

This PDF is a selection from a published volume from the National Bureau of Economic Research

Volume Title: Innovation Policy and the Economy, Volume 8

Volume Author/Editor: Adam B. Jaffe, Josh Lerner and Scott Stern, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-39121-3

Volume URL: <http://www.nber.org/books/jaff08-1>

Conference Date: April 12, 2007

Publication Date: April 2008

Chapter Title: Front matter, introduction to "Innovation Policy and the Economy, Volume 8"

Chapter Author: Adam B. Jaffe, Josh Lerner and Scott Stern

Chapter URL: <http://www.nber.org/chapters/c5299>

---

# **Innovation Policy and the Economy 8**

---

# **Innovation Policy and the Economy 8**

**edited by**

**Adam B. Jaffe, Josh Lerner, and Scott Stern**

NBER/*Innovation Policy and the Economy*, Number 8, 2007

ISSN: 1531-3468

ISBN-10: 0-226-39120-5

ISBN-13: 978-0-226-39120-5

Published annually by The University of Chicago Press.

© 2007 by the National Bureau of Economic Research.

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

### ***Standing orders***

To place a standing order for this book series, please address your request to The University of Chicago Press, Chicago Distribution Center, Attn. Standing Orders/Customer Service, 11030 S. Langley Avenue, Chicago, IL 60628. Telephone toll free in the U.S. and Canada: 1-800-621-2736; or 1-773-702-7000. Fax toll free in the U.S. and Canada: 1-800-621-8476; or 1-773-702-7212.

### ***Single-copy orders***

*In the U.K. and Europe:* Order from your local bookseller or direct from The University of Chicago Press, c/o John Wiley Ltd. Distribution Center, 1 Oldlands Way, Bognor Regis, West Sussex PO22 9SA, UK. Telephone 01243 779777 or Fax 01243 820250. E-mail: cs-books@wiley.co.uk

*In the U.S., Canada, and the rest of the world:* Order from your local bookseller or direct from The University of Chicago Press, Chicago Distribution Center, 11030 S. Langley Avenue, Chicago, IL 60628. Telephone toll free in the U.S. and Canada: 1-800-621-2736; or 1-773-702-7000. Fax toll free in the U.S. and Canada: 1-800-621-8476; or 1-773-702-7212.

### ***Special orders***

University of Chicago Press books may be purchased at quantity discounts for business or promotional use. For information, please write to Sales Department—Special Sales, The University of Chicago Press, 1427 E. 60th Street, Chicago, IL 60637 USA or telephone 1-773-702-7723.

This book was printed and bound in the United States of America.

10 9 8 7 6 5 4 3 2 1

---

# NBER Board of Directors

## Officers

Elizabeth E. Bailey, *Chairman*

John S. Clarkeson, *Vice Chairman*

Martin Feldstein, *President and Chief Executive Officer*

Susan Colligan, *Vice President for Administration and Budget and Corporate Secretary*

Robert Mednick, *Treasurer*

Kelly Horak, *Controller and Assistant Corporate Secretary*

Gerardine Johnson, *Assistant Corporate Secretary*

## Directors at Large

Peter C. Aldrich

George C. Eads

John Lipsky

Elizabeth E. Bailey

Jessica P. Einhorn

Laurence H. Meyer

Richard B. Berner

Martin Feldstein

Michael H. Moskow

John H. Biggs

Roger W. Ferguson, Jr.

Alicia H. Munnell

John S. Clarkeson

Jacob A. Frenkel

Rudolph A. Oswald

Don R. Conlan

Judith M. Gueron

Robert T. Parry

Kathleen B. Cooper

Robert S. Hamada

Marina v. N. Whitman

Charles H. Dallara

Karen N. Horn

Martin B. Zimmerman

## Directors by University Appointment

George Akerlof, *California, Berkeley*

Joel Mokyr, *Northwestern*

Jagdish Bhagwati, *Columbia*

Andrew Postlewaite, *Pennsylvania*

Glen G. Cain, *Wisconsin*

Uwe E. Reinhardt, *Princeton*

Ray C. Fair, *Yale*

Nathan Rosenberg, *Stanford*

Franklin Fisher, *Massachusetts*

Craig Swan, *Minnesota*

*Institute of Technology*

David B. Yoffie, *Harvard*

Mark Grinblatt, *California, Los Angeles*

Arnold Zellner (Director Emeritus),

Saul H. Hymans, *Michigan*

*Chicago*

Marjorie B. McElroy, *Duke*

## Directors by Appointment of Other Organizations

Jean-Paul Chavas, *American*

*Organizations*

*Agricultural Economics Association*

William W. Lewis, *Committee for*

Gail D. Fosler, *The Conference Board*

*Economic Development*

Martin Gruber, *American Finance*

Robert Mednick, *American Institute of*

*Association*

*Certified Public Accountants*

Timothy W. Guinnane, *Economic*

Angelo Melino, *Canadian Economics*

*History Association*

*Association*

Arthur B. Kennickell, *American*

Harvey Rosenblum, *National*

*Statistical Association*

*Association For Business Economics*

Thea Lee, *American Federation of Labor*

John J. Siegfried, *American Economic*

*and Congress of Industrial*

*Association*

## Directors Emeriti

Andrew Brimmer

Franklin A. Lindsay

Richard N. Rosett

Carl F. Christ

Paul W. McCracken

Eli Shapiro

George Hatsopoulos

Peter G. Peterson

Arnold Zellner

Lawrence R. Klein

---

## **Relation of the Directors to the Work and Publications of the NBER**

1. The object of the NBER is to ascertain and present to the economics profession, and to the public more generally, important economic facts and their interpretation in a scientific manner without policy recommendations. The Board of Directors is charged with the responsibility of ensuring that the work of the NBER is carried on in strict conformity with this object.
2. The President shall establish an internal review process to ensure that book manuscripts proposed for publication DO NOT contain policy recommendations. This shall apply both to the proceedings of conferences and to manuscripts by a single author or by one or more co-authors but shall not apply to authors of comments at NBER conferences who are not NBER affiliates.
3. No book manuscript reporting research shall be published by the NBER until the President has sent to each member of the Board a notice that a manuscript is recommended for publication and that in the President's opinion it is suitable for publication in accordance with the above principles of the NBER. Such notification will include a table of contents and an abstract or summary of the manuscript's content, a list of contributors if applicable, and a response form for use by Directors who desire a copy of the manuscript for review. Each manuscript shall contain a summary drawing attention to the nature and treatment of the problem studied and the main conclusions reached.
4. No volume shall be published until forty-five days have elapsed from the above notification of intention to publish it. During this period a copy shall be sent to any Director requesting it, and if any Director objects to publication on the grounds that the manuscript contains policy recommendations, the objection will be presented to the author(s) or editor(s). In case of dispute, all members of the Board shall be notified, and

the President shall appoint an ad hoc committee of the Board to decide the matter; thirty days additional shall be granted for this purpose.

5. The President shall present annually to the Board a report describing the internal manuscript review process, any objections made by Directors before publication or by anyone after publication, any disputes about such matters, and how they were handled.

6. Publications of the NBER issued for informational purposes concerning the work of the Bureau, or issued to inform the public of the activities at the Bureau, including but not limited to the NBER Digest and Reporter, shall be consistent with the object stated in paragraph 1. They shall contain a specific disclaimer noting that they have not passed through the review procedures required in this resolution. The Executive Committee of the Board is charged with the review of all such publications from time to time.

7. NBER working papers and manuscripts distributed on the Bureau's web site are not deemed to be publications for the purpose of this resolution, but they shall be consistent with the object stated in paragraph 1. Working papers shall contain a specific disclaimer noting that they have not passed through the review procedures required in this resolution. The NBER's web site shall contain a similar disclaimer. The President shall establish an internal review process to ensure that the working papers and the web site do not contain policy recommendations, and shall report annually to the Board on this process and any concerns raised in connection with it.

8. Unless otherwise determined by the Board or exempted by the terms of paragraphs 6 and 7, a copy of this resolution shall be printed in each NBER publication as described in paragraph 2 above.

---

# Contents

Introduction xi

Adam B. Jaffe, Josh Lerner, and Scott Stern

**1 Real Impediments to Academic Biomedical Research 1**

Wesley M. Cohen and John P. Walsh

**2 Commercializing University Innovations:  
Alternative Approaches 31**

Robert E. Litan, Lesa Mitchell, and E. J. Reedy

**3 Economic Experiments and Neutrality in Internet Access 59**

Shane Greenstein

**4 Patent Reform: Aligning Reward and Contribution 111**

Carl Shapiro

**5 Public Policy toward Patent Pools 157**

Josh Lerner and Jean Tirole

---

## Introduction

This volume is the eighth 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 policymakers focus on innovation and new technologies in seeking to address recent 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 policymakers and those interested in the interaction between public policy and innovation. The following are our goals:

- 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 2007.

The first two papers offer complementary perspectives on the impact of policy and institutions at the university-industry interface. Over the last several years, a vigorous policy debate has emerged about the appropriate relationship between academic and commercial research. In

the first paper, Wesley M. Cohen and John P. Walsh focus on one of the most contentious areas of debate: the role of formal intellectual property (such as patents) in publicly funded university research. Several analysts have suggested that academic research, particularly in the life sciences, has suffered an “anticommons” effect, whereby the proliferation and fragmentation of intellectual property rights has limited the ability to follow-on researchers to effectively build on prior scientific discoveries. Cohen and Walsh reorient this debate toward a focus on “real” impediments to academic research. They argue that, from a practical perspective, patents likely play only a minor role in shaping exchanges of materials, data, or tools among scientific researchers. Instead, researchers are able to limit access by follow-on researchers through secrecy or not sharing research materials. Moreover, the choice of whether to share research materials is grounded in both scientific and commercial incentives. Drawing on both qualitative evidence as well as their own detailed survey data, Cohen and Walsh provide evidence that the *practical* limits on sharing may be much more important than the limits imposed by formal intellectual property rights. Thus, to promote a high level of scientific research productivity and cumulative discovery, policymakers may need to establish institutions and incentives that encourage sharing, even for discoveries that are, at least in principle, in the “public domain.”

In the second essay, Robert E. Litan, Lesa Mitchell, and E. J. Reedy address the potential for experimentation and for competition among institutions at the University-industry interface. By and large, efforts to commercialize academic discoveries are organized around university-run technology transfer offices (TTOs), which serve as the only “authorized” licensing channel for inventions developed by university researchers. While universities acknowledge that the objectives of the TTO are multi-dimensional, an emerging body of empirical evidence suggests that (1) TTO officers are provided incentives slanted heavily toward the maximization of licensing revenue and (2) most TTOs realize only a very small level of licensing revenue. Much of a TTO’s time is devoted to technologies that are expected to produce significant short-term revenue, as opposed to technologies that have a longer road to commercialization or those that may benefit society but offer little in terms of licensing fees. To maximize the social benefits from university inventions, Litan, Mitchell, and Reedy suggest that university licensing efforts should be tilted toward enhancing the volume of innovations brought to the marketplace (i.e., focusing on the total flow of deals at the expense of the guaranteed revenue associated with each deal). The essay argues for significant in-

stitutional experimentation in the licensing process and the potential for competition between alternative technology transfer channels. In particular, the authors evaluate the potential benefits (and potential risks) associated with alternative institutions, including a “free agent” model (where external agents could serve as technology brokers), the development of regional alliances among universities, the use of Internet-based brokerage systems, and directly removing barriers for direct commercialization by faculty (and relying on faculty loyalty to earn a financial return). By promoting competition and experimentation in the technology transfer process, these authors emphasize the potential for policy to shape the social benefits from public investments in academic research.

In “Economic Experiments and Neutrality in Internet Access,” Shane Greenstein focuses attention on the crucial role of market experience and learning in evolving high-technology markets. Economic experiments consist of the introduction of new products or business models in actual markets that result in significant learning for market participants. These experiments involve more than just technical invention; they also lead to changes in business operations and organizational procedures that translate technology into economic value. Because economic experiments cannot take place in a laboratory, managers must move beyond building prototypes or conducting highly stylized focus groups and instead subject new technology to real-world markets, learning about market demand, the nature of how alternative characteristics (and even pricing models) are valued, and what forms of potential competition are particularly important. While theoretical understanding of economic experiments is at an early stage, Greenstein draws out several broad insights: for example, outside of a few important exceptions, industry-wide returns from economic experimentation exceed the private returns. More importantly, the historical record illustrates that economic experimentation was extremely important for value creation in the development of Internet access markets. These insights motivate an inquiry into the potential role of regulation in the process of economic experimentation, with a particular focus on the contemporary debate over “net neutrality.” Under the economic experiments approach, optimal policy would grant considerable discretion to broadband carriers if they act only as carriers, such as allowing retail and wholesale price discrimination (within some binding limits applying to the latter). However, when carriers have economic interests in content markets, a three-part test is proposed, limiting carrier discretion within specific bounds. More generally, the policy analysis is premised on nurturing incentives for invest-

ing in economic experiments from both carriers and content providers, considerations that have often been overlooked within the policy debate over net neutrality.

The last two papers focus on the challenges posed by the shifts in the patent system and the appropriate legal and institutional responses. The past two decades have seen an explosion of patent awards across a wide variety of technologies and a dramatic increase in the volume of patent litigation between rivals. Numerous commentators have suggested that the proliferation of these awards has socially detrimental consequences: overlapping intellectual property rights make it expensive for firms to commercialize innovative products and difficult for inventors to move the technological frontier.

“Patent Reform: Aligning Reward and Contribution” by Carl Shapiro begins with the widely accepted observation that innovators must be able to receive as profits a reasonable portion of the social benefits of their innovations if innovation is to be suitably rewarded and encouraged. In many cases, Shapiro argues, the current U.S. patent system allows patent holders to obtain private rewards that *exceed* their social contributions. Such excessive patentee rewards are socially costly as they discourage innovation by others. Shapiro argues that it is critical that the rewards provided to patent holders be related to their actual social benefit. Thus, reducing excessive rewards to patent holders may boost social welfare. In particular, Shapiro highlights two reform proposals (expanding the independent invention defense and the use of reexaminations), which would have highly targeted effects on specific types of patent holders, while not causing an across-the-board reduction in the rewards to patent holders in general. In this respect, these reforms are quite different from the classic instrument of patent policy traditionally studied by economists, namely patent length. Further, because determining the optimal patent length requires an understanding of the relationship between the rewards provided to patent holders and the extent of inventive activity, which is enormously difficult, the proper patent length can be very difficult to compute; the proposed reforms circumvent this problem. After considering these reforms and their beneficial effects, Shapiro turns to three additional proposed changes relating to patent litigation: limiting the use of injunctions, clarifying the way in which “reasonable royalties” are calculated, and narrowing the definition of “willful infringement.”

*Patent pools*, which can be defined as formal or informal organizations where owners of intellectual property share patent rights with each

other and with third parties, are the focus of the paper by Josh Lerner and Jean Tirole, “Public Policy toward Patent Pools.” These pools have been proposed by many parties as a way in which firms can address this patent-thicket problem. Indeed, patent pools are already an economically significant institution and have also been increasingly seen as a potential solution for prevalent patent licensing issues in biotechnology-related fields. This paper aims at pointing out what we know and don’t know about patent pools, their general desirability, and the types of covenants that should or should not be included into their charters. It first presents the basic trade-off—that patent pools can be used to solve “stacking” problems that deter the adoption of innovative technologies, but can also be used by firms to suppress competition and maintain higher prices. After examining the extreme cases where patents of rival firms are perfect complements and perfect substitutes of each other, it turns to the more realistic but complex case where the patents are somewhere between these two extremes. In this middle ground, the authors highlight the importance of regulators’ stances toward independent licensing (the individual patent holder’s ability to license his or her property independently of the pool), grant-back policies (a requirement by the pool that members turn their future intellectual property to the pool if the latter is deemed essential to a proper working of the technology covered by the pool), and royalty control: appropriately designed policies can go a long way toward addressing the regulators’ concerns that the pool may be designed to suppress competition. The paper also considers the empirical evidence about these patent pools.

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 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