The Bayh-Dole Act of 1980 and University–Industry Technology Transfer: A Model for Other OECD Governments?*

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ABSTRACT. Recent initiatives by a number of OECD governments suggest considerable interest in emulating the Bayh-Dole Act of 1980, a piece of legislation that is widely credited with stimulating significant growth in university–industry technology transfer and research collaboration in the US. We examine the effects of Bayh-Dole on university–industry collaboration and technology transfer in the US, emphasizing the lengthy history of both activities prior to 1980 and noting the extent to which these activities are rooted in the incentives created by the unusual scale and structure (by comparison with Western Europe or Japan) of the US higher education system. Efforts at "emulation" of the Bayh-Dole policy elsewhere in the OECD are likely to have modest success at best without greater attention to the underlying structural differences among the higher education systems of these nations.

Key words: Bayh-Dole, technology transfer, patents

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1. Introduction

The relationship between academic research and industrial innovation was a central focus of Edwin Mansfield's research agenda. His papers on academic research and industrial innovation (1991, 1995) were important early contributions to the large literature on the economic benefits of US university research. Mansfield found a high social rate of return to investment in academic research performed between 1960s and 1970s, as well as important complementarities and feedbacks between the "basic" and "commercially oriented" research by academic researchers. Mansfield's findings were published near the peak of the "competitiveness debate" of the 1980s and early 1990s within the US over issues such as the alleged failure of US firms to exploit academic research more effectively for commercial advantage. These concerns contributed to the passage of the Bayh-Dole Act of 1980, which sought to facilitate patenting and licensing by US universities of inventions based on federally funded research.

The Bayh-Dole Act was followed by significant growth in patenting and licensing by US universities, and a number of assessments have argued that expansion in these activities enhanced the social returns to publicly funded research academic. Although tenuously anchored in empirical evidence, these assessments and other factors have led governments in many OECD countries to consider policy initiatives that emulate the Bayh-Dole Act. This paper examines the effects of Bayh-Dole on university–industry collaboration and technology

transfer in the US. There is a long history of such collaboration and technology transfer in the US university system stretching far back into the pre-1980 period, and these activities have been rooted in the incentives created by the unusual scale and structure (by comparison with many Western European nations or Japan) of the US higher education system. Based on this analysis, we argue that efforts at "emulation" of the Bayh-Dole policy elsewhere in the OECD are likely to have modest success at best without greater attention to the underlying structural differences among the higher education systems of these nations.

The global diffusion of these policies illustrates a phenomenon that has received little attention in the literature on innovation policy—the efforts by policymakers to "borrow" policy instruments from other economies and apply these instruments in very different institutional contexts. History, path dependence, and institutional "embeddedness" all make this type of "emulation" very difficult. Nonetheless, such emulation has been especially widespread in the field of technology policy, most notably in the area of collaborative R&D policies.

Our critique of the efforts to emulate the Bayh-Dole Act relies in part on a survey of recent evidence on the characteristics of the university–industry knowledge exchange and technology transfer, discussed in Section 2. We discuss the effects of Bayh-Dole, relying on evidence from the pre- and post-1980 periods, in Section 3. Section 4 provides an overview of efforts of other OECD nations to emulate the Act, and Section 5 concludes.

2. How does academic research influence industrial innovation? A review of recent studies

A number of recent studies based on interviews and surveys of senior industrial managers in industries ranging from pharmaceuticals to electrical equipment have examined the influence of university research on industrial innovation, and thereby provide additional insight into the role of universities within the US national innovation system. All of these studies (Cohen, *et al.*, 2002; GUIRR, 1991; Levin *et al.*, 1987; Mansfield, 1991) emphasize the significance of interindustry differences in the relationship between university and industrial innovation. The biomedical sector, especially biotechnology and pharmaceuticals, is unusual, in that university research advances affect industrial innovation more significantly and directly in this field than is true of other sectors.

In these other technological and industrial fields, universities occasionally contributed relevant "inventions," but most commercially significant inventions came from nonacademic research. The incremental advances that were the primary focus of the R&D activities of firms in these sectors were almost exclusively the domain of industrial research, design, problem-solving, and development. University research contributed to technological advances by enhancing knowledge of the fundamental physics and chemistry underlying manufacturing processes and product innovation, an area in which training of scientists and engineers figured prominently, and experimental techniques.

The studies by Levin *et al.* (1987) and Cohen *et al.* (2002) summarize industrial R&D managers' views on the relevance to industrial innovation of various fields of university research (Table I summarizes the results discussed in Levin *et al.*, 1987). Virtually all of the fields of university research that were rated as "important" or "very important" for their innovative activities by survey respondents in both studies were related to engineering or applied sciences. These fields of US university research frequently developed in close collaboration with industry. Interestingly, with the exception of chemistry, few basic sciences appear on the list of university research fields deemed by industry respondents to be relevant to their innovative activities.

The absence of fields such as physics and mathematics in Table I, however, should not be interpreted as indicating that academic research in these fields does not contribute to technical advance in industry. Instead, these results reflect the fact that the effects on industrial innovation of basic research findings in such areas as physics, mathematics, and the physical sciences are realized only after a considerable lag. Moreover, application of academic research results may require that these advances be incorporated into