

HELSINKI SCHOOL OF ECONOMICS



Patenting behavior and firm size

Essay assignment

Economics of Immaterial Property Rights

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Iiro Mäkinen
k77255

The relative importance of small firms in the context of technological change and industrial renewal has been a subject of considerable interest since at least the seminal work of Joseph Schumpeter (1912, 1942). In his early work, Schumpeter introduced the notion of creative destruction and argued that small entrants are the primary source of technological change (Schumpeter Mark I). Later, however, Schumpeter came to emphasize the importance of professional R&D as a source of technological innovation (Schumpeter Mark II), thus questioning the anti-trust orthodoxy of the time. Provoked by Schumpeter's controversial claims, the scholars of industrial organization "...became preoccupied with the effects of firm size and market concentration on innovation..." (Cohen 1995:183). As a result of this preoccupation, a large body of empirical literature investigating the effect of firm size on innovation emerged. Cohen (1995:189-190) summarizes the findings as follows: "The robust empirical patterns relating R&D and innovation to firm size are that [1] R&D increases monotonically – and typically proportionately – with firm size among R&D performers within industries, [2] the number of innovations tends to increase less than proportionately than firm size, and [3] R&D productivity tends to decline with firm size".

Cohen and Klepper (1996) suggest that these findings can be explained by the relative advantage of large firms in appropriating returns to innovation. They argue that returns to R&D increase as the output over which the fixed costs of innovation can be spread increases, because firms are highly dependent on appropriability mechanisms such as secrecy and lead time, which confine them to exploiting their innovations through their own output (e.g., Levin et al. 1987, Harabi 1995, Cohen et al. 2002). This argument is based on the notion of limited firm growth as a result of innovation.

Cohen and Klepper's argument implies that greater returns to R&D induce large firms to invest more in R&D than small firms do. Furthermore, if R&D is subject to diminishing marginal productivity, large firms also experience lower average productivity of R&D than small firms. This is because the cost spreading advantage allows them to undertake more R&D projects at the margin.

The ideas model of innovation (Green and Scotchmer 1995; O'Donoghue, Scotchmer and Thisse 1998; Scotchmer 2004) highlights the importance of providing also small firms with sufficient incentives to innovate. The ideas model assumes that ideas for innovation are scarce and exogenous, while the materialization of an innovation requires both an idea as well as an investment in it. In this context it is highly probable that not all valuable ideas originate in the research labs of large corporations, and thus also small entities need to be provided with sufficient incentives for developing their ideas into innovations. Harnessing the innovative capacity of small firms is clearly an important challenge also for the Finnish economy.

Immaterial property rights (IPR), and patents especially, provide a mechanism for appropriating returns to innovation, which does not confine the innovator to exploiting the innovation through own output but renders the innovation saleable in disembodied form (through licensing arrangements). However, it has been argued that small firms are disadvantaged also in exploiting innovations through IPR, because obtaining and enforcing IPR might be prohibitively costly for many small firms. Small firms, for instance, often lack the resources necessary for litigation (see, e.g., Scotchmer 2004:203 and references therein). In this paper I will set out to review some of the literature on the relationship between patenting and firm size in order to

draw conclusions on whether the IPR system improves the position of small innovators or whether it further enforces the advantage of large firms in appropriating returns to innovation. I will start by briefly reviewing studies on the perceived effectiveness of patent protection for appropriating returns to innovation, and move then to studies on the propensity to patent. In the end I will draw conclusions on the basis of the reviewed literature and propose potential directions for future research—my master’s thesis in particular.

In the spirit of acknowledging the disadvantage of small firms in appropriating returns to R&D through methods other than patenting Levin et al. (1987) argue that “for small, start-up ventures, patents may be a relatively effective means of appropriating R&D returns, in part because some other means, such as investment in complementary sales and service efforts, may not be feasible”. Similarly Griliches (1990) suggests that for small firms:

“...patents may represent their major hope for ultimate success and hence would lead them to pursue them with more vigor. A well-established major firm does not depend as much on current patenting for its viability or the survival of its market position. Thus, even at an equal underlying inventiveness rates, the propensity to patent may be lower for large firms, at least relative to the successful new entrants in their field.”

Empirical evidence, however, seems to suggest that small firms perceive patenting as a relatively inefficient means for appropriating returns to innovation. Sattler (2002), for instance, finds the perceived efficiency of patent protection to increase with firm size, when he studies the issue using German data from the ‘Mannheim Innovation Panel’. Arundel (1996,1997) finds a similar pattern in studying the 1993 Community Innovation Survey (CIS) results for seven European countries. Moreover, Arundel

(2001) finds the probability of a firm to rate patenting as a more effective measure of appropriation than secrecy in the 1993 CIS data to increase with firm size. On the basis of this evidence it seems likely that smaller firms might be disadvantaged also in appropriating returns to innovation through patenting—perhaps even more so than with other methods of appropriation.

In addition to studying the perceived effectiveness of patenting as a means for appropriating returns to innovation, various researchers have also attempted to measure the propensity of firms to patent their innovations (see Arundel and Kabla 1998 for a brief review of some of these studies). Taylor and Silberston (1973), Scherer (1983), Bound et al. (1984), and Licht and Zoz (1998), for instance, study the propensity to patent by relating the number of patents to R&D expenditure, but interpreting their results is problematic, since the differences in their results may be due to either the productivity of R&D or the propensity to patent the resulting inventions. Jensen and Webster (2006) study the relationship between IP usage and firm size using Australian data and find that small firms tend have higher rates of IP usage than large firms. Jensen and Webster interpret this as evidence against the hypothesis that small firms would be disadvantaged in their ability to utilize IP protection. Again, however, their results can reflect either the higher innovative productivity of small firms in terms of patentable inventions per employee or the higher propensity to patent inventions in small firms.

Some researchers, on the other hand, have attempted to explicitly control for the innovative output of the firms, when studying their propensities to patent. Mansfield (1986), for instance, studies patenting behavior of American firms and finds

indication of increasing propensity to patent with respect to firm size. Furthermore, Arundel and Kabla (1998) use data from a survey of Europe's largest industrial firms to study the relationship between the proportion of innovations that a firm patents and various determinants of the propensity to patent. They also find the propensity to patent to increase with firm size. Using data from the French survey on appropriation (EFAT), Duguet and Kabla (1998) find that the propensity to patent an innovation increases with the level of R&D. Their further analysis of this size effect suggests that all the effect of size passes through R&D rather than directly to the propensity to patent. This is rather intuitive, since resources devoted to the management of IPR probably correlate more with the scale of innovative activities than firm size per se. Brouwer and Kleinknecht (1999) also find that for a given level of innovative output, smaller firms tend to have a lower probability of applying for a patent. On the other hand, they also arrive at an interesting finding that smaller innovators, who file an application for a patent, generally apply for a larger number of patents than larger firms, given their level of innovative output.

The conclusion that small firms have a disadvantage in appropriating returns to innovation through patenting seems to emerge from the literature, even though some contradictory evidence has also been generated. If we assume—as Cohen and Klepper (1996) suggest—that small firms have a disadvantage in appropriating returns to innovation through mechanisms other than patenting, the result that they nevertheless choose alternative mechanisms over patenting more often than large firms suggests that they experience even greater disadvantages in the utilization of patents. There are, however, at least two more caveats that need to be addressed before such a conclusion can be drawn. First, most of the studies reviewed here study the patenting

behavior of relatively large firms, whereas Pavitt (1985) and Bound et al. (1984), for instance, argue that small firms tend to patent more relative to their R&D expenditure than do large firms. Hence, it might be possible that the propensity to patent does not depend linearly on firm size. The Finnish innovation data collected by Saarinen and his colleagues using the so-called object-approach¹, for example, shows that small (1-9 employees) and large (over 800 employees) firms patent a larger proportion of their innovations than medium sized firms (see Saarinen 2005:143-150). The second caveat that should be mentioned here is that firm size might not be independent of the characteristics of innovations developed in the firm (see Tanayama 2002). Hence, the differences in the observed propensities to patent might also reflect differences in the characteristics of innovations, not only some inherent firm-size related probabilities to patent.

Arundel and Kabla (1998) suggest an object-based method for studying the propensity to patent. They argue that this could be done, by identifying all major innovations, for instance, by reviewing trade and technical journals and then determining the percentage of these that were patented. Saarinen (2005) performs such an analysis. I suggest that the analysis could—and in fact should—be taken a step further by running regressions that use the characteristics of the innovation and the firm to explain the patenting decision. Van der Panne and Kleinknecht (2005) carry out such an analysis with a limited number of observations (216) and explanatory variables, and find a negative impact of firm size on the propensity to patent. I believe that a more thorough analysis in such a manner could shed new light on patenting behavior, and help in assessing whether or not small firms are disadvantaged in appropriating

¹ See, e.g., Palmberg et al. 1999 and Saarinen 2005 for discussions on the methodology.

returns to innovation through patenting. I will set out to attempt such a task in my master's thesis.

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