PUBLIC R&D INVESTMENTS AND PRIVATE-SECTOR PATENTING: EVIDENCE FROM NIH FUNDING RULES: Review of Economic Studies (2019)

The question: To what extent do public R&D investments affect private-sector patenting? Valuable applied innovations, such as medical technologies, rely on knowledge created by academic scientists. But basic research is usually not developed by private firms because the ideas are difficult to take directly to market. Therefore, many government agencies like the National Institutes of Health (NIH) fund basic research in order to incentivize the production of basic knowledge with the expectation that this will increase downstream applied innovations in the private market. This paper is one of the first to credibly estimate the causal effect of public spending on private-market patenting. It also investigates whether public funding "crowds-out" private investment that would have occurred in the absence of public research grants.

The results: The authors find that a $10 million increase in public research funding to a specific scientific area increases the private R&D activity in that area by 2.7 patents. The authors roughly estimate that these patents have a value of $13.9 million to $30.2 million in total benefit to firms and consumers, as estimated using stock returns and drug development revenues. When a specific NIH disease-science area receives an unexpected windfall of funding in a given year, there is a noticeable increase in patents that are linked to academic papers that were funded by those grants. Furthermore, rather than crowding-out private funding, public grants seem to increase total patenting activity in a given disease-science area, even among patents that do not directly cite NIH-funded academic paper.

The lessons: According to economic theory, private firms under-invest in knowledge creation because it is difficult to appropriate the value of ideas once they become public. This market failure is a justification for public institutions to finance the creation of research, especially for early-stage scientific studies. The authors find that additional public dollars lead directly to increased patenting activity by private firms. Furthermore, they find little evidence that public grants crowd-out private investment. On the contrary, they find that patenting activity increases even for inventions that are not directly linked to the original public grants, suggesting that the funding creates large positive knowledge spillovers.

The Research Approach: This paper measures commercial output of public funding by directly linking NIH grant numbers to their resulting academic publications and the patents that cite those papers. This provides a direct measure of follow-on patenting to NIH funding even when the patenting takes place in a different medical area or many years after the fact. In order to assess whether NIH funding crowds-out private sector funding, the authors define a broader set of patents that cover similar topics as those that are directly linked to the NIH-supported publications. The causal impact of funding on these patents is difficult to isolate because science areas that attract high public expenditures are probably also very active patenting areas. This correlation cannot be interpreted as a causal relationship because it could be driven by unobserved factors that simultaneously affect private patenting and public funding in a given research area. Therefore, the authors use quasi-random variation in public funding across different NIH sections that is caused by idiosyncratic rigidities in the funding rules. Using an

instrumental variables analysis, they isolate quasi-random variation in funding for a given disease/science area that is based on the arbitrary placement of “paylines” in the application peer review rankings.