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The IPR System, Venture Capital and Capital Markets –
Contributions and Distortions of Small Firm Innovation?

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Abstract:

This study explores how capital markets, exemplified by venture capital, and recent trends in the patent system may influence innovation activity and the financing of small businesses. Specifically it is evaluated if there are costs and distortions of incentives related hereto. Additionally, the positive contribution of venture capital in the patenting process is investigated.

It is found that trends at a macro economic level is nowadays of major importance for the patenting and innovation behaviour and financing of firms. Patenting has increased in scale, scope and trade volume, patents have become a strategic asset to an extent that may de-link it from innovation activities. The IPR-system may render distortions of innovation activities facilitated by these trends. These distortions may impose costs on the overall function of the innovation system, costs that are unequally distributed among firms as small firms are bearing most of the burdens.

The results points to new perspectives on strategy that are important to management of firms and investment funds.

Keywords: Small firms; venture capital; IPR

Jel codes: O34; G24

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1. Introduction¹

It is widely recognized that there are not only benefits from the patent system but also costs (Mazzoleni and Nelson, 1998). Among the costs could be mentioned the transaction costs from the anti-commons problem and the barriers to entry that patents create. In a much-cited, 50 year-old passage from a review of the economic effects of the patent system by Machlup (1958) it is claimed that the patent system has not been socially beneficial, but now that it's here it is difficult to just remove.

'If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it' (Machlup; 1958, p.80).

Originally the IPR system was set up as granting a temporary exclusive right in return for publishing information on new inventions. Decisions on patenting were closely related to business economics. It is maintained in this paper that strategy and trends at a macro economic level, particular the functioning of the capital markets, is nowadays of major importance for the patenting behaviour of firms. It is also maintained that the IPR-system may render distortions of innovation activities facilitated by these trends, although it is recognized that financial institutions may also have positive effects on the patenting activity of firms. These distortions may impose costs on the overall function of the innovation system, costs that are unequally distributed among firms.

As emphasized by Macdonald (2003, p.15)

“Whenever resources are diverted from one purpose to another to satisfy the requirements of the patent system, and when the incentive to patent becomes distinct from the incentive to innovate, there is likely to be a cost in terms of discouraged innovation.”

This general proposition is in this paper explored by investigating one recent source of distortion that of the impact of capital markets on the patenting activity. A number of studies have mapped

¹ Comments on earlier draft of the paper is gratefully acknowledged, in particular from Francis Chittenden, Manchester Business School, Lee Davis, Copenhagen Business School, Odile Janne, Birkbeck, Esben Sloth Andersen, Aalborg University. Errors are solely my responsibility.

the importance of motives to patent including both the traditional motive to patent that the IPR-system grants opportunities to exploit a potential temporary, super-normal profit from new products or processes and what have been denoted strategic motives to patent (Arundel and Patel, 2003, Arundel et al., 1995, Cohen et al., 2002, OECD, 2003, Blind et al., 2006). Included in the strategic motives is that patents may improve access to capital markets, although this is rarely investigated explicitly. Capital markets is a rather general term, so the approach taken in this paper is to go into a specific aspect, i.e. the relationship between venture capital firms and firms using IPR, in the following taken primarily as the patenting firms. This approach allows us to incorporate considerations on the impact of small firms, who are by and large not listed and thus are not using market based financing. Because financial institutions such as venture capital firms (VCFs) are embedded in a larger web of institutions and markets in a financial system, VCFs may be seen as a micro- representation of the larger capital market. In this manner we are also able to catch the possible ways that such institutions may contribute positively to patenting and innovation.

Admittedly it is a special and rather specific aspect of the strategic motives to patent to gain access to capital markets. The above-mentioned empirical surveys of motives to patent generally find that the main motive to patent is still protection from imitation followed by the more strategic motive of (offensive or defensive) blocking competitors. In the patenting literature there is a general opinion that the strategic motives to patent have gained in importance and widened in scope (Arundel et al., 1995, Blind et al., 2006, Arundel and Patel, 2003). In some surveys the exchange potential of a patent is a highly ranked motive, but generally most strategic motives are ranked much lower than protection and blockade but is found to have increased in importance (Blind et al., 2006). Access to the capital market is rarely included in surveys as a separate category. In OECD (2003) this was included but ranked lowest among the motives to patent². Blind et al.(2006) find that the importance of access to the capital market was ranked 12th among 15 possible motives. Nevertheless, 26 per cent of the firms in that survey list this as either of high or very high importance. This indicates that if not of prior direct importance then patents as spurring access to capital is still of considerable importance to a number of firms. Additionally, other motives to patent asked in surveys are closely related to the aspect of access to financing. This goes for motives such as ‘increase of company value’, ‘reputation/image’, ‘negotiation position’, ‘asset for exchange’. It may also be argued that the way capital markets function and evaluate

² In that survey it was asked about changes in importance during the last 10 years. Among other results, firms pointed to that increasingly they felt a pressure to patent because of patent practises of others. What has been described as a ‘patent race’ in the 1990s may explain this trend.

patents may indirectly influence the motives to patent and even the way innovation processes are pursued and prioritised.

Although the empirical evidence is mixed, as indicated above, then many studies see access to capital markets as a factor in the initial decision to patent or not (Kortum and Lerner, 2000, Audretsch et al., 2007, Blind et al., 2006). In addition to the macro effects indicated above, this paper further argues that the financier-patentee dyad may also be important in the management of the patenting process and in the valuation of the invention. Moreover, it argues that patenting has increased in scale, scope and trade volume, which has further spurred interest in this area among management and in strategy discussions. In particular, patents have become a strategic asset to an extent that may de-link it from innovation activities. The present functioning of capital markets may reinforce this.

Even if the existing literature on this is limited, this explorative research is primarily based on combining insights from previous studies, although the arguments are supplemented with information from interviews. Interviews were done with a general manager (but with hands-on experience with the IPR-aspect of VC-deals) and four investment managers in three venture capital firms. These VCFs were not intended to be randomly selected; rather they were picked because they focus upon small, technology-based firms where the problem is expected to be present (Yin, 1994). Also, diversity of the venture capital firms was sought. They were thus combined covering different specializations on regions, industries, and two countries, Denmark and the UK, and they covered insights from both the formal venture capital market and business angels. The interviewees were selected through referral from a member of the board of a VCF. Interviews were semi-structured both testing out the ideas developed in this paper and asking openly about the role of IPR in investment criteria and the potential aiding of management during the IPR-process. The paper combines elements from different strands of literature, which hitherto have been rather separate.

The paper is structured as follows. A brief discussion of theories on the role of financial institutions in the patenting process follows this introduction. Trends in the trade, use and value of patents and possible distortions of innovation activities are highlighted in section 3. Section 4 discuss if such distortions are unequally distributed among firms of different size and industries. Section 5 then goes a step further in explaining how VCFs may impact decisions to patent before a brief wrap up taking a knowledge-based economy perspective.

2. Contributions from financial institutions (VCFs) to the IPR process – intermediation and signalling

The behaviour of firms is naturally influenced by changes in the macro economic environment, such as trends in the capital markets. Below venture capital firms are seen as one representation of financial institutions, others could have been mentioned, but VCFs are deemed particularly relevant in this context because of the characteristics. VCFs are characterised – at least in their ‘classical’ version (Bygrave and Timmons, 1992) as focused upon SMEs, high-tech firms, high-growth firms, and they are particular good at screening, monitoring and advising firms. An additional, but related aspect is that VCFs are networkers, they have extensive knowledge on who-knows-what, that is, they may efficiently guide firms to the right external advice if they have shortcomings themselves (Amit et al., 1998, Bottazzi and Rin, 2005). At least for SMEs and/or new firms resource constraints in the patenting process may require an external partner. Firms may therefore have incentives to engage with specialised organisations such as VCFs and patent agents to carry through their patenting process. These two aspects, the contribution in the process and the role as intermediary, are unfolded below.

The financing of the innovation process has in financial theory been described by applying models of asymmetric information, leading to credit rationing and principal-agent problems (Myers and Majluf, 1984; Leland and Pyle, 1977; Stiglitz and Weiss, 1981; and numerous later models). The principal-agent theory discusses how a principal (e.g. a provider of funds for a venture capital firm) can set up a compensation system to motivate an agent (e.g. the management of a venture capital fund) to act in the principal’s interests (Reid, 1999). It is presupposed that there are potential conflicts of interests and that the principal cannot directly observe the actions of the agent. In the present connection it is important to note that VCFs are in a double principal-agent role: they act as principals in relation to their portfolio companies, but they are also agents vis-à-vis their back-funding institutions, typically banks and pension funds. Contractual arrangements may alleviate some of the uncertainties associated with a deal.

A number of studies have emphasized that the venture capital firm may have an important intermediary role (Shane and Cable, 2002, Sorenson and Stuart, 2001). Venture capitalists are important parts of networks, and are both in between and central to several different types of networks. The intermediating role may hence be different according to the type of activity VCFs are engaged in (Florida and Kenney, 1988). They give access to networks and expertise and traditional dyad-descriptions of the total process may therefore be inadequate. Rather, and

increasingly, the typical relationship is one of more complex structure (Howells, 2006). We may therefore think of VCFs as part of a wider (financial) environment in which restrictions and incentives are imposed on the behaviour of the VCFs, and via VCFs to the innovating firm.

Once patents are granted there may be an important signalling effect of patents in a knowledge-based economy. Much of the debate on the signalling effect of patents is centered on the effect of the patent system, rather than the micro-level, individual patent (Bessen, 2004). However, there are also important signals from the single patent. It is known from the IPR-literature (Arora, 2001, Arrow, 1962, Hsu and Ziedonis, 2007) that patents signal niche and expertise on a technological front level and it signals the intangible sources of competition within the firm. It is a signal of being an interesting partner for collaboration. Moreover, it may signal to VCFs that assessment of technologies may be pursued less costly, and more precise. Patents may be an efficient and cost efficient way of signalling these features because they are recognized, reliable sources of information, whereas other types of announcements may be used more strategically involving the risk of false information. One indicator of this may be the changes in stock prices following announcement of an important patent application. Poltorak and Lerner (2002) find that strong patent portfolios increase stock prices. Even in relation to consumers a patent may have signalling effects as it is believed that a patent is costly and a sign of a truly innovative product. Therefore, firms often write 'patent pending' on their products.

Patents may also be efficient signals because they are accessible and distributed sources of information (Long, 2002). It is therefore likely that in many cases the value of signals exceed the costs of information disclosure³. There is now debate on whether cumulative innovation is better stimulated by inventors publishing the information rather than patenting as publishing signals that licensing fees of follow-on invention can be avoided (Bar-Gill and Parchomovsky, 2004). In this vein it may be argued that patents may not only reduce asymmetries in information between investor and firm, the uncertainties associated with assessing the management of a technology-based firm, such as the risk of moral hazard, may be alleviated by the existence of a patent. Moreover, the fact that knowledge-based innovation may have characteristics of a public good implying non-exclusiveness means that patents may help appropriating returns from R&D (Arrow, 1962). The relative weight of patents versus hard to judge intangibles such as the competences of the management, quality of R&D etc. – may therefore shift.

³ In the debate on voluntary disclosure of information there has also been pointed to negative effects such as distortions of the markets and competition (Bar-Gil and Parchomovsky, 2004).

On the other hand it may be questioned if the information in the patent disclosure is really useful to the broad spectrum of investors (Heeley et al., 2007). In addition to being sceptical to the value of the technical descriptions in the patent disclosures Heeley et al., (2007) find that the context matters in particular if the patent is granted to a firm operating in complex product technologies. In these technologies there is less transparency concerning the link between the patent and rents from the innovation, some of the reason being that there is often a number of different actors involved, or that the patenting is motivated by other, strategic, reasons than direct protection of rents from copying. The granting of a patent may in these circumstances not reduce information asymmetries for investors substantially; there is still a need for a lot of firm specific information concerning how the patent relates to generating value from the innovation. Similarly, Kash and Kingston (2001) find that firms operating in complex technologies take out patents extensively to position themselves in relation to possible cross-licensing or trade.

3. Trade, value and strategic use of patents – distortions of innovation activity?

There is evidence of increased propensity to patent. In the past 10 years (1995-2006) the number of patent applications to the European Patent Office went up from 80,000 to 200,000, a yearly growth rate three-fold that of GDP in Europe (Guellec and van Pottelsberghe, 2007). The upsurge of patenting in recent years has also exceeded the growth in R&D-expenditures. The number of patents taken per currency unit of R&D has increased 20% (Guellec and van Pottelsberghe, 2007). Trade with patents and licences has recently boomed. The EU-Commission estimates the global trade to be EURO 100 billion⁴, a 40-fold increase in the past 20 years. OECD (2004) and Athreya and Cantwell (2007) also shows that the IPR-market has grown substantially over the past 10 years. One of the explanations of this in the literature is that patent strategies have become much more complex and increasingly unrelated to innovation activities, which in turn has to do with the increase in strategic motives for patenting⁵. This development accentuates that a patent may in this sense act as collateral, as it may represent a value in its own right, unrelated to the inventing firm. Today intellectual property is hence not only a legal asset it may also represent a commercial value

4 This may even be a conservative estimate. Moore (2005) cites sources that claim that this is the amount earned in licensing fees by U.S. firms alone. The Cohen-Boyer patent on gene splicing alone has up till now generated licensing revenues of 155 million \$, and Texas Instruments earn licensing revenues of \$ 800 million annually, a little less than the \$ 1 billion earned by IBM.

5 Other, complementary explanations include that R&D is nowadays organised more efficiently, is more specialised, and subject to division of labour between firms. It is moreover more oriented towards applied research rather than basic research. A second type of explanations focus upon changes in the legal framework and -practise, which is said to be more 'patent friendly'.

and may thus be a financial instrument (Kash and Kingston, 2001)⁶. The ways to reap the commercial benefits vary. A patent may e.g. be sold, licenses may be sold, or a patent may be used as collateral. A direct way of monetizing a patent is to base a company on this patent and develop a business around the technology in question.

Many patents are never used neither internally in the firm or licensed out (Lemley and Shapiro, 2005, Moore, 2005). For example, the US patent office issue yearly 200,000 patents, however, there is only a commercial use for a minority⁷ (Lemley and Shapiro, 2005) and the revenues are highly skewed (Scherer et al., 2000). Lemley and Shapiro (2005) mention that the top 1 percent of patents generate more than thousand times the revenues of the median patent. Even several years ago debates on the (missing) value of patents involved estimates such as that out of a sample of 1600 patents 65 were licensed and 36 generated sufficient revenue to cover the cost of patenting (Udell, 1990). Macdonald (2004) refers to estimates by Glass (1990) showing that one in a hundred patents render any income at all. As many patentees do not know which patents will be commercially valuable in the future an excess number of patents are taken out despite knowing that this is like a lottery ticket – the majority of patents will be worthless, but maybe one or two may give significant commercial value. Debate prevails as to why so many patents are not used. Reasons for this mentioned in the literature includes that it is difficult to know a priori which patents will show to be valuable⁸. Consequently, the value of patents may be poorly understood (Rivette and Kline, 2000).

Whereas these reasons relate to a perception of ‘value’ as commercial, monetary value, the reasons for taking out patents also influence the valuations of patents. For example, if firms take out patents to signal quality of R&D or to make the company more attractive to venture capital, this may render a positive effect, but not necessarily a commercial one, which may have justified to pay maintenance fees of the patent. Defensive blocking of competition can also be strategically valuable, but may not imply use of the patent. In a similar way non-used patents may be seen in an option perspective. The owner has the option to optimise the timing of commercialisation or eventually abandon it according to the development of the business strategy and market (Bloom and van Reenen, 2002, Dempster, 2006). In a similar vein some firms file patent applications with

6 One example of this is the securitization of the royalty streams from the copyrights of David Bowie. In 1997 he issued 10-year bonds, which rendered a 7.9% revenue on the basis of the royalties of Bowie-songs from before 1990. This gave him a 55 million dollar funding.

7 An empirical study of maintenance fees of 100,000 patents (Moore, 2005) in the US finds that the renewal rate is 46 percent.

8 It may, though, be very easy to forecast the (poor) commercial value of many of the patents described at these websites: <http://totallyabsurd.com/absurd.htm>; <http://www.crazypatents.com/>; <http://www.delphion.com/gallery>. <http://www.around.com/patent.html>; <http://www.patscan.ca>

many and broad claims but keep delaying the granting process until the timing is right and the most promising part of the technology is identified. This is often denoted ‘submarine patents’. Financiers may therefore see a pool of non-used patents as a valuable option rather than an indication that the company is producing less valuable inventions.

The above indicates that patenting is now even a strategy discipline, something also visible in the management literature and in the number and content of IPR-courses offered at management schools⁹. This is also indicated by the increasing sophistication of the vocabulary connected to patenting strategies, involving terms as patent stacking, -pooling, -blocking, -clustering, -flooding, -blanketing, -consolidation, -fencing and surrounding, -bracketing, -harvesting and ramping up, blitzkrieging etc. Strategies associated with these terms involve a host of measures to position the firm in a patenting game where the patents are rather taken in response to the competitive situation and as parts of negotiations on licensing than to enhance the innovation activity in itself (Kash and Kingston, 2001). Indeed, this strategic game has led to that many firms file applications that have never been intended to get granted, one reason being to prevent others to patent in that field. Another reason is to create uncertainty in a particular technological field (Guellec and van Pottelsberghe, 2007).

In this setting the decisions of R&D-managers on what to pursue in terms of research, development and innovation is replaced by decisions by patent attorneys on what is patentable (Macdonald, 2004, The Economist, 2005). There is a trend towards dismantling the link between innovation and the assessment of economic potentials. As mentioned by Blind et al. (2006) ‘the decision to patent – despite the significance of the protection motive – in part is uncoupled from the technological necessities to protect the own invention from imitation by other market participants, or that the strategic behaviour of other market participants is taken into account and that patents serve increasingly as new sources of income’ (p.656).

In addition to behavioural changes also the institutional changes in the patent system has had an impact. It is discussed in the literature (Jaffe and Lerner, 2004) if e.g. the changes in the U.S. where the patent office is transformed into a private company reliant upon fees from granted patents and maintenance fees made applicants into clients and gave incentives to grant patents of dubious value and without thorough work preceding the grant. This in turn has produced an

⁹ Grandstrand (1999) even ascribe some of the more aggressive and frequent patenting of Japanese firms in the 1980s compared to US and European firms to the fact that management of intellectual property rights was earlier a part of the enterprise culture in all levels of management in Japanese firms.

increase in applicants and subsequently an increased workload in the patent office. Therefore, as Jaffe and Lerner (2004, p.18) state

“...the institutional changes of the last two decades have altered the incentives of inventors, firms, and the patent office in ways that encourage legal manoeuvring and discourage innovation”.

The growth in the market for knowledge in terms of trade with patents and licensees obviously make VCFs put even more emphasis on the value of formal IPR when financing the firm. The patent may itself be a source of revenues even if the firm itself fails to be as profitable as expected. The above-mentioned theories of asymmetric information and moral hazards causing reluctance among VCFs pointed to particular problems in assessing the quality and intentions of the owner/management. By evaluating something tangible, a patent, the VCF reduces much of the uncertainty associated with investing in knowledge-based firms (Long, 2002, Lemley, 2000, Harhoff and Reitzig, 2004). It does require, though, that the patent is useable if applied in another context. Despite these arguments against the importance of IPR in venture capital assessments of investments then VCFs still value highly the reduction of uncertainty concerning knowledge-based firms and they regard IPR as an tradable asset. Moreover the presence of IPR legitimises investment decisions, as explained later. Venture capitalists and other financiers may be more reluctant to finance companies only based on ‘soft’ intangibles rather than a documented portfolio of IPR. Indeed the mere belief in patents as a valuable asset may shift behaviour in a way that distorts incentives to produce innovation away from fulfilling a market need with costumers towards incentives to make inventions that may be patented, regardless of the market projections. As long as the patent represents a value as a commodity in itself, this justifies decisions to pursue these types of inventions. In a way the value attached to patents has become much the same as bank notes – they are worth something because there is a convention that they represent value. As long as this belief is upheld and trusted trade can occur.

Debate prevails on the economic costs of patenting for the individual firm. There is less debate on the costs of the patent system on the overall effects on the innovation rate in society. It is traditionally argued that the very purpose of the patent system is to stimulate innovation. However, the ‘patent race’ and the strategic use of patenting indicates that the system does in fact also impose severe distortions on the incentives to innovate. Moreover, these distortions are unequally distributed among firms in different industries and of different size, as discussed in the next section, and as emphasized by Macdonald (2003, p.14)

‘Indeed, innovation may well be discouraged as inimical to the effective use of patents in strategy. Such games, originally devised in the pharmaceutical industry, have evolved a depressing sophistication in other industries. They are games for big companies. The weak are neither invited, nor able, to play. In their innocence, they still expect the patent to have something to do with innovation.’

4. Unequal distribution of costs between firms in different industries and size

Patents involve costs in the form of pure fees for the granting and maintenance of the patent but also as external expertise (patent agents) and language translation. For many firms, especially small, and medium sized enterprises, both the timely process and the costs involved in the patenting process pose a problem for these firms and may decrease the incentives for patenting inventions. This is also reflected in surveys, which have found differences in the motives to patent between large and small firms; Blind et al. (2006) e.g. find that the growth of patent applications from large companies account for a significant share of the total growth in patent applications and that strategic exchange and incentive motives are more important for large firms, corresponding to the arguments in the proceeding section¹⁰. But there are also generic differences between large and small firms in their ways of managing the patenting process and their preconditions for doing so. Specifically, large firms produce, in absolute terms, more products and processes that may be patented. This may in turn justify establishing an internal patent expertise, or even -department, and will generally enhance the build up of internal competences in managing the patenting process.

Moreover, in addition to scale effects, the economic muscles of a large firm are important in at least three respects. First, the mere costs of patenting may better be covered by the large firm, which in turn may imply that larger firms may pursue a patenting strategy that is broader in terms of both the number of patents and the geographical coverage of patents around each invention¹¹. Second, the large firm may better afford to enforce their rights. Third, and related to the second point, the ability and strategy of large firms to fiercely enforce their rights may in itself prevent infringement of the patent.

¹⁰ Davis (2006) finds though, that in spite of resource constraints small, Danish firms often replicate the patenting behaviour of larger firms.

¹¹ Harhoff and Reitzig (2004) estimates a typical cost of a patent to be EURO 29.800, of which application fees make up a small share, the bulk being translation costs and related professional assistance. The same source provides estimates from patent attorneys that costs of an opposition case may range between EURO 15.000 and 25.000 for each party.

The bulk of IPR trade is by large firms. Large firms who engage in strategic patenting are on the stock exchange valued according to their patenting activity. Small firms are typically not listed and excluded from what has been denoted a ‘game’ of patenting determined by external factors, specifically capital market valuation of the patenting activity of the firm. Again, this is perhaps most powerful underlined by Macdonald (2003, p.16), who claims that

‘Share prices rise on news that a patent has been granted, and fall on news that it has been challenged. So secure are profits from pharmaceutical patents that plans are afoot to use them as financial instruments by issuing notes on them to investors (Rivette and Kline, 2000). The wonder is that all this activity can take place in the complete absence of innovation. Innovation has in many ways been supplanted by the patent, which, in itself, creates no wealth at all.’

The extent to which the technology is protected by a patent should be carefully examined and mirrored against the costs of obtaining and maintaining the patent. This assessment is most often very difficult to make and may for the small firm require external competencies. The challenges for small firms in handling the patenting process by them selves are not only economical, but also technical. A number of legal issues arise in the patenting process, which often are beyond the capabilities of small firms. To take an example, the choice of legal scope of the claims is far from trivial. The commercial value of a patent may be jeopardized if the scope of the submitted claims are too narrow, thus enabling determined competitors to avoid these claims. Blocking competitors from this by submitting broad claims is for a small firm not an easy task as it requires a sense of future directions of technology, industry and markets. On the other hand, costs and speed in the time to granting of the patent may be arguments for keeping claims narrow¹².

There are clear indications of sector differences in the need for clearly documented and extensive IPR to make firms attractive to external financiers. VCFs often go into biotech investments where there is a particular strong demand for IPR (Mazzoleni and Nelson, 1998)¹³. This has to do with

12 From a societal point of view broad claims held by a firm may make it unattractive for others to invent around but close to the original invention. Improvements and minor variations of the invention may be hindered. Instead, the broad patent may be an incentive for other firms to work out very different alternatives thus stimulating more radical inventions (Mazzoleni and Nelson, 1998). It is, however, difficult to assess the societal effects of broad versus narrow patents(ibid.) although the authors do warn against implementing too strong and broad patent regulations. One the arguments against such broad coverage of patents is that it creates excessive barriers to entry for new firms.

13 In the studies on motives to patent there is no uniform opinion on whether there are generally differences among sectors. Cohen et al., (2002) do find such differences, whereas Blind et al. (2006) argue that technology has become less relevant. Heeley et al. (2007) find differences in how the market perceive patents in industries where the link between patenting and harvesting the rents from the innovation is transparent and industries where it is less obvious how the appropriation of rents will take place. In the latter case, often in industries corresponding to what Cohen et al. (2002) denotes ‘complex product industries’, there is less value of patents as signals or information to reduce asymmetric information. These are the industries where the strategic motives to patent is most frequent, and where the patenting may be part of a more complex patenting pattern involving fencing, positioning the firm in negotiations on

the large size of such investments, the greater risk of copying, and the long time horizon until commercialisation; the time horizon for bio-tech firms to produce something which is possible to commercialize may be a minimum of 5-7 years. Regarding the latter time horizon it is important to note that patents are lasting, whereas management and R&D-personnel may change during a 7-year period.

At the same time many VC funds are fixed-end funds with duration of typically 10 years. This poses a pressure to go into the biotech investment early in the life of the fund. Therefore, the VCF will require to have settled an exit strategy already at the time of initial investment. This, in turn, calls for an evaluation of the value of the IPR and the potential commercial benefits from the invention.

Investments and production in the knowledge-based economy entail characteristics, which may both spur and limit the incentives to prefer financing patenting firms rather than other firms. To take factors limiting the value of patenting in the eyes of VCFs first, it is generally believed that the length of product life cycles has decreased. The shorter product life cycles combined with the fact that there is a considerable and increasing time lag between application and grant of patents means that the incentives for patenting decreases. Second, innovations tend to be still more cross-disciplinary, not only incorporating knowledge from different scientific fields, but also combining existing, known technologies in new ways. Innovations also tend to be of a still broader type involving not only technology based products or processes, but also new organisational forms, new marketing concepts, distribution channels and –forms, and business models. As this in some cases may not represent sufficient novelty to qualify for a patent other appropriation methods becomes more relevant. Moreover, it may again be the small firms in traditional industries, relying on incremental innovations who are not benefiting from the patent system and the recent upsurge in IPR-trading. Third, events at the capital market, such as the burst of the IT-bobble, have taught investors that in some technologies and industries the investments in innovation efforts are often sunk. This implies that in many cases patents may rationally be of decreasing value as collateral as the technology quickly becomes obsolete. This means that e.g. secrecy may become of increasing relative importance as a protection method.

5. The influence of VCFs on the IPR process

cross-licensing etc. In this setting, patents may even function as currencies in a market place for trade with technologies, however a currency that is primarily available to large firms (Kash and Kingston, 2001).

The above indicates that there may be incentives for VCFs to be more willing to invest in firms with a patent or patentable invention. These firms may be more attractive because they precisely are technology-front companies, and because an issued patent implies that a technology search has already been undertaken, reducing the likelihood that another patent will block the commercial exploitation of the technology. In particular for small firms, who need additional capital for development, the holding of a patent may be very important (Mazzoleni and Nelson, 1998). The patent also conveys information on the managerial competencies of the firm (Mann and Sager, 2007). What it does not say, however, is something on the business aspect of the patent, i.e. how the rents from the technology is to be appropriated (Heeley et al., 2007). The patent may be used internally in the company, and it may act as an asset in itself, both of these cases can be a source of super-normal profits and growth, which is a precondition for VCFs to enter.

In addition, a patent is important for exit from the investment. Some investors fear taking over an empty shell when investing in knowledge based firms. Part of the due diligence of a firm is to assess the threats of competitors, something immensely reduced if the core technology is protected. A patent is therefore an important documentation and core of a company otherwise based on intangibles. When the firm is valued in the market place a core and broad patent may be an advantage because it represents a bargaining power vis-à-vis acquiring licensing agreements or other IPR from other firms. Firms with a patent may thus be attractive also because the patent in itself may represent a value, even if the firm fails to bring the technology to a production or licensing agreement. Although it may be difficult to separate the effects of the technology and the patent per se there are strong indications that these factors both are related to the venture capital process. Mann and Sager (2007) find that the factors that enable and motivate software firms to obtain patents corresponds to factors that allow firms to progress through the venture capital cycle¹⁴.

One may question if this means that innovation and/or R&D-activities are distorted through these valuation mechanisms¹⁵. Mediating these external valuations VCFs may get to implicitly or explicitly influence the innovation process in firms in multiple ways. In particular, the legal status of the patent, the appropriability methods and the business strategy.

14 They do not, though, find strong evidence that patents directly facilitate financing, which is not surprising, given that they study firms in the software industry, who only rarely get patents.

15 Mann and Sager (2007) refer to historical evidence (Moser, 2005) that suggest that IPR affects the directions of innovation.

This points to the other content of venture capital investment documentation with respect to IPR. The most important of such documentation is probably that VCFs require documentation of 'freedom to operate'. This includes that patentability of not yet patented products must be investigated and that the firm will be able to operate without risk of infringement claims from outsiders. By incorporating the patent landscape already in the product development process the firm may be able to design around existing patents, or to license these other patents. Investors are thus not only interested in the IPR of the firm, but also in the rights of others. VCFs strive to minimize risks. When we talk about SMEs the risk of a lawsuit may mean that the VCF will not invest as this may close down the SME¹⁶. To provide such documentation of no actual or potential litigation against the company external counselling should be called in to provide a non-infringement opinion and possibly also an opinion of freedom-to-operate and validity of patents. The choice of this external counsel may be made to ensure independence and would ideally be done after consulting the potential investor.

A related aspect is considering whether the optimal measure of appropriation has been selected. In some cases and industries patents may not be the only or most relevant method (Arundel, 2001). In Internet businesses and software development copyright protection may be better suited whereas firms in biotech and life sciences are likely to be starved of external financing without patents. Trademarks are often of particular importance to consumer products. In some cases the combination of different IPR provides the best solution. Both patents and copyrights protect some computer software. Again, the IPR must be carefully considered in relation to the business strategy and –environment.

Patents are highly valued by the financial community as such, and by most of the boards of VCFs. VCFs therefore have incentives to press for patenting. When Kortum and Lerner (2000) find that venture-backed firms file patents three times as often as comparative firms it may reflect that VCFs urge their portfolio firms to patent or that the high patenting rate of firms made VCFs interested in these firms in the first place. Although under-researched other studies seem to confirm that venture capital firms exert an impact on the commercialisation strategy of firms. Hsu (2006) finds that the monitoring of portfolio firms, e.g. through board participation, make up a disciplinary role on entrepreneurs who otherwise tend to suffer from over-emphasis on controlling the commercialisation of the technology, even on the expense of less profits. Venture capital firms are able to re-direct entrepreneurs in the direction they see as the most profitable such as e.g. choose between licensing out patented technologies or entertain an acquisition bid. The above-

¹⁶ Silverman (1989) list that, even by then, patent lawsuits in the US cost about \$ 500.000 per claim. This means that if the firm only has a weak patent, this may represent a risk, which VCFs take into account in their decision process.

mentioned literature support the underlining assumption in this study that venture capital firms may influence business decisions regarding the commercialization and development of innovations within the portfolio firm.

The integration of the IPR and the business strategy is an often-overlooked aspect of IPR, especially among small firms. It is also one where VCFs may contribute. The development of the IPR of the firm needs to be done in accordance with both the internal competences and technology development and with the external business context in which the value of the IPR is to be tested. A footloose development of science may not be attractive to investors no matter if it is leading edge technology. The documentation and description of the IPR must demonstrate the commercial potential of the technology rather than only the scientific achievement.

The trends discussed above were largely confirmed from the interviews with VC managers. The role of VCFs as networker with respect to IPR was pointed to, especially in relation to mediating firms and patent agents. The importance of a patent stands out in the decision criteria and due diligence. If proper IPR is not in place the VCFs may help the process, however, this is often done by calling in external counselling. IPR expertise was said to be absent in VCFs, which make them rely extensively on external IPR-expertise. One VCF had a list of patent agents with competence profile related to each of these. Another VCF always recommended the same patent agents because they know and trust these. These measures are taken because of immense credence problems in the selection of external expertise (Day and Barksdale, 2003).

A further aspect was discussed; the investment managers make their opinion on the screening of investment opportunities, which afterwards is decided upon by the board. Following an increased emphasis on patents the trend is that the presence of a patent is used as a legitimisation of decisions to the board of the VC-fund. The double-principal-agent role as mentioned in the theoretical section is felt strongly. Moreover, the patent agents and attorneys are used because they take away some of the responsibilities of the VC management if things go wrong.

It was emphasized in section 4 above that the type of firm may impact on the issues discussed here. Likewise, the type of financier may make a difference. Above VCFs are mainly treated as a uniform entity. However, VCFs specialize and differ, not only in their focus on types of firms and investment criteria, they may also differ in the value they create and in their assistance to patenting firms. The range of possible equity financiers goes from technology transfer offices at universities to (semi-public or private) innovation incubators, business angels, seed funds, technology funds

and private equity/Buy-out funds. The extent to which each of these may assist the firms in the patenting process may generally increase the more the financier is focused upon small, new firms. In fact, the case of Technology Transfer Offices at universities may be a particularly illustrative case. In these offices, although they may also themselves differ, they often deal with inventors who are completely unaware of the patenting process. They will consequently often take a lead role in the process and also call in patent lawyers early in the process.

6. Conclusions

Exemplified through a discussion on the role of venture capital in the patenting process this study has explored how capital markets and the recent trends in the patent system itself may influence patenting and innovation activity. Specifically it was evaluated if there are costs and distortions of incentives related hereto.

The access to capital as a strategic motive to patent is in empirical studies ranked relatively low among motives to patent, but strategic motives generally have increased in importance. It was also clear that trade with IPR has increased and, related, that IPR increasingly is seen as a financial asset.

Paradoxically the patent system was supposed to spur innovation, however, while this is surely also one (positive) effect then there are also severe distortions of incentives related to innovation activities by the way patents are treated today. Moreover, these costs are unequally distributed, as the small, low-tech firms relying on incremental innovations seem to bear the burdens. It should be remembered that VCFs contribute to the patenting process in a number of ways. Especially they are important in relation to securing the value of the patent and to put the IPR into a business context and ensure ownership of the IPR as well as clear the road for commercial exploitation of the patent, including making sure that the patent is not infringing other IPR. Another important role is to function as an intermediary to technology, legal and IPR-specialists. The VCF is embedded in a financial system that values patents highly as does most boards of VCFs. Therefore VCFs may have an incentive to push portfolio firms into patenting rather than other means of appropriation.

Trends in the knowledge-based economy mean that incentives for patenting may decrease. On the other hand, there has been a huge increase in both patenting and trade with patents (OECD, 2004). This may reflect another trend – that firms are increasingly based on intangibles, therefore

financiers value the ownership of a patent highly as it eliminates some of the risks of investing in knowledge-based firms and they value patents as collateral and as an asset in itself more highly when there is a vibrant market for knowledge assets. Patents are likely to make firms more attractive for investors, not only because of the economic reasons just mentioned, but also because it contributes to legitimising investment decisions in relation to the board of the Fund. It may even be that the apparently strong trend to go for patented technologies is a reflection of what early in venture capital research was denoted 'capital market myopia' (Sahlman, 1985).

Even if studies on the value of patents show that the average value may be low, then it may even be argued that they fulfil much the same function as bank notes: the very belief in their value constitutes their value. Because everyone is convinced they see something valuable, this value becomes real. The question is if this is a case of 'The Emperors new Clothes' and that it only takes a change in this myopic behaviour to erode this part of strategy thinking¹⁷.

17 'The Emperor looked into the mirror, but all he could see was himself wearing a jewelled crown and collar and absolutely nothing else, but of course he couldn't say that or he would be thought stupid and not fit to be Emperor.the Emperor started out upon his grand parade through his capital...Then a small boy shouted, 'He's not wearing any clothes at all, he's got nothing on!' and then the people began to laugh....Although the entire Empire was searched from top to bottom, the two rogues were never found, but, like all good stories, this one too has a happy ending, for the Emperor learned to spend less of his time collecting clothes and more to ruling his Empire.' (Emperor's new clothes, re-told by Kenneth Keay, Anker International, 1996).

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