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

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

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Introduction

This volume is the fifth 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, an active debate surrounds 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 policy makers 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 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 the papers presented at the group's meeting in Washington, D.C., in April 2004.

The first paper of this year's volume evaluates the implications of the rise of internationally competitive software sectors in a small but growing number of non-G7 countries. During the 1990s, India, Ireland, and Israel (the 3Is), as well as China and Brazil, experienced extraordinarily

rapid growth in their software industries (with growth rates ranging from 20 to 40 percent). Across these countries, more than 500,000 workers are employed in the software sector, and the industry now plays a role in these nations' export composition and aggregate economic growth. Ashish Arora and Alfonso Gambardella address the origins and impact of the globalization of the software industry. They pay particular attention to the implications for future U.S. technology leadership. First, they examine the conditions that allowed the countries within their study to experience sustained growth. On one hand, each country has been able to draw on a large population of highly skilled but underemployed workers and has served as an important source of technically trained immigrants to the United States. However, substantial variation exists in the importance of exports and the role played by multinational firms. For those countries with a substantial export orientation, the overwhelming majority of work is focused on relatively low-level programming rather than high-end design work.

This analysis holds several policy implications. First, and perhaps most important, Arora and Gambardella conclude that continued globalization of the software industry offers significant benefits for the United States. U.S. technological leadership rests in part on the continued position of the United States as the primary destination for highly trained and skilled scientists and engineers, and fears about the potential loss of technological leadership through outsourcing are likely overblown. In the vast majority of cases, software exports from countries such as India are far from the technological frontier. For developing economies, it is important to emphasize that the software industry has depended on the availability of a well-trained technical workforce, a low level of investment in physical capital, and a policy of openness to international trade. Beyond a set of direct benefits such as employment growth, the most important impact of these success stories is to provide a model for technology entrepreneurship in other industrial sectors.

The second paper considers the proper training for would-be entrepreneurs. William J. Baumol begins with the observation that innovations emerge from two sources in our economy: large corporations and entrepreneurs. These two activities are complements, not substitutes. Entrepreneurs tend to provide the more heterodox, breakthrough innovations, while the research and development (R&D) establishments of the larger firms create the enhancements to those breakthroughs that

contribute considerably to their usefulness. While routine innovations are of great and probably of growing importance, the entrepreneurial independent innovator in his or her small-business enterprise continues to play a critical role. Revolutionary breakthroughs continue to be provided to a considerable degree by small enterprises that can avoid the conservative propensities of the giant firm.

The education that is best adapted to the requirements of one of these activities is markedly different from that most suitable for the other. Baumol argues that many of the features of the U.S. educational system can serve to stimulate the formation of innovative new firms and to encourage their more radical innovative contributions. The American educational system seems to be less rigid and demanding than those in the other industrialized countries, thereby enabling it to serve more effectively the needs of entrepreneurs. Baumol suggests the need for more attention to this issue so that educational procedures can better prepare students for entrepreneurial careers.

The third paper presents a framework for evaluating the growth strategies of different cities. Maryann Feldman and Roger Martin proceed from the observation that the growth and competitive advantage of individual firms depends on the strengths and resources of the local economic environment, and that the role of location often cannot be understood by evaluating policy at the level of individual countries. Instead, to evaluate strategies whose aim is to reinforce and enhance the value of location-specific resources, the appropriate unit of analysis is most often a city or a metropolitan area. Feldman and Martin argue that cities may benefit from a strategic orientation that seeks to exploit those resources and attributes that are both unique and not easily replicated. To maximize wage and property values, cities should seek to establish and maintain what they call jurisdictional advantage. Drawing from a well-developed literature in firm strategy, their analysis focuses on how the potential for jurisdictional advantage varies across different environments and on the implications of this variation for city-level policy and planning. Their analysis highlights the different roles to be played by firms and governments in the process of identifying and establishing jurisdictional advantage and the importance of translating strategy into action despite substantial implementation challenges.

The fourth paper considers another lever for governments to use in promoting growth: taxes. William M. Gentry and R. Glenn Hubbard seek to understand the extent to which tax policy encourages or discourages entry. They find that the level of the marginal tax rate has a

negative effect on entrepreneurial entry and so does the progressivity of the tax. These effects are principally traceable to the upside effect: if entrepreneurs are successful, they are likely to find their marginal tax rates also increasing. In supplemental analyses, the authors emphasize the importance of taxes on entrepreneurship. First, the effects are large. The Omnibus Budget Reconciliation Act of 1993, which raised the top marginal individual income tax rate (and thus the progressivity of the tax schedule), is estimated to have reduced the probability of entry into self-employment for upper-middle-income households by as much as 20 percent. Second, the effects are economywide, not just confined to traditional manufacturing or service industries. Gentry and Hubbard show that prospective entrants from innovative industries and occupations are no less affected by the considerations they examine than other prospective entrants.

In the fifth paper, Michael L. Katz and Howard A. Shelanski offer an integrated assessment of the interplay between innovation and merger policy. Merger review, the single most active component of antitrust enforcement in the United States, has traditionally focused on whether a proposed transaction would lead to higher or lower prices, based on a static analysis that compared market power and efficiency effects. However, an increasing number of cases focus on environments where an assessment of the role of innovation is crucial for evaluating the impact of the merger proposal on welfare. Katz and Shelanski highlight two ways in which the potential for innovation may warrant a reconsideration of appropriate antitrust policy. First, when market structure influences innovation incentives, the rate and direction of innovation may itself be a crucial dimension of market performance. Merging parties frequently assert that the transaction will allow them to engage in greater innovation, while antitrust enforcers may object to a transaction on the grounds that it will lead to a loss of competition that would otherwise spur innovation. If mergers can have a substantial (positive or negative) impact on the rate of innovation, an important issue for antitrust enforcement agencies is how to incorporate innovation concerns into their mission and evidentiary methodologies. Second, innovation can dramatically affect the relationship between the pre-merger marketplace and what is likely to happen if the proposed merger is consummated. For example, static market shares are often used as a measure of market power. However, significant innovation may lead to the rapid displacement of a supplier that, by traditional measures, appears to be dominant. When innovation is central to competitive

dynamics, effective merger analysis must account for the potential of innovation in forming predictions about the likely competitive effects of a proposed transaction.

These concerns have led some observers to call for fundamental reforms in antitrust policy, such as a laissez-faire approach to mergers in markets subject to a high rate of technological innovation. Katz and Shelanski focus on a less radical approach, arguing that innovation can be incorporated into traditional merger analysis by expanding the set of tools used in antitrust investigations. Accounting for innovation in merger analysis requires reduced reliance on systematic presumptions about the impact of static market shares on price and welfare. Instead, antitrust enforcement agencies can expand the scope of their expertise and undertake factual inquiries that are specific to the circumstances of a given merger proposal.

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

Adam B. Jaffe, Josh Lerner, and Scott Stern