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Research Policy 32 (2003) 639–658

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# Bottom-up versus top-down policies towards the commercialization of university intellectual property

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Received 1 March 2001; received in revised form 1 September 2001; accepted 1 February 2002

## Abstract

What national policies are most efficient in promoting the commercialization of university-generated knowledge? We address this question by characterizing and evaluating the policy pursued in Sweden and the US, two countries that put a great deal of resources into university R&D, but follow very different models for commercialization. Despite a leading academic record, there is an impression of laggard rates of commercialization of academic research results in Sweden. Although there exist no micro data to evaluate this impression, we argue that it is likely to be true in part due to the top-down nature of Swedish policies aimed at commercializing these innovations as well as an academic environment that discourages academics from actively participating in the commercialization of their ideas. This sits in stark contrast to a US institutional setting characterized by competition between universities for research funds and research personnel, which in turn has led to significant academic freedoms to interact with industry, including significant involvement in new firms.

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*JEL classification:* J24; O31; O32; O57

*Keywords:* Academic entrepreneurship; Innovation; Intellectual property; R&D; Spin-off firms; Technology transfer; University–industry relations; Universities and business formation

## 1. Introduction

Today, the commercialization of university-generated knowledge looms large in the public discussion. This is natural given the recent scientification of technology in key industries. Since a large share of the production of scientific results takes place at universities, the interface between universities and industry has come into focus. Policymakers in many developed

countries have responded by erecting extensive infrastructures intended to facilitate the commercialization of scientific research output. This paper identifies two central strategies, and the incentive structures that they create. We then consider which set of policies are most effective. Following Nelson and Rosenberg's (1993) methodology for comparing national innovation systems, we compare subsets of the US and Swedish innovation systems that affect the commercialization of university technology. As this methodology does not provide a means to evaluate the efficiency of different national policies, our study is highly exploratory and our conclusions only suggestive. However, this caveat does not make such studies less urgent. In this study,

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we will evaluate two national policies towards the commercialization of university intellectual property, namely, the United States and Sweden. The US model is very much focused on creating (economic) incentives for universities to commercialize their research output and then allowing them to experiment to find the best means by which to do that. In contrast, the Swedish model, which is similar to most European Union countries' models in some respects, is very much an attempt by the government to directly create mechanisms that facilitate commercialization. Indeed, our findings are echoed in the results of parallel research conducted by Gittelman (2002), who reaches conclusions similar to our own.

Measured by per capita publication measures, Sweden is an academic powerhouse. In some subfields, this translates into significant amounts of academic output on absolute levels as well. Because of data constraints, it is difficult to detect transfer of university inventions in Sweden. Although it is unclear if this reflects a lack of transfer in general or simply a data problem, it is evident that Sweden's transfer performance through one mechanism, the small start-up firm, is weak. An important clue to this puzzle comes from a growing body of evidence that the role of academics in commercializing their discoveries is critical. This paper compares the different incentive structures that academic researchers face in the United States and Sweden and demonstrates that in Sweden academics face strong disincentives to take the time away from their academic pursuits to facilitate knowledge transfer to the commercial sector. This problem is likely to be especially important when the optimal mode of transfer is through new start-up firms. We do not claim that there is conclusive evidence that the Swedish technology transfer programs are a failure. However, in light of our analysis we believe that it is unlikely that Sweden is harvesting the full commercial potential of its research output as successfully as the US.

Surprisingly, we find suggestive evidence that the American university system, whereby intellectual property is commonly awarded to universities, is more effective in facilitating the commercialization than the Swedish system in which rights are awarded directly to the inventor. That is, in order to understand the incentives created by intellectual property rights, it is imperative to understand the larger institutional context.

It is important at this early stage to define the domain of our analysis. There are a plethora of mechanisms for technology transfer (Sandelin, 2001). Graduate students regularly carry knowledge from the ivory tower into other sectors. Publications and conferences permit industry to monitor and exploit new knowledge produced at universities. Faculty consulting leads directly to the transfer of knowledge. Whereas visiting scholars have long allowed academics from different institutions to exchange knowledge, more recent constructs such as industry affiliate programs, research collaborations and interdisciplinary research centers have brought industry representatives onto campus for similar purposes. Technology licensing is a mechanism that has expanded greatly in the US since the Bayh-Dole Act of 1980. The analysis of all these mechanisms is well beyond the scope of this study. Instead, this analysis will focus on these mechanisms insofar as they facilitate the transfer of *novel* ideas over which intellectual property rights can be established.

A further qualification is perhaps in order. In the exercise that follows, we attempt to establish that Sweden, a country with half the population of Greater Los Angeles, is unsuccessful in commercializing university technology due to an unfavourable incentive structure. We do this by comparing its relative performance with that of the United States. One might expect that a country so small cannot reasonably be expected to produce enough commercially valuable knowledge to have any substantial commercialization activity simply because the supply of ideas may be too low. We cannot directly evaluate the strength of this claim because it is unknown at what levels of academic output, as measured by publications, one might expect to see substantial levels of commercialization activity, even if we could agree on exactly what is meant by substantial. To deal with this challenge, we offer some evidence that academic output in commercially relevant fields such as biotechnology is large, even on an absolute scale. Second, as we argue later, we feel that it is likely that by correcting its incentives, Sweden could be reasonably expected to improve its performance in commercialization.

Recent surveys of technology licensing offices (TLOs) in US universities have revealed an important finding in the American experience that may be directly relevant to the modest Swedish achievements in technology transfer: commercialization of university

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