

# **Introduction to the Special Section on Patent Use**

*(forthcoming, Research Policy, September 2016)*

**Ashish Arora** (Duke University, Durham NC, and NBER, USA)

**Suma Athreye** (Brunel University, UK and UNU-MERIT; Maastricht)

## **1. Introduction**

Patents combine incentives for the production of technological knowledge (by granting temporary monopolies) with incentives for diffusion of that knowledge (usually through licensing). However, we know little about how patents are actually used, either strategically to block competitors or to facilitate trade in technology. Several developments suggest that the use of technology vested in patents has grown through the late 80s and 90s (Arora, Fosfuri and Gambardella, 2001, Gambardella et al 2007).

Public discourse on intellectual property often focuses very narrowly, sometimes primed only by anecdotal accounts of how patents are being used (or abused). The Hargreaves review (2011) of UK Intellectual Property<sup>1</sup> notes that we know relatively little about what happens to patents once they are issued. These concerns have also been noted in the Government's response to the Hargreaves Committee report.<sup>2</sup>

The reliance on anecdotes and limited experience mean many myths abound especially about the usefulness and use of patents. One common criticism is that *very few firms use patents*. Although the probability of patenting by any randomly selected firm is low the propensity to patent when conditioned on firms having innovated or having new to the market innovations is considerably higher at 18% in the UK (Hall et al 2013). Depending on the way patent propensity is conceptualized, Arora, Athreye and Huang (2013) estimate that between 28 -

---

<sup>1</sup> Hargreaves Report (2011: p.13). Downloadable from <http://www.ipo.gov.uk/ipreview-finalreport.pdf>

<sup>2</sup> Downloadable from <http://www.ipo.gov.uk/ipresponse-full.pdf>. Pp. 3.

40% of all innovations are patented in the UK. Arora, et al., (forthcoming), find that 42% of new products are patented by the innovating firm. These figures suggest that, at least in the U.S. and UK, the patent system is important to the protection of innovations.

Another commonly heard criticism is that *small firms have a lower patent propensity*. When papers explore the issue of what explains the probability of patenting, the factors that are commonly highlighted are R&D scale, and size. However, we should expect the probability of patenting to depend upon the scale of innovation even if two firms share the same propensity to patent. Large firms by virtue of having more innovations would patent more, while small firms by virtue of having fewer innovations would patent less. However, even when one controls for the influence of the scale of R&D, the evidence is mixed. Arora et al. (forthcoming) find that larger U.S. manufacturing firms are more likely to patent their most valuable product innovations. However, Arora, Athreya and Huang (2013) find no difference in patenting rates for a firm's most valuable innovation across firms of different sizes, using a sample of UK firms.

The papers in this Special Section on Patent Use look more closely at three other passionately debated aspects of patent use with the dispassionate analysis of evidence using novel data or novel methods. These are respectively the role of appropriation and disclosure in the functioning of technology markets; the role of appropriation through IP use in collaborative innovation and the factors influencing the number of not-used patents thought by many to be a monopoly burden on society. We look at each issue and our contribution to the debate in turn.

## **2. Patents and technology trade**

When looking to source technology externally, firms must first understand what they are buying before they pay for it. However, when they have this knowledge, the technology has

effectively been transferred and the buyer no longer need pay for it. In his seminal paper Arrow (1962) described how patents can help overcome the paradox of disclosure. Patents can also make an invention more valuable by protecting against imitation, thereby encouraging follow-on investments in improvements and commercialization. This “appropriation effect” can also facilitate licensing.

Although a large literature has developed on the potential for technology trade and the catalysing role of patents in facilitating ‘ideas for rent’ (see Arora and Ceccagnoli, 2006 for a review) the evidence on the mechanisms at play is more scattered. Hsu, Gans and Stern (2008) find that licensing activity increases sharply after a pending patent is granted. Hegde and Luo (2015) find that early disclosure of patent applications also increases licensing. Using novel data on 860 negotiations to sell or license immature technology in Australia, de Rassenfosse, Palangkaraya and Webster analyse the mechanism through which patenting affects the negotiation outcome: by encouraging fuller disclosure by inventors or by increasing buyers’ confidence over appropriation. Their unit of analysis is a technology transaction negotiation. In their dataset, not all negotiations were successful and not all negotiations involved a granted (or pending) patent. As such, they are able to explore the effects of owning a patent on a successful licensing negotiation separately from the effect of disclosing a technology (through a patent application).

They find support for the argument that patents help successful negotiations because it supports appropriation. They find no evidence in favour of the disclosure effect and conclude that firms probably use non-patent strategies to protect disclosure. An important policy conclusion from their analysis is that pending patents and long lags between patent application and grant, may harm technology transactions by demanding disclosure without supporting appropriability.

### **3. Collaborative innovation and patent use.**

Closely related to the disclosure versus appropriation function of patents is the debate on the paradox of openness. As technology becomes more complex, firms may need to collaborate in order to innovate. The relationship between the reliance on external sources of knowledge and the appropriability strategy of firms has been analysed extensively since the early paper by Cassiman and Veugelers (2002). This literature has converged around two conflicting points of view, which Laursen and Salter (2014) dub the “paradox of openness”, namely that opening up to outside sources of knowledge to innovate may weaken the firm’s power to capture rents from that knowledge. In other words, openness, or external sourcing, entails a trade-off. On the one hand, firms are more likely to seek external collaborators if they can protect their innovation, and more generally, guard against unintended knowledge spillovers to partners. Patents can protect against such spillovers. On the other hand, a focus on patenting and exclusivity makes a firm less efficient in developing collaborative innovations, and hence also, a less attractive partner. Numerous papers have tested for and found a U-shape relationship. The conclusion favoured in many papers is that firms will choose an intermediate level of appropriability in order to develop technology with external collaboration.

Even if we put aside the question of what an “intermediate level of appropriability” means, this conclusion seems too facile. In particular, we know that knowledge is often valued differently by different firms and also that firms differ in their ability to create value from externally acquired knowledge. If this is the case, then the relationship between external sourcing (openness) and appropriability must be contingent on these sources of heterogeneity. Put differently, recognising that not all collaborators are equal in the value of innovative knowledge and not all firms are equal in how they create value from externally obtained

knowledge may lead us to a very different appreciation of the relationship between appropriability and recourse to external knowledge.

Two papers in this special section focus on the consequence of such heterogeneity using data drawn by more specialised innovation surveys. The paper by Miozzo et al uses data from a survey of Knowledge Intensive Service firms in the US and UK, while Arora, Athreye and Huang use data from a Survey of Innovation and Patent Use in UK firms. Both of these surveys focus on the appropriation behaviour of collaborating firms and use the structure of community innovation surveys but complement them by building in significant detail into the survey instrument.

Miozzo et al, argue that service firms often co-create knowledge with their clients. Not only does this make external collaboration with clients much more valuable than other types of collaboration, it also generates the potential for conflicts of ownership over jointly-created knowledge assets. They find that reliance on formal methods of appropriation rises with the perceived importance of collaboration with clients (albeit the increase is non-monotonic). This is surprising because survey after survey has reported that service sector firms do not benefit from formal methods of appropriability. In contrast, innovation in collaboration with other kinds of partners such as universities, suppliers and competitors are protected using contractual and strategic methods.

Arora, Athreye and Huang focus on a different source of heterogeneity viz. firms with different capabilities. They start from the premise that both patenting and openness are jointly determined, and therefore, one cannot use a causal inference approach, as is common in this literature. They argue that the relationship between patenting and openness is contingent on the technological and innovation leadership of firms. Leading firms are more vulnerable to unintended knowledge spillovers during collaboration as compared to followers, and

consequently, the relationship between patenting and openness should be stronger for leaders than for followers. Followers, with incremental innovations, benefit less from patenting. With little proprietary technology and knowhow, followers may be less willing to patent because it makes them a less attractive open partner.

#### **4. Patent non-use**

When patents are granted, the patentee is under no legal obligation to use the patent, by embodying the patented knowledge in a product or process. Instead, the patented invention may cover a product that could potentially compete with the firm's existing products or processes. Magiolino (2011) notes that although in the early part of the twentieth century, US courts were split about the lawfulness of patent non-use, by the end of the twentieth century, the right of the patentee to keep out competition by patent non-use was recognised as a valid right. Consistent with this forfeiture or compulsory licensing was never enshrined in U.S. law as a reasonable consequence of patent non-use. The rise of non-practicing entities, also called patent-trolls, whose business model relies upon asserting patents against others, has reignited the debate on patent non-use.

Scholars like Bessen and Meurer, (2008) and Boldrin and Levine, (2013) argue that many strategic patents are actually low quality patents and should never have been taken out. In cumulative or complex innovation, where patents are fragmented and held across many parties, scholars such as Mazzoleni & Nelson (1998), Heller & Eisenberg, (1999), and Scotchmer (2004) argue that non-use patents may restrict innovation itself.

Surveys of inventors based on patent records have been a useful source of information on the purpose of patenting. The paper by Torrisi et al draws upon surveys of inventors applying to the EPO (Pat Val 1 and 2); while the paper by John Walsh et al use a similar survey of inventors from the United States who filed for triadic patents – both assess the extent of

patent non-use and the factors underlying such non-use. Their findings about the extent of non-use are remarkably consistent. Both find that about 42-45% of all patents are never used suggesting that the bulk of patents are successfully commercialised by firms. The papers use slightly different survey instruments so have somewhat different things to say in their assessment of what such non-use represents.

Torrise et al combine the data on the motivation for patenting with actual use to generate three categories of patent. These are: Commercial use patents (which are all used in production or licensing by the firm owning the patent), strategic non-use patents (patents that were filed with the intention to block competitors and are not actually used) and sleeping patents (patents that were not filed with a motivation to block competition but are nevertheless not used). They find patent non-use to be strongly correlated with firm size- large firms have a greater number of “Rembrandts in their attic”. They also find that discrete technologies ( e.g. pharmaceuticals, cosmetics) are more likely to have strategic non-use patents compared to complex technologies (e.g. electrical machinery, electrical energy, audiovisual technology and information technology) where more patents are commercially used. The relationship between patent use and competition is less straightforward. On one hand presence of competitors appears to be positively associated with commercial use but the presence of many competitors is also associated with higher shares of strategic non-use and sleeping patents. Poor legal validity is positively associated with sleeping patents.

In the case of the US, Walsh, Lee and Jung are able to divide the category of non-use patents into pre-emptive patents, prospective patents and failed patents based on the reasons given by firms for the non-use. They define pre-emptive patents as those intended to block prevent other firms from inventing around, prospective patents as those which the firm is still developing and failed patents as patents that are of poor quality or that are not used because of technology and market obsolescence. Walsh et al report that the share of pre-emptive

patents is still much smaller than that of prospective and failed patents. Like Torrisi et al, they also find strong industry effects, a role for firm size, and for competition in explaining these shares. Thus they find that pre-emptive patents occur more often in strong appropriability sectors while failed patents occur more often in fast moving technologies. They also find competition and firm size increase the share of pre-emptive patents.

From a policy perspective, both authors suggest going after pre-emptive patents or strategic non-use patents is likely to have limited gains. Instead, based on data for the US, Walsh et al suggest that a more important problem for policy may be how to decrease failed patents.

Following Kukkonen, (1998) they suggest more developed capital markets or market mediators for patents could increase the ability to commercialize some kinds of failed patents.

Torrisi et al suggest a stricter enforcement of the inventive step criterion in the granting of European patents and measures to improve the utilisation of sleeping patents which include the use of patent intermediaries.

## **5. References:**

Arora, Ashish, Wes Cohen, and John Walsh (forthcoming). The acquisition and commercialization of invention in American manufacturing: Incidence and impact. *Research Policy*.

Arora, Ashish, Andrea Fosfuri and Alfonso Gambardella (2001) *Markets for technology*; MIT Press.

Arora, Ashish, Marco Ceccagnoli. (2006). Patent protection, complementary assets, and firms' incentives for technology licensing. *Management Science* 52 (2), 293-308.

Bessen, J., and M. Meurer. (2008.) *Patent Failure*. Princeton, NJ: Princeton University Press.



Boldrin, Michele, and David K. Levine (2013) "The Case against Patents. " *Journal of Economic Perspectives*, 27(1): 3-22.

Cassiman, B., Veugelers, R., (2002). R&D Cooperation and Spillovers: Some Empirical Evidence from Belgium. *The American Economic Review* 92, 1169-1184.

Gambardella, A., Giuri, P., Luzzi, A., (2007)., "The Market for Patents in Europe", *Research Policy*, Vol. 36 (8), pp.1163-1183.

Hall, Bronwyn, Christian Helmers, Mark Rogers, and Vania Sena (2013) The importance (or not) of patents to UK firms. *Oxford Economic Papers* 65 (3): 603-629.

D Hegde, H Luo. 2015. Patent Publication and the Market for Ideas. Harvard Business School Strategy Unit Working Paper, 2015

Heller, M. A. and Eisenberg, R. S. (1998) Can patents deter innovation? The anticommons in biomedical research. *Science* 280, 698–701.

Kukkonen, C.A (1998) The use of patent licensing center as an intermediary for facilitating the licensing of commercially viable, unused patents. *Virginia Journal of Law and Technology* 3: 1522-1687.

Laursen, K. and A. J. Salter(2014) The paradox of openness: Appropriability, external search and collaboration. *Research Policy* 43, 867-878.

Magiolino, M (2011) Intellectual property and antitrust: a comparative economic analysis of US and EU law. Edward Elgar Publishing.

Mazzoleni, R., Nelson, R.R.,(1998). The benefits and costs of strong patent protection: a contribution to the current debate. *Research Policy* 27, 273-284.

Scotchmer, Susan(2004) Innovation and Incentives. The MIT Press, Cambridge, MA