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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 two above.
## Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>xi</td>
</tr>
<tr>
<td>(Adam B. Jaffe, Josh Lerner, and Scott Stern)</td>
<td></td>
</tr>
<tr>
<td>1 Is the Pharmaceutical Industry in a Productivity Crisis?</td>
<td>1</td>
</tr>
<tr>
<td>(Iain M. Cockburn)</td>
<td></td>
</tr>
<tr>
<td>2 When Ideas Are Not Free: The Impact of Patents on Scientific</td>
<td>33</td>
</tr>
<tr>
<td>Research</td>
<td></td>
</tr>
<tr>
<td>(Fiona Murray and Scott Stern)</td>
<td></td>
</tr>
<tr>
<td>3 Wrapping It Up in a Person: The Mobility Patterns of New PhDs</td>
<td>71</td>
</tr>
<tr>
<td>(Paula Stephan)</td>
<td></td>
</tr>
<tr>
<td>4 Innovation Incentives for Information Goods</td>
<td>99</td>
</tr>
<tr>
<td>(Erik Brynjolfsson and Xiaoquan (Michael) Zhang)</td>
<td></td>
</tr>
<tr>
<td>5 Innovating under Pressure—Towards a Science of Crisis Management</td>
<td>125</td>
</tr>
<tr>
<td>(Daniel Diermeier, Wallace J. Hopp, and Seyed Iravani)</td>
<td></td>
</tr>
</tbody>
</table>
Innovation Policy and the Economy:  
Introduction to Volume 7

This volume is the seventh 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 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 2006.

The first two papers take complementary yet contrasting approaches towards biomedical innovation. The first paper focuses on the apparent slowdown in new drug approvals and research productivity in the pharmaceutical industry. Despite a dramatic rise in public and private
pharmaceutical R&D expenditures, new drug introductions seem to have experienced a decline since the mid 1990s. Amid expressions of alarm by the media and policymakers, Iain M. Cockburn offers a more systematic assessment of the apparent pharmaceutical R&D productivity crisis. Cockburn suggests that the measurement of the inputs and outputs of pharmaceutical R&D is more subtle than standard measures might suggest, and the pharmaceutical productivity crisis is, at the very least, overstated. There are inherent difficulties in linking the inputs and outputs of pharmaceutical R&D: all drugs are not equal, incremental learning and innovation are important sources of quality improvement, and there are long time lags between discovery and commercialization. Indeed, the rapid rise in expenditures on early stage discovery (and public research) bodes well for a sharp uptick in new drug approvals and therapies over the next decade.

With that said, the lack of capacity in translational medicine (bringing the “bed and bench” together) and the increasing prevalence of intellectual property disputes among those engaged in the drug discovery process pose significant challenges going forward. While the strident claims about a productivity crisis may be overblown, there seems to be significant scope for policy initiatives aimed at enhancing the impact of public funding and public policies encouraging the development and diffusion of pharmaceutical innovation.

The second paper investigates a central challenge raised by Cockburn—the proliferation of formal intellectual property rights over knowledge traditionally maintained in the public domain. Fiona Murray and Scott Stern focus attention on the prevalence and challenges raised by dual-purpose knowledge—when a single discovery simultaneously contributes to scientific understanding and yields potential commercial applications. Over the past decade, a sharp policy debate has emerged over the role of patents protecting dual-purpose knowledge. According to the anti-commons perspective, patents may “privatize” the scientific commons, imposing a significant tax on cumulative scientific discovery. At the same time, patents may facilitate disclosure and trade in the “market for ideas,” encouraging cumulative innovation.

Murray and Stern review recent qualitative and quantitative evidence to adjudicate this debate, highlighting three overall findings. First, from the perspective of individual researchers, patenting does not seem to come at the expense of scientific publication, and both respond to the
process of scientific discovery. Second, patent grants may reduce the extent of use of knowledge: the citation rate to a scientific article describing a dual-purpose discovery experiences a modest decline after patent rights are granted over that knowledge. Finally, the impact of patents may be indirect; rather than directly impacting behavior through patent enforcement, scientific conduct may be affected through related mechanisms such as material transfer agreements. Taken together, academic science has remained an adaptable and resilient institution; rather than subverting the nature of academic science, patents seem to have been incorporated into the overall process of scientific exchange and cumulative discovery.

The third paper in the volume, by Paula Stephan, examines the placement of new PhDs in industry. She argues that while the licensing of academic technology has gotten considerable attention, these flows of individuals are an important and neglected mechanism for transmitting knowledge from universities to industry.

Stephan finds some striking geographic patterns. Two of these are as follows.

- Geographic mobility is very common. Only 37 percent of PhDs trained in science and engineering stay in the state where they earned their doctorate. Almost one out of five new PhDs going to work for industry heads to the San Jose metropolitan area; 58 percent go to work in one of 20 cities.
- Midwestern universities educate over 26 percent of all PhDs going to industry, but in many cases, a very considerable fraction of those students leave the state for employment on the coasts.

She ends the paper with the thought-provoking argument that as the traditional U.S. industrial base shifts, Midwestern state legislatures are likely to be unwilling to continue to subsidize the education of scientists and engineers who work for firms elsewhere. She suggests that a highly trained workforce will only be maintained if the Federal government steps in to provide financial support for graduate education.

Erik Brynjolfsson and Xiaoquan (Michael) Zhang then consider how to provide incentives for producers of digital goods. Unlike traditional products, digital goods can be reproduced without cost. While a price equal to the marginal cost—that is, free distribution—might be economically efficient for consumers, such a pricing scheme would eliminate the economic incentives for creating such goods in the first place.
A variety of policy proposals to address this dilemma have been pro-
posed in recent years.

The authors suggest that manufacturers of digital goods can solve this
dilemma without help from policy-makers. In particular, they propos a
new mechanism which solves this problem, essentially decoupling the
price of digital goods from the payments received by innovators. The
proposal incorporates two key elements, including the use of massive
bundling and the use of "random" coupons. By bundling access to a
wide variety of digital goods in a single package, it is possible to signifi-
cantly reduce the deadweight losses arising from monopoly pricing. As
well, by selectively limiting access to a very small share of the bundle
for individual consumers, it is possible to infer the overall value placed
by consumers over that portion of the bundle, and so appropriately
reward different suppliers for their individual contributions to the bun-
dle. This system appears to work better in stimulating innovation and
encouraging widespread use than either giving the digital goods away
for free or charging all consumers a premium price and consequentially
sharply limiting their distribution.

In the final paper in this volume, Daniel Diermeier, Wallace J. Hopp,
and Seyed Iravani turn our attention towards the challenges facing
both public and private organizations that need to respond quickly and
effectively to unanticipated events. As dramatically highlighted in expe-
riences ranging from the September 11th attacks to Hurricane Katrina,
the ability of public sector organizations to respond to crises varies
dramatically, and seems to depend on their resiliency and adaptability.
In offering foundations for a science of crisis management, Diermeier,
Hopp, and Iravani integrate recent research on social networks with a
flow network approach from production systems modeling to model
performance under crisis conditions. Instead of preparing for specific
scenarios (i.e., contingency planning), responding to the "unimagina-
ble" may be enhanced by cultivating the ability to respond quickly and
adaptively to unfamiliar situations, requiring both individual skills and
effective collaborative relationships. In other words, the effectiveness
of an organization in a crisis depends less on formal hierarchy (which
may be unavailable or congested) than on the ability of individuals to
trust, learn, and coordinate with each other.

Using agent-based simulation methods to evaluate alternative net-
work structures, it turns out that overall performance depends on the
interaction between the structure of a social network and the ability
to learn and propensity to adapt by individuals within that network.
While the authors emphasize that the science of crisis management is at an early stage, the use of a formal analytical structure in this domain points the way to enhancing the design and performance of organizations faced with circumstances and events outside of their planning and experience.

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