

## **The Influence of University Research on Industrial Innovation: Evidence from the Pharmaceutical and Semiconductor Industries**

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We explore how the influence of university research on industrial innovation in the pharmaceutical and semiconductor industries has changed over the last decade. In particular, we use U.S. patent data to examine the role of research scientists as a pathway for the diffusion of ideas from university to industry (and vice versa). The scientists involved in the patented invention are listed on each patent, as are the firms and universities to which the patents are assigned. We proceed by first identifying the firms and their subsidiaries in the Compact D/SEC database that are in the semiconductor and pharmaceutical industries and then matching them to the U.S. patent records. Because each scientist's patenting history is contained in the patent data, we can examine the composition of inventors to determine whether an inventor on a firm's patent had previously appeared as an inventor on a patent assigned to a university. Appearing on a patent assigned to a university is evidence that the scientist had exposure to university research, either directly as a university researcher or through some kind collaboration with university researchers. We also match the doctoral degree information from the Dissertation Abstracts to our scientist data.

We find in the pharmaceutical and semiconductor industries that between 1989 and 1997, the percentage of patents assigned to firms that involved inventors with a university background (UNIV) increased from 6.16 to 10.06 percent, and 1.71 to 3.42 percent, respectively. Moreover, the percentage of patents that involved inventors with a university background and doctoral degrees (UNIV\_PHD) increased even more sharply during the same period: 5.44 to 9.48 percent in the pharmaceutical industry, and 0.91 to 2.89 percent in the semiconductor industry. We take this as evidence that the university to industry transfer of ideas, both as represented by innovations in university laboratories and as embodied in university scientific training, has increased in the last decade.

We plan to investigate with our data how these measures of university-industry interaction are related to various firm characteristics. Our preliminary regression results show in both industries that both UNIV and UNIV\_PHD are negatively correlated with a firm's R&D size, and positively correlated with its R&D expenditures per scientist, with the fraction of Ph.D. holders among scientists, and with the number of business lines. This indicates that small firms with multiple product lines are more active in diffusion of ideas from university.