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Disclosure and Subsequent Innovation

Evidence from the Patent Depository Library Program

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Patents grant a temporary monopoly right to inventors in exchange for the disclosure of technical information that enables replication of the patented invention. Patent disclosure is thought to facilitate follow-on innovation by transmitting useful knowledge and by avoiding unnecessary duplication of investment. The U.S. Supreme Court has even called disclosure the "quid pro quo of the right to exclude."

Yet, despite the extensive literature tracing the effects of monopoly rights resulting from the patent systems on innovation, there are few studies that evaluate whether patent disclosure helps prospective innovators to stand on the shoulders of earlier generations of inventors.

This is unfortunate, as intellectual property lawyers have expressed doubts about whether patent disclosure is, in fact, useful in fostering cumulative innovation. Skeptical scholars argue that strategic behavior in crafting patent documents can make it difficult for follow-on inventors to extract key information from prior art searches. As well, they argue that many inventors avoid reading patents because this increases the legal risk of "willful infringement." As a result, such researchers are doubtful that, in practice, patent disclosures transmit truly valuable information to potential future inventors. Resolving this debate and measuring the impact, if any, of disclosure for subsequent innovation is of central importance for innovation policy and for our understanding of potential levers to increase the rate of cumulative innovation. There is, however, a paucity of empirical evidence on this question because of a fundamental challenge for causal analysis: The patent system makes the right to exclude competitors (i.e., the monopoly right) dependent on the disclosure of technical information. Because these features co-occur, empirical analysis cannot isolate the effect of the monopoly right on subsequent innovation (the "incentive effect") from the impact of information provision via disclosure on subsequent innovation (the "enablement effect").

To overcome this challenge, we analyze the expansion of the U.S. Patent and Trademark Office (USPTO) and the Patent and Trademark Depository Library (PDL or patent library) system between 1975 and 1997. During this period, such patent libraries were the only places outside of USPTO headquarters in Washington, D.C., that provided public

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access to the full range of technical information available on patent documents and that provided tools to search for prior art. While monopoly rights remained national and constant across the region, the opening of patent libraries created de facto variation across regions in the extent of patent disclosure during the pre-internet era, since such information was more readily available in regions that had such libraries relative to those that did not. We leverage this variation to ask whether differential access to disclosed technical information affected subsequent innovation in regions that received patent libraries.

The USPTO patent library system was founded by an act of Congress in 1871 with the aim of providing innovation-related resources for inventors, entrepreneurs, and incumbent firms. Initial growth was limited, however, and by 1975, only 20 libraries had been established, primarily in New England and states east of the Mississippi. The program was reinvigorated between 1975 and 1997 as the USPTO opened 59 new libraries across the United States. The USPTO did not construct new facilities for the patent deposit libraries, but instead opened PDLs in existing libraries that applied for PDL membership and were able to document that they could commit to dedicating sufficient space, staff, and resources for patent library materials. Thereafter, the library housed a complete set of patent documents and received an official designation as a USPTO Patent Depository Library.

To estimate the impact of opening a patent library on regional innovation, we compare the change in the number of granted patents filed in the region of newly opened libraries with the change in the number of patents in the regions around a control sample of geographically proximate Federal Depository Libraries (FDLs). These constitute a natural control group since the FDLs share the mission of providing the public with official government documents, and nearly all patent libraries are also FDLs.

While the data demonstrate that the regions around the control group and the regions that received patent libraries have similar patenting trends in the period before library opening, our ability to draw causal conclusions from our analysis depends on whether the number of patents in regions that receive libraries would have followed the same trend as those of the regions around the control libraries. This would occur if the opening of a library depended on expected future patenting. While we cannot exclude this situation completely, we should note that this possibility would only arise if libraries that submitted applications to become PDLs (or the USPTO) were prescient enough to choose to open libraries in the precise year and location in which a boost in future patenting was about to occur.

In our primary analysis, we find that the USPTO patent deposit library opening corresponded to an increase in local patenting per capita of 17 percent. Consistent with surveys that suggested approximately 50 percent of PDL users traveled 10 miles or fewer to get to the library, we find that the effect of library opening is highly localized and becomes insignificant outside of the typical library commuting distance of 15 miles. The magnitude of the effect implies an increase of approximately 2.5 patents per year per 100,000 residents in the library region. While this is certainly not enough to radically transform the innovative capacity of the local regions, our estimates suggest that the economic value of these patents substantially exceeds the incremental costs associated with opening and managing the patent deposit libraries.

One concern about the analysis is that patents induced by library opening may reflect trivial innovations or innovations that are of lower quality than those that had been patented previously. However, we do not find evidence of this. Instead, we find no negative effect on patent quality, as measured by patent citations received, which suggests that the additional patents induced by PDL opening are not of lesser economic value than those produced prior to library opening.

Our results suggest that improved access to patent technical information plays a key role in driving the main effect. First, we find that patenting increases more among young companies than enterprises that had greater patenting experience and larger patent portfolios. This is consistent with the expectation that the costs to access the technical information contained in patents were greater for smaller firms than for larger firms.

Second, we find that this effect is most pronounced for technology categories associated with chemistry. This is consistent with work by legal scholars suggesting that patents involving chemical formulae are the most difficult to obscure and is also consistent with survey evidence that suggests inventors in chemistry are most likely to benefit from reading prior art.

Third, we find that after library opening, local inventors start to use knowledge that is less local and that the geography of innovation becomes more dispersed. This suggests that patent libraries facilitate the recombination of ideas across distance and knowledge and contribute to like-minded inventors building on each other's ideas.

A fourth piece of evidence pointing to the role of disclosure in our findings is that the effect of patent libraries opening is strongest in the 1980s, after patent libraries introduced computer databases that substantially improved the ability

to search for prior art. Interestingly, and also consistent with the idea that patent technical information drives the core result, the effect of library opening is not obtained for libraries established after the internet made patent literature universally available and readily searchable in the mid-1990s.

To determine whether library opening affects economic outcomes other than patenting, we examine data from the U.S. Census on regional business dynamics. We find that Metropolitan Statistical Areas (MSAs) in which patent libraries were established experienced significantly greater rates of small-firm entry and exit than did MSAs with comparable FDLs that did not receive such libraries. In addition, local job creation accelerated in regions with patent library openings, and this effect was driven by new entrants. These results suggest that the impact of PDLs is not simply an artifact of increased patenting but is consistent with the prospect that patent libraries affected local entrepreneurial environments.

Taken together, these findings document that patent disclosure contributes to subsequent innovation and that this effect appears in contexts in which patent technical information is informative. We contribute, therefore, to the debate on the benefits of patent disclosure and the merits of the patent system as a whole. Our evidence is consistent with economist Fritz Machlup's argument that a patent "serves to disseminate technological information, and that this accelerates the growth of productivity in the economy." By finding particularly strong effects in chemical innovations (a technological area in which disclosure is thought to be particularly effective) but weaker effects in other areas, our study also offers qualified support for critics that argue that the usefulness of disclosure through patents is limited and that the benefits of reading patents are mixed. Our empirical analysis highlights a potential upside of more stringent disclosure for innovation.

More broadly, our research contributes to the literature on research-enhancing institutions by showing that investments in patent libraries helped to fuel regional innovation. Research-enhancing institutions lower the cost of access to economically valuable knowledge and may help to foster geographical and intertemporal spillovers on which economic growth is based. For example, Biological Resource Centers, which are libraries of living organisms, can foster follow-on innovation by providing open and low-cost access to research materials for life sciences. In recent work also profiled in a Cato Research Brief in Economic Policy (no. 116), Barbara Biasi and Petra Moser show that reducing the access costs to science books during World War I increased scientific output particularly in those regions in which libraries bought these books.

Historical analyses of the U.S. patent system have noted its role in democratizing innovation (i.e., enabling innovation to take root in various geographic regions) across socioeconomic groups and among different types of enterprises. Our results provide evidence that, through its 1975–1997 Patent Depository Library program, the USPTO continued to play a role in spreading innovation across regions and organizational types. In an age before the internet, searching patent documents at a local patent library provided an accessible way to study such prior art, especially for resource-constrained inventors.

NOTE:

This research brief is based on Jeffrey L. Furman, Markus Nagler, and Martin Watzinger, "Disclosure and Subsequent Innovation: Evidence from the Patent Depository Library Program," NBER Working Paper no. 24660, May 2018, http://www.nber.org/papers/w24660.