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## **Innovation Policy and the Economy: Introduction to Volume 6**

This annual series, sponsored by the National Bureau of Economic Research, provides a forum for research on the interactions among public policy, the innovation process, and the economy. Discussions cover all types of policy that affect the ability of an economy to achieve scientific and technological progress or that affect the impact of science and technology on economic growth. The books are designed to be of interest to general readers interested in public policy as well as to economists. The issues covered in this year's volume include the impact of patent policy changes on innovation, the consequences of the globalization of the R&D workforce and improvements to the new drug approval process.

This volume is the sixth publication 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. At the same time, 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 with the economic and security challenges that our nation has recently faced.

The IPE group, with support of the Ewing Marion Kauffman Foundation, seeks to provide an accessible forum to bring the work of leading academic researchers to an audience of policymakers and those interested in the interaction between public policy and innovation. Our goals are:

- 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 policymakers consider important;

- to increase the awareness of policymakers (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 the papers presented in the group's meeting in Washington, DC, in April 2005.

The first two papers take complementary yet contrasting approaches towards patent policy. The first paper, by James Anton, Hillary Greene, and Dennis Yao, examines the diversity of patent protection. Policymakers and economists alike often regard patents as providing ironclad protection against imitators. But in reality, patents differ substantially by the degree to which they provide protection from unauthorized imitation and, therefore, strength of a patent is a major concern to innovators and imitators alike. Patents may lack strength because they have a probability of being overturned or are relatively easy to circumvent.

Their paper explores the implications of weak patents. Weak patents cause firms to rely more heavily on secrecy and this, in turn, creates situations in which competing firms lack economically important information about the capabilities of their competition as well as their future innovative trajectories. The paper highlights the implications of weak patent rights and private information on innovation and disclosure incentives, antitrust policy, and organizational incentives and entrepreneurial activity.

The second paper is rooted in the changes in patent policy over the past two decades. Adam Jaffe and Josh Lerner make the case for the reform of the U.S. patent system. The authors argue that changes in the patent system over the last two decades have made patents much more potent legal weapons, while at the same time weakening the examination process that is supposed to ensure that only truly novel and original inventions are granted patent. The result has been that patent litigation—such as the attempt by Amazon.com to prevent BarnesandNoble.com from selling books with a single click of the mouse—is throwing sand in the gears of the U.S. innovation machine. The political difficulty that previous patent reform efforts had encountered is described, as well as some possible remedies.

The third paper in the volume considers the impact of the Internet, and policies towards e-commerce, on consumer welfare. While the focus of most commentary during the "dot-com" boom focused on the

potential benefits to suppliers, Fiona Scott Morton focuses attention on a more fundamental and long-term consequence of the diffusion of Internet technology—significant and multifaceted enhancements to consumer welfare. The Internet opens up a new distribution channel, enhances price competition along several dimensions, increases the scope and accuracy of consumer information, facilitates “matching” between potential buyers and sellers (most notably through online auction markets such as eBay), and serves as the backbone for several novel forms of communication (e-mail, instant messaging, etc.). While some of these benefits are captured by traditional price indices (e.g., the benefits of price competition), other dimensions are likely overlooked (such as the convenience of having access to precise information).

Scott Morton synthesizes a burgeoning empirical literature that seeks to assess the size of these welfare gains, pointing out several studies suggesting a significant welfare improvement. Interestingly, those that benefit the most from the Internet may be precisely those who fare poorly in traditional markets—minorities purchasing new automobiles from traditional retailers tend to pay a price premium, while those that also use the Internet are competitive with other population groups. Ensuring the continuation of consumer welfare gains from the Internet has the potential for a significant payoff: while policies protecting traditional retailers may be associated with significant welfare losses, enforcing consumer protections that limit the ability of online retailers to “obfuscate” their pricing, or discriminate across different types of consumers, may have important and beneficial welfare consequences.

Ernie Berndt, Adrian Gottschalk, and Matthew Strobeck then turn attention to a more specific policy challenge, namely how to improve the drug development and approval process. The paper is motivated by both the long lags and delays associated with the drug development process (only a small portion of which can be directly attributed to regulatory delay), and the need for open and free exchange of data and information to ensure safety and efficacy (as highlighted by the recent revelations over the pain reliever Vioxx).

The authors report the findings of a detailed survey of senior FDA personnel, as well as senior R&D and regulatory managers of leading firms throughout the pharmaceutical and biotechnology industries. The survey was conducted just prior to the Vioxx withdrawal, and provides a nuanced and informative portrait of the areas of agreement and disagreement between firms and regulators in this important sector. While most industry managers provided a positive assessment

of the Prescription Drug User Fee Act (PDUFA), there was significant disagreement (including disagreement within firms) on several issues, including how confrontational to be with the FDA, and the effectiveness of communication channels with the FDA. The analysis suggests that there are a number of practical changes that could be made to the FDA approval process that would simultaneously enhance the process of drug development and increase the flow of communication between firms and the FDA; whether the industry and the agency are able to agree upon and implement such changes in the light of several drug recalls in 2004 and 2005 remains an open question.

In the fifth paper in this volume, Richard Freeman considers the globalization of the R&D workforce (most notably, scientists and engineers) and the implications of globalization for policy analysis. Though R&D "offshoring" has begun to receive a great deal of attention in the business and political press, few systematic analyses of the changing global R&D workforce have yet been conducted. Freeman presents evidence for a number of striking changes in the global job market for scientists and engineers:

- First, the US share of the world's science and engineering graduates is declining rapidly, both in terms of degrees awarded within the United States, and the number of degrees awarded to citizens from different countries.
- Second, while science and engineering careers are (increasingly) attractive for those from outside the United States, the job market for young scientists and engineers in the U.S. has become relatively weak. Moreover, a significant increase in the absolute size of the science and engineers workforce of countries such as China and India will have only a small impact on the overall share of those economies devoted to R&D.

Taken together, these changes—rooted in the globalization of trained science and engineering talent—will have a significant impact on U.S. comparative advantage, and imply substantial adjustments for the U.S. labor market and for patterns of global trade. Freeman suggests that the U.S. faces a long transition towards a less dominant position as a global innovator. Addressing this challenge will not be easy. Policymakers have an opportunity to manage how smooth the transition will be as the U.S. becomes one of several centers of global R&D excellence. As well, it is possible to significantly enhance the incentives for U.S. students to pursue careers in science and engineering, particularly in those areas

where the U.S. might be able to establish or maintain global leadership. Finally, Freeman suggests that the consequences of the globalization of the R&D workforce may depend on whether the U.S. is able to leverage its position as the nexus of global innovation, linking scientists and engineers to the venture capitalists, entrepreneurs and managers who can most effectively commercialize global innovation.

The final paper of this year's volume offers a synthesis of the long economics literature on the relationship between market structure and innovation, and the implications of that literature for empirical research and policy analysis. Surveying a wide range of studies, Richard Gilbert draws out several key insights, emphasizing that the relationship between innovation and competition depends on of both the type of innovation and a detailed understanding of the market environment. The size and character of the innovation, the extent of competition before and after innovation, the availability of property rights, and the nature of R&D dynamics and learning are all crucial ingredients in assessing the influence of market structure on innovation in a given environment. Unfortunately, most empirical studies, and many policy analyses, are cross-sectional in nature, and abstract away from the very factors that might provide guidance about this key relationship. Gilbert goes on to highlight a small but growing set of studies—each of which is usually focused on a single industry—which directly account for specific industry factors and a careful understanding of key technological opportunities. Gilbert suggests that an industry-specific approach is more likely to yield useful insight into the equilibrium relationship between innovation and market structure than cross-sectional analysis.

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

Adam B. Jaffe, Josh Lerner, and Scott Stern

