

Do patents facilitate access to entrepreneurial finance?

Joan Farre-Mensa (HBS), Deepak Hegde (NYU Stern), Alexander Ljungqvist (NYU Stern)

Patents secure the legal rights of inventors over their inventions. In theory, these legal rights enable inventors to seek capital and other resources required to develop their ideas without fear of expropriation (Kitch 1977). In addition, patents can provide a valuable signal to investors, helping them identify which innovative startups are most promising. However, a number of scholars have recently voiced concerns that the US Patent and Trademark Office (USPTO) grants patents of dubious quality and to nearly all those who apply (e.g., National Academy of Sciences 2001, Jaffe and Lerner 2004, Bessen and Meurer 2008). As a result, it is an empirical question whether patents indeed alleviate entrepreneurial firms' financial constraints, be it by certifying their quality or by protecting their property rights.

Do patents facilitate startups' access to finance, in particular venture capital (VC)? If so, what are the mechanisms through which patents facilitate access to venture capital? And how does the role of patents in raising venture capital vary across different technologies? We propose to investigate these questions by using a comprehensive sample of nearly 100,000 U.S. firms that applied for a patent between 2001 and 2012. About 10 percent of these firms eventually secured venture capital. A unique feature of our data is that it covers both granted and rejected patent applications; in addition, we have information on several intermediate events in the patenting process and can identify the examiner that reviewed each patent application. This will allow us to study how the resolution of uncertainty surrounding patent rights affects a startup's access to venture capital.

Identification challenges and empirical strategy

To illustrate the challenges associated with identifying the causal effect of patents on startups' access to venture capital, consider estimating the following empirical specification using a sample of startups that apply for patents:

$$\text{Access to capital} = \beta \text{ patent granted} + \gamma \text{ other variables} + \varepsilon \quad (1)$$

where *access to capital* captures whether the startup is able to secure VC financing (in a first-round or in follow-on rounds). Hsu and Ziedonis (2013) estimate the above specification using a sample of 370 venture-backed semiconductor startups and report that β is positive. This is undoubtedly a valuable first step. However, if patents are correlated with unobservable firm quality, any positive correlation between patents and venture financing may be entirely driven by the fact that higher quality startups are both more likely to attract venture capital and to be granted patents. In order to identify the causal impact of patent rights on startups' access to venture capital, one would ideally want to randomly allocate patents among a group of identical firms and then track whether those firms with patents are more likely to receive venture funding.

Of course, such an ideal experiment is not feasible. Instead, our empirical strategy will exploit exogenous variation in individual patent examiners' leniency to instrument for the probability that a patent is granted. This will allow us to compare similar pairs of firms that submitted patent applications of comparable quality, one of which was approved (because it was randomly

allocated a more lenient examiner) while the other was not. Specifically, we will define the instrument as follows:

$$\text{Examiner leniency}_{ij} = \frac{n_{\text{grant}_j} - \mathbf{1}(\text{grant}_i = 1)}{n_{\text{application}_j} - 1} \quad (2)$$

where n_{grant_j} is the number of patents granted by examiner j ; $n_{\text{application}_j}$ is the number of patent applications reviewed by examiner j , to whom patent application i was assigned; and $\mathbf{1}(\text{grant}_i = 1)$ is an indicator equal to 1 if patent application i was approved. Thus, our leniency measure will capture the patent grant rate of examiner j across all the applications she has reviewed with the only exception of application i itself. Our analysis will include industry-times-application-year fixed effects to capture potentially time-varying differences across industries in the supply of VC funding and in patent approval rates.

Critically, firms play no role in choosing the patent examiners that examine their applications. This suggests that our instrument satisfies the exclusion restriction—patent applications are assigned to examiners (within technology subclasses) entirely based on examiners’ work-loads. This instrument has been used by Sampat and Williams (2014) to study the effect of patent grants on follow-on innovation in the field of genetic engineering.

Assuming that we find that patents do have a causal effect on firms’ ability to raise venture capital, our next step will be to uncover the mechanism through which this effect operates. In particular, our goal is to disentangle the extent to which patents act as a signal of a startup’s quality or, by contrast, whether financiers value patents because they reduce competition and allow firms to extract rents from competitors and customers. We can shed light on this question by exploiting cross-sectional variation in the characteristics of the entrepreneurial ventures. For instance, if patents are more valuable for first-time entrepreneurs, whose quality is as-yet unknown, than for serial entrepreneurs, this would suggest that patents play an important role as signals of quality. Our analysis will also allow us to examine how the role of patents varies across technology fields with different levels of technological uncertainty and capital requirements.

Implications for entrepreneurship and public policy

Securing the property rights of entrepreneurs and individual investors so that they can access resources from external agents is often seen as a key benefit of the patent system (Arora et al., 2001, Lamoreaux and Sokoloff 1999). Yet there is little systematic evidence that patents do, in fact, perform this function. By identifying the effect of patents in facilitating entrepreneurial firms’ access to capital and uncovering the channels through which this effect operates, our study will deepen our understanding of the overall welfare implications of patents. This will help policymakers develop efficient patent policies that enhance entrepreneurial firms’ ability to finance their innovations.

References

Arora, A., Fosfuri, A., and Gambardella, A., 2001. *Markets for Technology: Economics of Innovation and Corporate Strategy* (MIT Press, Cambridge, MA).

Bessen, J., and Meurer, M.J., 2008. *Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk* (Princeton University Press, Princeton, NJ).

Jaffe, A.B., and Lerner, J., 2004. *Innovation and Its Discontents: How Our Broken Patent System is Endangering Innovation and Progress, and What to Do About It* (Princeton University Press, Princeton, NJ).

Kitch, E., 1977. The nature and function of the patent system, *Journal of Law and Economics* 20, 265–290.

Lamoreaux, N.R., and Sokoloff, K.L., 1999. Inventors, firms, and the market for technology in the late nineteenth and early twentieth centuries. Pp. 19–60 in *Learning by Doing in Markets, Firms and Countries*, edited by Naomi R. Lamoreaux, Dan M. G. Raff, and Peter Temin (University of Chicago Press, Chicago, IL).

National Academy of Sciences 2004 Committee on Intellectual Property Rights in the Knowledge-Based Economy, National Research Council. *A Patent System for the 21st Century*, National Academies Press, Washington, DC, 2004.

Sampat, B., and Williams, H., 2014. How do patents affect follow-on innovation? Evidence from the human genome. Working paper available at <http://economics.mit.edu/files/9778>