next two papers focus on the operation of the patent and copyright systems, extending a body of research that has been explored in the IPE series since its inception. In “Intellectual Property as a Bargaining Environment,” Joseph Farrell considers how the operation of the patent system (and antitrust scrutiny of intellectual property agreements) influences the efficiency of the market for technology. He observes that losses in social welfare arising from intellectual property reflect failures to negotiate more efficient outcomes; any welfare analysis of the patent system must account for efficiency or failures arising from the negotiation environment. Building on an emerging body of both theoretical and empirical evidence, Farrell suggests that efficient negotiation in the shadow of intellectual property is often difficult. Among other issues, bargaining over intellectual property is subject to imperfections arising from information gaps and “holdout” problems (particularly when negotiations involve multiple property holders). Farrell considers the potential impact of a range of policies designed to facilitate licensing and negotiation, including rules relating to patent pools, standard-setting organizations, and antitrust and contract law. He concludes that, to the extent that there are significant imperfections in the market for technology,

policies that facilitate licensing and overcome bargaining problems may reduce the welfare losses associated with the patent system.

Douglas Lichtman then considers the impact of copyright law on the production and diffusion of creative works. In “Copyright as Innovation Policy,” he argues that the traditional emphasis on the incentives of producers of creative works is incomplete; copyright policy also has a significant impact on the innovative investments of technologists who create new means for distribution or manipulation of creative content. The tension between providing incentives to creative artists and incentives for the development of new technologies for distribution is illustrated in the case of the Google Books Search Project, an ambitious effort to digitize published works. Lichtman argues that, by and large, the Fair Use Doctrine provides an effective means for balancing the rights and incentives of artists and technologists in cases such as Google Books. Judgments that explicitly balance the rights and incentives of competing parties are likely to enhance the efficiency of both the production and distribution of creative works better than bright-line rules that eschew a separate economic analysis.

The final two papers consider the relationship between market design and innovation, a relatively new set of issues for the IPE series that is coming to play an increasingly important role across a range of innovation policy areas. In the first of these papers, “What Have We Learned from Market Design?” Alvin Roth identifies some cross-cutting lessons concerning the ability of effective market design to promote efficient exchange. Building on his own research with numerous collaborators, he considers a wide range of market design initiatives in both the public and private sectors, with applications ranging from the medical school residency matching program to public school choice and to kidney exchange. Roth highlights three overarching principles for effective market design:

1. *Market thickness*: A sufficient proportion of potential market participants must be able to come together ready to transact with one another.
2. *Lack of “congestion”*: The market must allow enough time, or make transactions fast enough, so that market participants can consider enough alternative possible transactions to arrive at satisfactory outcomes.
3. *Market safety*: Participants must believe that it is safe to participate in the market in a simple manner as opposed to transacting outside the marketplace or by engaging in strategic behavior in a way that reduces overall welfare.

Roth also highlights the (surprisingly important) role of repugnance in determining whether markets are able to operate (and whether their operation can involve monetary transfers). The analysis suggests that economists' experience in market design and market experiments has provided new insights into how to design efficient systems. Moreover, market designers provide policy makers with new and powerful tools to achieve efficient outcomes in an ever wider range of circumstances.

Finally, in "Innovation and Market Design," Peter Cramton asks how market design affects innovation. He considers a number of important market design initiatives, including emission allowance auctions, air slot auctions, spectrum auctions, and electricity markets. Cramton suggests that each of these market design initiatives has played a role in improving incentives to innovate or enhancing the diffusion of new technologies (as in the case of spectrum auctions). First, effective market design improves the ability of prices to serve as a guide to where innovation is likely to be the most profitable. Second, building on the history of various market design initiatives, Cramton suggests that market design tends to enhance competition among asset owners and so sharpen the incentives for innovation. Finally, consistent with the essay by Roth, Cramton argues that market design alleviates a range of market failures and so enhances innovation by helping ensure that the incentives to innovate better reflect the social impact of these breakthroughs.

While the issues involved are undoubtedly difficult, these essays highlight the role that economic theory and empirical analysis can nonetheless play in evaluating key policies affecting innovation. They suggest that contemporary research in economics can usefully inform the evaluation of current and prospective innovation policy alternatives.

Josh Lerner and Scott Stern