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Theme A

## WHO REALLY PROFITS FROM PATENT INFRINGEMENTS? INNOVATION INCENTIVES AND DISINCENTIVES FROM PATENT INDEMNIFICATION RULES

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Keywords: Patents, litigation, damage awards, innovation, infringement

JEL - code(s): K41,L00, L20

# Who Really Profits from Patent Infringements? Innovation Incentives and Disincentives from Patent Indemnification Rules

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*Comments welcome!*

## Abstract:

The size of damages awarded in courts underlines the great impact that indemnification regulations should have on innovation and imitation incentives. Surprisingly from an economic standpoint, however, various calculation methods for damages are acknowledged by the law and may be applied in parallel within one case. This paper analyses the effects of the multitude of different indemnification rules on innovative and imitative activity from an economic perspective. It discusses the economic suitability of legal definitions by comparing regulations from six different jurisdictions (US, JP, DE, UK, FR, NL). Our analysis shows that economic damages fall in between the compensations provided by the two generic legal notions of ‘lost profits’ and ‘infringer’s profits’. Modeling a Cournot competition of two capacity constrained firms we can show that policy and managerial implications from the existing regulations are complex. One of our findings is that legal systems lacking the notion of ‘infringer’s profits’ enable large corporations to behave opportunistically towards small innovators. Another finding shows that small firms can behave opportunistically towards large deliberate infringers if plaintiffs can choose infringer’s profits.

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## 1. Introduction

Patent rights are regarded as property rights in virtually all jurisdictions despite residual dogmatic inconsistencies associated with this view.<sup>6</sup> Consequently, if patent rights are used by third parties without the consent of the patent holder, the latter may sue the infringers for damages. Surprisingly at first sight, however, damage awards may be calculated following different rationales not only across different jurisdictions but at times even within the same legal system. Three forms of possible damage award calculations re-appear in slightly different fashions within most Western (including Japanese) legal systems, namely “lost profits”, “infringer’s profits”, and “reasonable royalty rates”. Damages calculated as “lost profits” refer to the losses incurred by the patent owner compared to the hypothetical situation in which he/she would have produced and sold the patented technology without being infringed. “Infringer’s profits” are the net profits of the third party gained through the unlawful use of the patented technology. And finally, patent holders may sue their infringers for the payment of a virtual royalty fee that is calculated on the fictitious assumption that holder and infringer had entered a licensing agreement before the unlawful use of the protected technology took place.<sup>7</sup> Whilst there may be some reason for the existence of these different forms of calculations<sup>8</sup> from a practical legal point of view, from an economic view it appears problematic that the plaintiff may choose between three or more potential damage awards in only one infringement case.<sup>9</sup> This complex “forum shopping” possibility provided by law even within one jurisdiction but certainly across jurisdictions, may well be inefficient from a social welfare point of view. As a matter of fact, the incentives to *deliberately* infringe

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<sup>6</sup> E.g., the preamble of the WTO/TRIPs Agreement according to which members recognize “that intellectual property rights are private rights”.

<sup>7</sup> The details of the different damage award rules and their realizations across different jurisdictions are described in part two of this paper.

<sup>8</sup> The rule to award fictitious reasonable royalties is, in fact, an expedient to lower the burden of proof for the plaintiff compared to a scenario in which he/she seeks a verdict on lost profits or infringer’s profits.

<sup>9</sup> We will elaborate on this point in more detail in section two.

other people's patents in the first place<sup>10</sup> and incentives to then pursue the infringer(s) make it difficult to say whether patent enforcement rules still serve to maximize overall welfare or not. A lot might depend on the assessment of economically appropriate damages in such cases.

Who could tell, e.g., whether Mattel, Inc. would ever have licensed Lemelson's patent to produce a toy truck at a royalty rate of 4.5% arriving at a payment of almost 25 million US\$ total?<sup>11</sup> In producing the truck toy by itself, would Lemelson have gained the same profits? Vice versa, would Mattel, Inc. have had even better incentives to innovate if they had anticipated that Lemelson would sue them for the total infringer's profits? And would this have been desirable from a social welfare point of view?

Would Conair from the beginning have entered into a 28.5 million US\$ licensing agreement with Dr. Gaus on his circuits used to protect users of hand-held hair dryers from being electrocuted when the dryers are immersed in water if Conair had to fear a verdict on the payment of infringer's profits?<sup>12</sup> Could the trial have been avoided, and would this have been overall efficient?

What incentives are provided for competitors of the SquareD company by the award of 13.2 million US\$ in damages that SquareD had to pay to Mr. and Ms. Calabrese for the infringement of their relay system for accessing large quantities of data?<sup>13</sup> Is infringement profitable? Or is being infringed profitable? And how does this equation affect incentives to innovate?

The examples show that the rules of patent infringement go far beyond the broadly discussed juridical problem of establishing legal certainty for patent owners. Patent infringement rules

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<sup>10</sup> This paper discusses the effects of both *deliberate* and *inadvertent* infringements (see Bebchuck and Png, 1999) on innovation and imitation incentives from an *ex-ante* perspective.

<sup>11</sup> See *Lemelson vs. Mattel*, US District Court for the Northern District of Illinois, No. 77 C 4558.

<sup>12</sup> See "Jury blows away Conair with \$ 28.5 M infringement award", *Litigation Week*, 11 February 2002.

<sup>13</sup> See *Calabrese vs. SquareD*, US District Court for the Northern District of Illinois, No. 97 C 2199.

touch the patent system at its economic heart. They have an impact on the incentives for companies and individuals to innovate, imitate, and co-operate. And a simple glance at the size of the awarded sums to successful plaintiffs underscores the practical relevance of these regulations in the field of patent economics.

This paper studies the phenomena associated with the existence of different rules for awarding damages in the international patent system. It tackles a very relevant intersection of law, economics, and management that has consequently seen various important contributions during the last years.<sup>14</sup> In contrast to most of the existing literature, however, this paper does neither resume the fundamental discussion of liability vs. property rights<sup>15</sup>, nor does it put the patent system's entire aptitude to set incentives for R&D up for a new discussion. Within a given legal reality characterized by the existing patent systems in the world, we present a theoretical economic analysis of the effects exerted by indemnification rules on innovation incentives and disincentives. Similar to Blair and Cotter (1998, 2001) we analyze the economic effects of damage award rules in detail, but we introduce two major new aspects. For once, we seek to put our finger on the economically most interesting difference when it comes to indemnification rules; i.e. their suitability to take account of the effects exerted by plaintiffs' and defendants' different capacities to produce patent protected goods on overall efficiency. Secondly, to the best of our knowledge we present the first international comparative study analyzing the dogmatic frameworks of six major patent jurisdictions with respect to indemnification rules and we illustrate for the first time the theoretical problem accruing from legal forum shopping possibilities in multinational infringement cases.<sup>16</sup> Like

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<sup>14</sup> On the economic relevance of patent litigation see Lanjouw (1998), Lanjouw and Schankermann (2000), Harhoff and Reitzig (2001). Quite a few articles by legal scholars have been published on multiple damage award calculations. For Germany see e.g. Assman (1985), Heil and Ross (1994), Karnell (1996), Lehmann (1998), and Vollrath (1993).

Economic aspects of patent indemnification are treated by Ayres and Klemperer (1999), Conley (1987) and Schankerman and Scotchmer (2001).

<sup>15</sup> See Calabresi and Melamad (1972), Kaplow and Shavell (1996), and Melville (1999).

<sup>16</sup> We will not elaborate in detail on the procedural legal steps that must be taken to move one case into the

Bebchuck (2001), our paper does so by taking a consequent *ex-ante* perspective in an attempt to avoid rather sanctimonious *ex-post* discussions.<sup>17</sup> Finally, we discuss our results both from a legal and an economic and managerial perspective.

In more detail, the remainder of the paper is structured as follows. Part two summarizes the legal principles and applied rules for indemnifications across different countries. Section three compares the different legal regulations from an economic point of view, and discusses implications for the innovation and imitation incentives that originate from these different rules. In particular (part four), we model the impacts of firms' capacities and competitive characteristics on the innovation incentives and disincentives. Finally, the paper discusses policy implications in part five. The discussion draws from the results of the economic analysis, however, considerations as referring to compliance with national law are also presented.

## **2. Patent Infringement Indemnification – An International Comparison**

There are two types of remedies against patent infringement: injunctive relief and damages. Requesting the infringer to stop the infringing activity is always possible regardless of how much damage the patentee has actually suffered. The recovery of damages is an acknowledged remedy in all cases where property rights have been infringed. Damages incurred in the case of patent infringements are notoriously difficult to calculate, however, due to the intangible nature of the right. Most jurisdictions provide for a number of methods

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particular jurisdiction in which the plaintiff seeks to have his case judged. While there are some limits to this possibility, the opportunities provided by the international procedural law are multifarious, however, rendering this option a vividly used one. Thus, for the purpose of this paper we assume that in economically relevant cases (where patent protection is most likely to take place at the international level) plaintiffs will find ways to move their cases to the desired jurisdiction.

<sup>17</sup> The *ex-ante* perspective appears especially important in cases where *ex-post* bargaining is difficult. This is particularly true for patent infringement cases where infringements can lead to irreversible changes in the bargaining power of one party (e.g. because of bankruptcy or loss of market power).

for calculating damages where a patent has been infringed. They differ with respect to their understanding of what “damages” actually are, as well as the required effort from the plaintiff and the court to apply calculation methods. Most jurisdictions would regard damage awards as compensation for loss rather than a punishment for wrong behaviour.<sup>18</sup> Some of the differences among the calculation methods observed at the international level are due to a different understanding across countries whether damages shall be punitive or not. While international agreements on matters of industrial property such as the Paris Convention 1883 or the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) of 1994 harmonise a number of aspects, the recovery of damages is not among them. Art. 45.1 TRIPs only states the general rule that damages are meant “to compensate for the injury the right holder has suffered because of an infringement of his intellectual property right”. Some of the differences among the calculation methods, however, even exist on the national level. In various countries (we observe the U.S., Japan, Germany, the UK, France, and the Netherlands) the plaintiff can choose between several methods he/she wants to be applied for his/her case. A precise comparison of all different methods is difficult for various reasons. However, there are three principal or generic methods of damage calculation, namely the patentee’s own damages, the infringer’s profits, and an ordinary licensing fee.

## **2.1. Obtaining Evidence of the Scope of Infringement**

In principle, the law acknowledges that regardless of how damages are calculated, the intangible nature of the patent right in question requires some information from the infringer. From a practical standpoint (i.e., to satisfy legal constraints) the patentee requires information about the infringer’s turnover to calculate lost profits or an ordinary licensing fee.<sup>19</sup> When

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<sup>18</sup> With the notable exception of the United States that awards punitive damages “up to three times the amount found or assessed” (35 U.S.C. § 284) depending on the “egregiousness of the defendant’s conduct” (*Ortho Pharmaceutical Corporation v. Smith*, 19 March 1992, 959 F.2d 936 (Fed. Cir. 1992)).

<sup>19</sup> Note that from an economic standpoint far more information may be needed.

claiming the infringer's profits, the infringer's accounting data will have to be presented in court. Instruments and scope of obtaining such information from the other side widely differ amongst the countries monitored.

The furthest reaching is the U.S. discovery procedure that allows both sides to request all information from the other side prior to trial. While this information may help to assess the case, it is also very costly.<sup>20</sup> A search of the other side's premises can be requested by the UK search order or the French *saisie contrefaçon*. Discovery or search orders are alien to the German and Japanese legal systems. While German law offers very little help to the patentee in order to ascertain infringement, once the infringer's liability has been established in principle, the court can order the infringer to give a detailed account of profits and turnover under Sec. 259 Civil Code. On this basis, the right owner can then choose which way of calculation he wants to use. Japanese law has given a similar remedy to the patentee in Sec. 105(2) Patent Act.

In general, one may say that the costs for the plaintiff rise from suing for an ordinary license fee over lost profits to the infringer's profits.

## **2.2. Calculation Methods**

Legal practice for the calculation of either one of the generic damage awards looks as follows:

### **a) Lost Profits**

Here, the patentee shall be reinstated in a position where he/she would have been but for the infringement, with the restriction that only losses from the patentee's own production are

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<sup>20</sup> According to Maloney, *The Enforcement of Patent Rights in the U.S.*, 31 *International Review of Industrial Property and Copyright Law* (IIC) 723-730 [2000], more than 50 percent of litigation costs

taken into account, not, e.g., from licensing (see below). The calculation method is accepted by all major jurisdictions (U.S.: 35 USC § 284; Japan: Sec. 102(1) Patent Act; Germany: Sec. 139 Patent Act; UK: Sec. 59 Patents Act; France: Art. L615-1(2) Intellectual Property Code). The leading U.S. case required the patentee in such case to show the following:<sup>21</sup>

- (1) demand for the patented product (as indicated by past sales);
- (2) absence of competing and non-infringing products (see below);
- (3) ability of the patent owner to actually market the quantity of goods<sup>22</sup> for which lost profits are claimed;<sup>23</sup> and
- (4) the amount of profit that would have been made in the absence of infringement.<sup>24</sup>

Where competing and non-infringing products are on the market, element (2) above requires a so-called market share analysis and an award based on a pro rata percentage of the infringer's sales.<sup>25</sup> Lost profits cannot be awarded where the infringing products do not substitute the ones of the patentee.<sup>26</sup> Or, to put it in the words of the German Imperial Supreme Court: "If there is no likelihood whatsoever that the commercial turnover of the infringer would have

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are incurred through the end of discovery. Even for cases with a potentially low value at risk (below US\$1 million), an average of US\$199,000 is spent on pre-trial phases of infringement litigation.

<sup>21</sup> *Panduit Corp. v. Stahlin Brothers Fiberworks*, 25 April 1978, 575 F.2d 1152 (6<sup>th</sup> Circuit 1978).

<sup>22</sup> The *existing* law generally accepts that in the absence of marketing capacity, the patentee cannot claim lost profits due to a lack of causality.

<sup>23</sup> A requirement that is also specifically mentioned in Sec. 102(1) Japanese Patent Act and that has been applied in the UK decision *Catnik Components v. Hill & Smith* [2], English High Court, 16 March 1983 [1983] F.S.R. 512. Also the German courts require demand for the product and actual production capacity: German Federal Supreme Court, 10 July 1979, GRUR 1979, 869-872.

<sup>24</sup> Only Japanese (and Korean for that matter) patent law differs in this respect: Sec. 102(1) Japanese Patent Act allows the patentee to calculate his damages by multiplying the number of infringing products sold by the infringer by the profit the patentee would ordinarily make when selling his own products. Such calculation method has been explicitly rejected by the UK decision *Gerber Garment Technology v. Lectra Systems*, Patents Court, 20 March 1995 [1995] R.P.C. 383, and the German decision, Federal Supreme Court, 6 March 1980, GRUR 1980, 844 – "Tolbudamid": "Uncertainty that one does not know if the defendant would have been able to achieve the same turnover in infringing products at higher prices".

<sup>25</sup> E.g., U.S. decision *State Industries Inc. v. More-Flo Industries Inc.*, 883 F.2d 1573 (Fed. Cir. 1989); UK decision *Catnik Components v. Hill & Smith* [2], English High Court, 16 March 1983, 1983 FSR 512.

<sup>26</sup> U.S. decision *Bic Leisure Products v. Windsurfing International*, 4 August 1993, 1F.3d 1214 (Fed. Cir.

been made by the patentee, the latter has to furnish proof that he would have indeed made part or all of the sales the defendant actually made.”<sup>27</sup>

b) An Ordinary Licensing Fee

The most common form of claiming damages is the reasonable royalty for three reasons. First, it is the form of indemnification where plaintiff and defendant can bilaterally agree on the size of the reward. Second, other than in the case where the plaintiff files for lost profits or infringer’s profits, only relatively little efforts have to be made by the right owner to prove his case. Finally, many patent owners do not wish to lay open their internal cost structures (which they would have to when filing for lost profits but – strangely – not in the case of an ordinary licence fee).

It is standard practice to calculate a reasonable royalty “on the basis of what royalty a willing licensee would have been prepared to pay and a willing licensor to accept”.<sup>28</sup> It is noteworthy that all jurisdictions monitored seem to treat the infringer in such case not different from an ordinary licensee, sometimes even better: Until about 1998, it was standard practice in Japan to use royalty rates calculated by over-the-board industrial averages of royalty rates between Japanese companies for domestic patents.<sup>29</sup> This changed once the word “ordinary” was deleted from the wording of Sec. 102(2) Japanese Patent Act.

From a doctrinal point of view, claiming a reasonable royalty is not a compensation for damages, but a form of compensation for unjust enrichment by using an exclusive right

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1993).

<sup>27</sup> Imperial Supreme Court, 23 February 1920, GRUR 1920, 103.

<sup>28</sup> UK decision *Catnic Components v. Hill & Smith*, (above footnote 17).

<sup>29</sup> Such statistical averages were taken from Hatsume Kyokai (ed.), *Jisshi ryôritsu (Use and Compensation)* (Tokyo 1980); Hatsume Kyokai (ed.), *Gijutsu torihiki to royalty (Technology Transfer and Royalties)* (Tokyo 1992).

without permission that the infringer, had he behaved lawfully, could have only used upon payment of a royalty.<sup>30</sup>

### c) Infringer's Profits

Some jurisdictions allow the patentee to recover the infringer's profits as one way of calculating damages. This is not allowed in the U.S. and France, and in Japan it is limited to cases where the patentee has actually used the patent.<sup>31</sup> In the UK, the claim for the infringer's profits is statute based (Sec. 60 UK Patent Act: "account of profits"), and in Germany based on the legal fiction that in using another's patent, the infringer undertook a business on behalf of the right owner, who would thus be entitled to obtain all profits made from such business.<sup>32</sup> Both jurisdictions allow fairly generous deductions where the infringer has used his own skill, labour and expenses in the marketing of the infringing products.<sup>33</sup>

Wrapping up the description of the status quo in the assessment of damage awards it seems as if reality often appeared bleak despite the efforts of legal doctrine to arrive at appropriate damage figures. Damage awards often boil down to a "compulsory licence for the past",<sup>34</sup> and the sums granted in court cases may become so low for all kinds of cultural but not economic

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<sup>30</sup> It should finally be noted that while in the U.S. and the UK courts allow for a combination of the above two methods (lost profits for those infringing items where the patentee can show marketing capacity and causal loss, a reasonable royalty for all those infringing items sold on top of this), German courts do not. It might thus be preferable for a German patentee to claim a licensing fee for the whole amount of infringing items where insufficient marketing capacity would not allow a lost profits claim for the whole amount.

<sup>31</sup> Osaka District Court, 27 March 1980.

<sup>32</sup> E.g., German Imperial Supreme Court, 22 October 1930, RGZ 130, 108.

<sup>33</sup> For the UK, *Gerber v. Lectra* (above footnote 19); for Germany, Düsseldorf District Court, 25 July 1996, 4 O 217/95 – "Winkelprofil III". However, according to the German Federal Supreme Court, the infringer cannot deduct costs that relate to general management expenses: German Federal Supreme Court, 2 November 2000, GRUR 2001, 329 – "Gemeinkostenanteil".

<sup>34</sup> Casucci (2000), p. 692/702.

reasons that they hardly reflect the real damages and sometimes not even merit the effort of a suit.<sup>35</sup>

The following table 1 summarizes which methods are applied in which countries.<sup>36</sup> It also shows in which of the countries plaintiffs may choose among several calculation methods.

*Insert Table 1 about here*

### **3. The economic point of view**

The economic purpose of the patent system is to provide incentives for innovation by allowing the patentee to control the use of the patented technology for a limited period of time. The social gains derived from these incentives and the patent system's disclosure function are weighed against the inefficiencies resulting from incumbency, cost of the patent system, and restrictions imposed on subsequent innovators.<sup>37</sup> The question of how to strike the optimal balance – in particular the issue of patent length and patent breadth – is complex.<sup>38</sup>

Incentives of a potential innovator would be aligned with those of a welfare-maximizing social planner if, first, the net surplus that the innovation creates was maximized (implying, among others, pricing at marginal cost), and second, the innovator was able to appropriate this

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<sup>35</sup> E.g., in the case of France, “damages granted by the courts are in the amount of 40,000€. In only nine of the 82 reported cases, would the damages and interest exceed 80,000€”: P. Véron, *see* “Le contentieux des brevets d’invention, Etude statistique sur 1990-1996 pour la Fédération Nationale des Entreprises (FNDE)-ASPI” (Legal questions Involving Patents in France, Statistics of 1990-1996 compiled on the basis of figures by the Ministry of Justice, (FNDE)-ASPI), November 1997.

<sup>36</sup> More detailed information on the individual country legislations can be found in the following references. Maloney (2000) for the US, Heath (2000) for Japan, Marshall (2000) for Germany, Cornish and Llewlyn for the UK, Petit (2000) for France, and Brinkhof (2000) for the Netherlands.

<sup>37</sup> See, e.g., Blair and Cotter (2001, pp. 45-46) and Henkel and von Hippel (2003).

<sup>38</sup> The economic analysis of incentives to innovate and the role of the patent system goes back at least to Arrow (1962), Nelson (1959), Nordhaus (1969), and Schmookler (1966). See Gallini and Scotchmer (2002) for a comprehensive discussion, and Grossman and Helpman (1991) in the context of economic growth. See Gilbert and Shapiro (1990) and Klemperer (1990) for an economic model assessing the effects of patent breadth.

surplus entirely. Obviously, this is a rather abstract goal, if only for the reason that the two conditions are contradictory: practical measures to ensure the innovator of the rewards of his/her work do increase incentives to innovate (dynamic efficiency), but usually decrease the surplus that the innovation creates *ex post* (static inefficiency).

To strike the optimal balance between these (and some further) counteracting effects is an issue not only for the design of patents, but also for the definition of indemnification rules. Scholars differ widely in their assessment of what damages would be optimal. There is support for indemnification beyond as well as below the losses incurred due to the infringement.<sup>39</sup>

We subscribe to the view that damages should at least cover the losses the innovator incurred due to infringement. While it is true that infringement may be *ex post* efficient, we think that the patent *granting procedure* itself is better suited to take care of this trade-off than the subsequent stage of remedies for infringement.<sup>40</sup> That is, if some kind of infringement was deemed beneficial by policy-makers, then it should make sense to define the underlying patent more narrowly (thus turning otherwise infringement into legitimate action). As to the potential infringer, we sympathize with the – admittedly more debatable – idea that

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<sup>39</sup> Blair and Cotter (1998), pp. 1635-1636, as well as Pincus (1991), p. 143, argue that damage awards should render the patent owner no worse off as a result of the infringement. Blair and Cotter add that they should render the infringer no better off. From the latter condition it follows that, if the infringer's profit is greater than the losses incurred by the patentee, then the latter is actually *ex post* better off with than without infringement (ignoring issues of uncertainty). In contrast, Ayres and Klemperer (1999, pp. 1028-1031) put more weight on the welfare increase effected by a wider diffusion of the innovation, coming to the conclusion that social welfare would increase if patent owners were awarded less than 100% of their losses.

<sup>40</sup> This rationale is buttressed by Calabresi and Melamad (1972). If transactions costs are low, then property rights are more efficient than liability rights. For this paper this could mean the following: the innovation incentives are better set by the property right (patent) than by the liability rule (indemnification regulation) if the costs for state and inventors in deciding on the optimal protection given a certain invention are lower within the patent office than within the courts. Given the specialization of the patent office, this should be the case. More complicated considerations resulting from the current discussions of the performance of patent offices, the US patent office in particular, are not considered in detail in this context.

infringement should not be profitable:<sup>41</sup> First, the potential infringer should have an incentive to negotiate for a license *ex ante*; second, infringing should not become relatively more attractive than innovating. Otherwise, firms that would innovate if infringements were impossible might prefer to wait for a competitor to innovate, and then imitate its product by infringing on its patent. Just like diminished profits for the innovator, this free riding opportunity would reduce innovative activity.

However, in this paper we do not intend to enter into the debate on what the optimal indemnification rule is. Instead, we focus on the implications that the different existent rules have on the actors' incentives. To this end, we compare the damages awarded under the three principal legal rules to lost profits in the economic sense, meaning the difference between profits absent infringement and with infringement, no matter how these profits are realized.<sup>42</sup> They may come from usage of the patented technology in the innovator's own products and/or from licensing (or even selling) the patent. Economic lost profits are the natural benchmark if we assume that the patent system, excluding infringement, is optimally designed. However, also without this assumption they are an obvious choice.

Lost profits as calculated by the courts ("legal lost profits") differ in general from the economic notion of lost profits ("economic lost profits"). "Legal lost profits" solely refer to those losses that stem from reduced output and/or reduced selling price of the patent holder; i.e., they are restricted to lost profits from own production. In some countries (e.g., US and UK, but not Germany), a combination of this indemnification rule with a license analogy is possible in cases where the infringer's output surpasses the patent holder's reduction in

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<sup>41</sup> See Blair and Cotter (1998), note 39, *supra*.

<sup>42</sup> Courts in the U.S. have recently made a first move towards such a notion of lost profits (Blair and Cotter 2001, section I.C), a "but-for" causation standard. However, the terminology already indicates the fundamental problem not only inherent in the US jurisdiction but even more prominent in countries

output. This is particularly relevant when the patent holder's capacity is constrained. However, in most practical situations, a combination of two indemnification rules makes the legal procedure too onerous for the plaintiff, such that one would rather claim a licensing fee for the infringer's complete output.

An ordinary license fee in the legal sense may reflect the actual economic damage fairly well in cases where the patent holder would have licensed out the patent anyway. This may be particularly relevant in cases where a small firm would have licensed a patent to a larger firm. From an economic perspective, if the patent holder and a potential licensee negotiate a (lump-sum) licensing fee, then the patent holder will demand at least its (economic) lost profits from alternative ways of exploitation, while the licensee will pay at most the additional profits he/she can realize by using the patented technology.<sup>43</sup> Hence, when, due to the infringement, the infringer gains less than the patentee loses, licensing would make no sense economically. In such a case, the legal and economic notions of licensing fees must diverge.

Finally, the legal notion of the infringer's profit may differ considerably from the (economic) lost profits. E.g., infringer's profits will be much larger when the infringer's market entry leads to a strong expansion of total output without too much margin reduction. This is likely the case when both firms are severely capacity constrained. Infringer's profits will come close to the (economic) lost profit of the patent holder when the infringement basically leaves market size and prices unchanged and scale economies can be neglected, or when the effects of market expansion and margin reduction cancel each other out.

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where case law plays a minor role. Lost profits from a legal perspective are still commonly regarded as lost profits from own production and do strictly speaking not cover damages that exceed this amount.

<sup>43</sup> This supposes that production and sales take place in case of licensing just as they would in case of

The size of the various profit measures depends on various factors, among the most important ones the following: The competitive pattern of the industry (particularly the capacity/size of the inventor and its competitors), the demand for the patent protected product or process, the effect of the underlying technology on production costs, and the degree to which the protected technology substitutes or complements existing products and processes.

The above is not to say, however, that calculating the different profit quantities is obvious. Consider, e.g., infringer's profits. For an economist, this quantity refers to the difference between profits with and without usage of the patented technology. While the definition sounds simple, problems arise in the attribution of overhead cost. How big really is the additional profit the infringer realizes due to its use of the patented technology when a reasonable share of overhead cost is attributed to the infringing product?<sup>44</sup> In some countries, these considerations are mirrored in legal rules (e.g., see Table 1, "Infringer's profits", for the case of Germany).

#### **4. Infringement rules and market characteristics – a model**

In order to analyze the economic implications of different indemnification rules for patent infringement we develop a simple microeconomic model. We make a number of simplifying assumptions to keep the model tractable and transparent. As the base case, consider a monopolistic firm selling a single product. This product is based on a technology patented by the manufacturer. We assume that fixed as well as variable cost of production are zero. We also make the standard assumption of a single market interaction and do not model changes in

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infringement, which is realistic for a one-off licensing fee. When the negotiators agree on a per-unit fee, the licensee's marginal cost are increased, with a likely negative effect on its output compared to the case of infringement.

<sup>44</sup> A corresponding question can be asked for the patent holder's lost profits, namely, if these are calculated with or without overhead cost attributed to the product.

output or external parameters over time. Market demand and profit functions are modeled in the following (standard) way:<sup>45</sup>

$$P(Q) = 1 - Q \quad (1)$$

$$\Pi_1^{Mon}(Q) = Q(1 - Q) \quad (2)$$

Profit maximization leads to a monopoly output of  $Q_1^{Mon} = 1/2$ , with a resulting profit of  $\Pi_1^{Mon} = 1/4$ . Now assume that a second firm (the infringer) enters the market, also offering a product based on the patented technology. Firms compete in output quantities.<sup>46</sup> The two products are close substitutes, such that the simplifying assumption of a unique market price is justified. Given output quantities  $Q_1, Q_2$ , market price  $P$  and firms' profits  $\Pi_1^{Duop}, \Pi_2^{Duop}$  obtain as ( $i = 1, 2$ )

$$P(Q_1, Q_2) = 1 - Q_1 - Q_2 \quad (3)$$

$$\Pi_i^{Duop}(Q_1, Q_2) = Q_i(1 - Q_1 - Q_2) \quad (4)$$

In duopoly, firm  $i$ 's reaction function, its best response to firm  $j$ 's output decision  $Q_j$ , is given by  $R_i(Q_j) = (1 - Q_j)/2$ . In equilibrium, the well-known result obtains that each firm produces  $Q_i^{Duop} = 1/3$  and earns profits of  $\Pi_i^{Duop} = 1/9$ . Hence, total profits in this standard Cournot duopoly without capacity constraints are smaller than in monopoly, which is intuitive in the long run when the monopolist can build whatever capacity it requires. This implies that the profits of the second firm (the infringer) are always lower than firm 1's (legal) lost profits.

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<sup>45</sup> See, e.g., Tirole (1988), p. 218.

<sup>46</sup> Competition in quantities (Cournot competition) is a sensible assumption given that we include capacity

In the short run, however, it may well be that capacity restrictions prevent the patent holder from serving the whole market, and that total profits are higher in duopoly than in monopoly. In this case, infringer's profits will be larger than the patent holder's lost profits. Hence, for a comprehensive analysis of different infringement scenarios it is crucial to consider various cases of capacity constrained firms, which implicitly model different competitive scenarios. Severe capacity constraints imply that the second firm's entry reduces market price only slightly (see equation (3)). The incumbent's output remains unchanged, and its profits are only slightly diminished. Hence, competition in this case is low. In the other extreme, without binding capacity restrictions, both market price and the patent holder's equilibrium output are strongly affected – competition is strong.

The calculation of Nash equilibria in the presence of capacity constraints, with capacity  $K_i$  for firm  $i$ , is straight forward<sup>47</sup>, based on the reaction functions

$$R_i(Q_j) = \begin{cases} (1-Q_j)/2 & : K_i > (1-Q_j)/2 \\ K_i & : K_i \leq (1-Q_j)/2 \end{cases} \quad (5)$$

This allows to identify those areas in  $K_1$ - $K_2$  parameter space where one or both firms operate at their capacity limit. In Table 2, we describe in detail the Nash equilibria and the corresponding profits for all parameter areas. What is important here is that both firms' profits in duopoly (excluding indemnifications for the moment) can be described as functions

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constraints in our analysis. Furthermore, Kreps and Scheinkman (1983) could show that, under some assumptions, capacity precommitment followed by price competition yields Cournot outcomes, thus giving a very lucid interpretation of competition in quantities.

<sup>47</sup> In the case of price competition under capacity constraints, existence of a pure strategy equilibrium is not guaranteed (Levitan and Shubik, 1972). The case of quantity competition considered here does not pose this problem.

$\Pi_i^{Duop}(K_1, K_2)$  of the capacities  $K_i$ . From these quantities, net profits under different indemnification rules (assuming detection of the infringement and conviction of the infringer) can be calculated in the way shown in Table 3.

*Insert Table 2 about here*

*Insert Table 3 about here*

Using the profit functions  $\Pi_i^{Duop}(K_1, K_2)$  given in Table 2 and the relations from Table 3, we calculate the relevant profit measures for both firms under different capacity combinations. This allows us to compare the incentives under different indemnification rules for varying competitive scenarios, described by capacity constraints. For illustration, we keep firm 1's capacity constant while varying  $K_2$ . In Figure 1, firm 1's capacity is fixed at  $K_1 = 0.1$  (i.e., it is "small"), while in Figure 2,  $K_1$  is "large" ( $K_1 = 0.6$ ). In all cases, profits are shown as multiples of the respective monopoly profit, since we are interested in the relative size of the different profit quantities. The patent holder's profit curves are shown as full lines, those of the infringer as broken lines.

Each of the two figures depicts the following cases: a) duopoly without indemnification (or, equivalently, operative profits before payment of damages); b) net profits after "legal lost profits" have been awarded to the patent holder (which, for the latter, implies the original monopoly profits, hence a curve (b1) that is constantly equal to 1); and c) net profits after "infringer's profits" have been awarded to the patentee (in which case the infringer's net profit equals zero, curve c2). Figure 3 shows a close-up of two symmetric cases (with the case of two small firms on the left hand side, and two large firms on the right hand side). When the patentee is strongly capacity constrained (Figure 1), total duopoly profits are above monopoly profits, and a voluntary licensing agreement would be feasible. Hence, Figure 1 additionally

shows profit curves for the hypothetical case of a voluntary payment of royalties (curves d1, d2; we assume for simplicity that the profit increase in duopoly compared to monopoly is split equally between the two firms, see below). Since such licensing would increase the patent holder's profits as compared to a monopoly, these curves are important benchmarks when discussing the economic lost profit and the innovator's incentives. Figure 3 shows a close-up of two symmetric capacity scenarios (both firms small, both firms large).

In the following section, the models results will be interpreted with respect to innovation and imitation incentives.

## **5. Discussion**

We now employ the model developed above to discuss the lead question of our article, namely to what extent patent indemnification rules affect incentives for innovation and imitation. To do so we initially compare the profits of patent holders (innovators) and infringers (imitators) along the different damage award regulations for the two scenarios of a small and a large patent holder. For both scenarios, we consider different sizes of the infringer. In a second step policy and managerial implications are elucidated.

### **5.1. Incentives for innovators and imitators from patent indemnification rules**

To discuss incentives for innovation and imitation is not necessarily the same as discussing incentives for patenting and infringing patents. Thus, the discussion starts with another simplifying assumption, namely that we consider strong appropriability regimes in which innovation is most likely accompanied by legal protection in the form of patenting. Furthermore, when considering the incentive distortions of infringement on innovation it is not trivial to find a feasible point of reference for the discussion of profits. Plausibly, one might refer to the attractiveness of innovation for the patent holder absent the risk of

infringement. In a classical setting (one product firm holding a discrete patent-protected technology) those profits would be the monopoly profits of the patent holder from in-house production. Introducing capacity constraints alters the discussion, though. From an economic perspective, the anticipated profits of a capacity constrained firm may exceed simple monopoly profits from in-house production because it might be feasible for the firm to choose a superior mix of in-house production and non-exclusive voluntary licensing. The latter part of the firm's profit function would then depend on its anticipated negotiation outcome with a potential licensee which again would depend on the licensee's anticipated profits, the holder's bargaining power etc. Without going into further detail, it becomes obvious that determining the *ex-ante* anticipated profits by a capacity constrained innovator in a general fashion requires further assumptions.<sup>48</sup> To model 'realistic' innovation incentives by capacity constrained firms would require to formally introduce the innovator's and the infringer's bargaining power before infringement. The latter would presumably depend again on various factors such as firms' capacities and the competitive scenario. At this point, however, we fear that the potential benefits from including bargaining power as an additional factor into a more sophisticated model are outweighed by the disadvantages from the dilution of the key findings of this article. Thus, for the purpose of this paper, we make another simplification. In the following we assume that the innovator and infringer would dispose of equal bargaining power when negotiating a legal license before infringement takes place.<sup>49</sup> Thus, for the cases in which an innovator's incentives to innovate are co-determined by his/her anticipated returns from royalties additional to his/her own in-house production – namely the cases of small innovators – we assume that the patent holder's incentives to innovate are determined

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<sup>48</sup> This is true even for our simple model. In real economic life, further complications in finding the correct point of reference arise: For example, the plaintiff might claim lost sales of unpatented items and spare parts (Blair and Cotter, 2001), p. 29. In addition to these conceptual problems, grave measurement difficulties exist (see, e.g., Pincus 1991).

<sup>49</sup> An obvious alternative simplification would relate the bargaining power to the capacity. Note, however, that such an approach may be at odds with reality. Consider the case where a small biotechnology corporation owns a patent and there are two potential large corporations interested in the

by his/her monopoly profits from in-house production plus half of the additional profits made in the legal duopoly case (when the patent gets legitimately licensed to a second corporation).<sup>50</sup>

a. The case of small patent holders

Figure 1 illustrates the patent holder's initial incentives to innovate (curve d1) and the infringer's incentives to imitate (curve d2) in our simple model for the case of a small patent holder (assuming that conviction of the infringer is certain, and that both players know about this; see below for a discussion) and different capacities of the infringer.<sup>51</sup> The symmetric case of two small (capacity-constrained) firms is indicated by an arrow at the horizontal axis (Figure 3, left, provides a close-up of this case as a 'snapshots' along the vertical axis). It becomes obvious that innovation incentives vary tremendously depending on the relevant indemnification rules. A rule awarding solely lost profits from own production will lead to a reduction of the innovator's incentives by the threat of infringement, since the attainable profits (curve d1) including voluntary royalties are larger (much larger if the infringer is a large firm) than firm 1's net profits after being awarded (legal) lost profits (curve b1). On the other hand, the small patent holder's incentives are vastly increased over his/her incentives absent infringement if he/she may expect to be awarded infringer's profits in the case of illegitimate imitation (c1), an effect that increases in the infringer's size. Looking at the imitation incentives for infringers in this scenario, we find that for any capacity of the infringer, imitation is profitable if all he/she has to fear is a verdict of lost profits according to

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commercialization of the invention. In this case, the sheer capacity ration of the potential licensee to the licensor firm does not correctly reflect the patent owner.

<sup>50</sup> Note: In the duopoly case the patent holder will not earn monopoly profits from in-house production any more. Due to his equal bargaining power he/she will, however, claim more than half of total the duopoly profits, namely half of the *additional* profits in the duopoly case compared to the monopoly case.

<sup>51</sup> It is interesting to note that, up to a capacity of  $K_2 = 0.44$  of the infringer, the patent holder operates at

current legal understanding (curve b2). But even if they had to fear a verdict that corresponds to an *economic* understanding of ‘lost profits’ there would remain incentives for imitation. Interestingly, in both cases incentives to imitate increase with rising capacity on the infringer’s side.

#### b. The case of large patent holders

When large firms are infringed, total profits are smaller in duopoly than in monopoly. Consequently, licensing makes no sense and the innovator’s profits from own production serve as a benchmark (curve b1). As Figure 2 illustrates, the innovator’s incentives remain undistorted if he/she can be sure that lost profits from own production are awarded). Since total duopoly profits are smaller than monopoly profits of the innovator, the latter will be better off by claiming lost profits. This has the additional advantage, for the patent holder, that the infringer’s net profit becomes negative., which might help to drive small imitators out of the market. As in Figure 1, the symmetric case is indicated by an arrow at the horizontal axis, and Figure 3, right, provides a close-up.

## 5.2. Policy and managerial implications

Despite the simplifying assumptions we had to make we feel that the analysis enables us to draw various conclusions. In the following we seek to provide policy makers and managers with some information we consider relevant for making design changes to patent indemnification rules or navigating high-technology corporations through legal systems.

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his/her capacity limit. Hence, there is no harm done in terms of units sold; the patent holder’s loss (curve a1 compared to curve b1) is entirely caused by the price erosion effect.

Our first finding addresses to policy makers and is very general and presumably very intuitive. We consider it inevitable for legal systems to align lawyers' and economists' notions of lost profits.<sup>52</sup> The dissonance between the two was a driving factor for writing the paper, and the analysis of parts two, three, and four have shown that it is not a trivial task to come up with a taxonomy that shows the relation between legal and economic terms. Despite the simplification we ourselves made in part 5.1 for illustrative purposes, in general we argue that lost profits can neither be defined as lost profits from in-house production nor as a combination of hypothetical losses from in-house production and a *standard* licensing fee. Rather than that lost profits will reflect an optimal mix of lost profits from in-house production and realistic licensing revenues from a patent holder's perspective. These profits for the holder will be determined by his/her capacities, the capacities of his/her competitors, and the bargaining power of the two parties. Thus, ultimately, what lawyers call *infringers' profits* represents one end of the range of *potentially lost profits* (this applies when all bargaining power lies with the patent holder). From an economic perspective, therefore, we do not see any reason why the Japanese law can not award infringer's profits as damages and why the German and the Dutch law can award infringer's profits only by applying the so-called 'business on behalf of the owner' in an analogous way. On the other hand, it seems natural – and actually overdue – to us that first cases from the UK are reported in which lost profits from own production and additional licensing fees exceeding the lost profits are combined in one plaint.

Secondly, we find that the choice for plaintiffs to choose among various forms of damage award calculations – either within one jurisdiction or among legal systems in the case of trans-boarder litigation – may not always be desirable from a welfare standpoint and can lead to managerial opportunities.

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<sup>52</sup> See also Schankermann and Scotchmer (2001) who come to the same conclusion that the reasonable royalty doctrine is only consistent with an economic understanding of damage awards in certain scenarios.

Recalling the two infringement scenarios developed in 5.1 we consider the infringement of small corporations by large competitors the most interesting case. By our definition, incentives for innovators are undisturbed only if they are awarded economic lost profits (curve d1, Figure 1). Lost profits in the legal sense, however, do certainly not reflect the real incentives for the innovator in these particular cases. This is because of two opposed reasons. At first the relative litigation costs are higher for the small innovator than for the large imitator. Thus, the likelihood for the innovator to enforce his right and enjoy damage awards is reduced. Secondly, however, the small patent holder's incentives are vastly increased over his/her monopoly profits from in-house production if he/she may expect to close a legitimate license deal with a large competitor even before infringement takes place. The most interesting consideration, however, is that holders can theoretically anticipate to be awarded infringer's profits in the case of proven illegitimate imitation at times. This last result may be unwanted from a welfare standpoint, in particular given the apportionment problem.<sup>53</sup> Consider the famous Lemelson patent which was systematically used to sue large corporations for enormous damage award sums after they had started production and sales. The cases presented in the introduction of this article can now be analyzed in more detail. Turning back to the respective questions posed initially one may at least question whether Lemelson would have gained 25 mio US\$ if he had produced the truck toy himself. The standard royalty rate that Mattel had to pay *ex-post* to Lemelson might in reality well have been negotiated at a lower percentage than 4.5%. If Mattel had known about Lemelson's patent from the beginning they would have considered the costs for developing an alternative solution and their willingness to pay license fees to Lemelson would depend on those alternative development costs. Also the SquareD corporation might at maximum have paid a third of 13.2 mio US\$ for the database technology by Mr. And Mrs. Calabrese and

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<sup>53</sup> See Blair and Cotter (2001), p. 14.

presumably even less than that. These infringements were most likely *inadvertant* and the infringers paid a high price. Note that these verdicts were filed in the US, that means in a country in which the maximum payment to be feared by infringers is a triple licensing fee which might still be lower than what the actual infringer's profits were! In Germany, the Netherlands, and Japan those sums could theoretically be even higher (depending on the infringer's capacity).

Two interesting aspects enter at this stage. One refers to the difference between patent systems that disclose information about pending applications and those which do not. Obviously, the Lemelson vs. Mattel case could not have taken place in Europe in the same fashion as it did in the US. Either Mattel would *deliberately* have infringed Lemelson's patent or they would not have infringed it. But they could hardly have infringed it unconsciously for more than 18 months which is the period after which patent applications get disclosed in Europe. Thus, we argue that until most recently there were good reasons for the US not to impose additional threats to imitators by awarding infringer's profits to innovators due to the lack of disclosure of patent information before grant. This would have set undesired incentives for being infringed. In systems, however, where patent information is disclosed before grant (including the current US system) the disadvantages of the infringer's profit rule should be minor and the positive externalities of the infringer's profits regulation (see above) may dominate because it comes closer to a verdict on lost profits in the economic sense.

The second interesting aspect is a dogmatic one which refers to the division of the 'overhead' profits. Without deeper analysis it remains unclear whether it is favorable to create overhead profits on the side of the small innovator by awarding him infringer's profits or to create additional profits on the side of the large imitator by filing a verdict on lost profits only. From a welfare standpoint, part of those overhead profits should presumably be allocated to consumers. Thus, in our eyes there is some economic justification for the penal element in the US damage award system that refers to 'willful infringement'. On the other hand, parts of the

damage awards should then be allocated to the public and not to the plaintiff only. Also, it remains problematic from a European's perspective to introduce penal elements into a civil procedure.

From a manager's perspective the case of the small inventor and the large infringer is also insightful. For a large corporation, illegitimate and deliberate imitation or the credible threat thereof may be an attractive option where infringer's profits can not be claimed and where willful infringement is hard to prove. Given the financial advantages of the large corporation over the small inventor the likelihood of the latter entering risky litigation is low anyway. Cases like Conair against Dr. Gaus are rather exceptions from the rule.

But the case of small firms being infringed is also insightful when looking at capacity constrained infringers. Again it is obvious from Figure 1 that a regulation for the award of lost profits in the legal sense would not restore all of the patent holder's incentives to innovate *ex-ante*. In a regime of constrained capacities ( $0 < K_{1,2} < 0.33$ ) lost profits in an economic sense lie in between infringer's profits and lost profits in the legal sense. Thus, neither of the existing rules is ultimately satisfying. From a welfare standpoint, however, in this particular regime we see good arguments to offer infringer's profits to the plaintiff who could in this way be overcompensated for his/her risk during the development of the initial innovation and the enforcement of the patent. The fact that imitators have certain incentives for infringement is more difficult to judge. As Figure 1 illustrates, infringing on a small patent holder may still be profitable if all the infringer has to fear is a verdict on lost profits (both in the legal and in the economic sense). We find it difficult to tell whether this is undesirable or not. The sole production of a good by one capacity constrained innovator is inefficient in itself because too few consumers can profit from the invention. Thus, the question remains whether the capacity constrained patent holder would have licensed his patent in an efficient way in the absence of infringement. If so, then imitation would be undesirable and economists might – in the

absence of a lost profit rule in the economic sense – favor a verdict on infringer’s profits over a verdict on lost profits in the legal sense. If not, imitation might even increase overall welfare, provided the negative effect on incentives to innovate is not too large. From a managers’ perspective the case of the two similar sized small firms is interesting, too. In jurisdictions where corporations do not have to fear a verdict of infringer’s profits imitation might be profitable even if the likelihood of conviction is high. These considerations may be particularly interesting for managers operating in France and in the US. Since their outside option for legitimate licensing negotiations with patent holders is enhanced relative to their colleagues in other jurisdictions, they might be able to close better deals than managers operating in other countries.

Finally we reconsider the case when large firms are imitated (Figure 2). As long as both infringer and plaintiff are large, we find that the existing law provides sufficient opportunities to create efficiency. But also if infringing firms are small compared to the plaintiff, from a welfare standpoint this case appears fairly uninteresting with the exception of multiple infringement. I.e. many small firms start to infringe the large corporation’s patent. In this case, incentives for innovation may effectively be distorted. From a manager’s perspective the lost profit rule offers the interesting option of driving small imitators out of the market by imposing negative returns upon the imitators.

The discussion showed that various arguments can be pondered and that no single solution may be optimal for all potential innovation and infringement scenarios. Obviously, policy makers and managers need to consider in each individual case which scenarios are most relevant for them to find optimal adjustments. The discussion did not explicitly include cost considerations for innovation – an aspect that remains to be elaborated on in the future.

Moreover, we did not explicitly model duration effects; i.e. for how much time does the infringement take place. Oftentimes – this is what we were told by practitioners – for large corporations preliminary injunctions for omission are the most important legal feature to avoid severe losses.<sup>54</sup> The *ex-post* calculation of the damage themselves may be secondary. Finally, we could only pinpoint the most important practical considerations that might become important when considering the implementation of economically sensible indemnification rules, such as burden-of-proof issues or dogmatic consistency considerations with other parts of legal codices that might be affected.

Although limited to cases of patent infringement, the above analysis also bears relevancy for the calculation of damages where other intellectual property rights such as copyrights or trade marks are infringed. As such, the analysis is part of the much broader question of appropriate allocation of economic gains on the basis of certain legal positions, be it intellectual property rights or other competitive advantages.

## **6. Summary**

The paper started from the premise that patent indemnification rules affect innovation incentives for (future) patent holders and imitation incentives for (potential) infringers significantly. Comparing existing patent damage award regulations from six different countries we came to the stunning insight that within and across various jurisdictions damage calculation regulations can be applied in parallel within one case. We illustrated that the parallel existence of three generic rules – namely lost profits, infringer’s profits, and ordinary licensing fees – combined with the plaintiff’s freedom of choice for either one of them leads to distortions from desired innovation incentives through patents, especially if innovator’s and imitator’s capacities differ. Using a Cournot model of two capacity-constrained firms, one

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<sup>54</sup> See Lanjouw and Lerner (2001) for a respective study. See also Hall and Ham Ziedonis (2001) for the discussion of the “shut down value” of injunctions.

innovator and one (illegitimate) imitator, we could identify various scenarios in which existing regulations offer space for opportunistic behavior by either one of the parties involved. The analysis revealed that lost profits in a legal sense can not retribute innovator's incentives in capacity constrained regimes. On the other hand infringer's profits can set unwanted incentives for small firms for being imitated. For these reasons we are afraid that legal 'forum shopping', namely the freedom of choice of a certain type of calculation method within one jurisdiction and the related possibility of choosing the country of jurisdiction in multinational infringement cases, leads to undesired results from a welfare standpoint. Our findings ask for a political debate about the necessity to introduce an economically sensible lost profit regulation, or alternatively to reduce the plaintiff's freedom of choice and harmonize international indemnification regulations. Our findings also show, however, that managers can currently still benefit from the variety of existing legal regulations if they succeed in navigating the legal thicket. SME managers should avoid the risk of being held liable for lost profits by large incumbents and try to sue large corporations for infringer's profits when their own patents are used illegitimately. Large corporations may want to pay attention that they move legal processes to jurisdictions in which they can not be held liable of infringer's profits.

Finally, the paper offers ample space for future work. First, it might be interesting to introduce bargaining power into the model and analyze how the competitive situation of the patent holder and infringer affects the incentives for innovation and imitation conveyed by the different indemnification rules. Second, duration effects could be considered and cost considerations for innovation and imitation could be modeled more explicitly. Moreover, we find it most interesting to extend this analysis to other fields of law in which indemnification rules play a role and to examine the broader applicability of our results. Finally, any related empirical analysis that would shed more light on the issue than the inspection of our introductory cases would be a contribution in our eyes.

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## Tables and Illustrations

*Table 1: Indemnification regulations within and across countries – an international comparison*

Country	Lost Profits	Licensing Fee	Infringer's profits	Choice for plaintiff
<b>U.S.</b>	35 USC § 284. Requirements: (1) demand; (2) marketing capacity; (3) absence of competing, non-infringing substitutes.	Fall-back provision where lost profits cannot be or are not claimed.	No	Yes
<b>Japan</b>	Sec. 102(1) Patent Act: Multiplication of infringer's turnover with profits the patentee would have made for such number of products. Marketing capacity of patentee must be proven.	Sec. 102(3) Patent Act: fall-back provision; estimate of royalty rate.	Sec. 102(2) Patent Act. Not applicable where patent was not used by patentee.	Yes
<b>Germany</b>	Sec. 249 Civil Code: restitution of the <i>status quo ante</i> . Limitation by production capacity and proof that infringing product could act as a substitute.	Most common form of calculation, normally agreed upon in court settlement. No "infringer's surcharge" can be claimed except for copyright matter (double royalty).	Based on the legal fiction that infringer undertakes a business allocated to the patentee. Deduction of infringer's expenses. Infringer's marketing efforts taken into account.	Yes: claim for inspection of infringer's accounts allowed prior to choice of calculation base.
<b>UK</b>	Yes, likelihood of having made the infringer's sales, deduction of infringer's efforts to commercialise.	Yes, a notional royalty as the minimum of lost profits.	Yes, but rarely requested.	Yes, after review of the defendant's commercial documents .
<b>France</b>	Only if patent is used; calculated by amount of counterfeit products, loss of turnover (determined <i>inter alia</i> by the quality of the patent (and amount of lost profits. Market share of patentee considered.	Where the invention is not used. Infringer's turnover multiplied by an appropriate royalty rate.	No, clarified in Patent Act 1968.	If patent is actually used: Yes.
<b>The Netherlands</b>	Same as Germany. Sec. 42(2) Patent Act 1910, Sec. 70(3) Patent Act 1995.	Regarded as the minimum that can be claimed as lost profits.	Sec. 43(3) Patent Act 1910; Sec. 70(4) Patent Act 1995: the infringer should not be allowed to keep his profits.	Yes, after inspection of documents.

*Table 3: Relation between basic duopoly profits and net profits under different indemnification rules for patentee and infringer*

Indemnification rule	Net profits firm 1 (patentee)	Net profits firm 2 (infringer)
none	$\Pi_1^{Duop}$	$\Pi_2^{Duop}$
"lost profits"	$\Pi_1^{Mon}$	$\Pi_2^{Duop} - (\Pi_1^{Mon} - \Pi_1^{Duop})$
"infringer's profit"	$\Pi_1^{Duop} + \Pi_2^{Duop}$	0
voluntary royalty <sup>55</sup>	$(\Pi_1^{Duop} + \Pi_2^{Duop} + \Pi_1^{Mon}) / 2$	$(\Pi_1^{Duop} + \Pi_2^{Duop} - \Pi_1^{Mon}) / 2$

<sup>55</sup> This line is only relevant if total profits in duopoly are higher than monopoly profits.

Table 2: Nash equilibria in different areas of  $K_1$ - $K_2$  parameter space, corresponding to different competitive scenarios due to capacity constraints

Area in $K_1$ - $K_2$ parameter space	Definition of area	Monopoly output $Q_1^{Mon}$	Monopoly profits $\Pi_1^{Mon}$	Duopoly output		Duopoly profits	
				firm 1, $Q_1^{Duop}$	firm 2, $Q_2^{Duop}$	firm 1, $\Pi_1^{Duop}$	firm 2, $\Pi_2^{Duop}$
A	$K_1 < \frac{1}{2}(1 - K_2)$ $K_2 < \frac{1}{2}(1 - K_1)$	$K_1$	$K_1(1 - K_1)$	$K_1$	$K_2$	$K_1(1 - K_1 - K_2)$	$K_2(1 - K_1 - K_2)$
B	$\frac{1}{2}(1 - K_2) < K_1 < \frac{1}{2}$ $K_2 < \frac{1}{3}$	$K_1$	$K_1(1 - K_1)$	$\frac{1}{2}(1 - K_2)$	$K_2$	$\frac{1}{4}(1 - K_2)^2$	$\frac{1}{2}K_2(1 - K_2)$
C	$K_1 > \frac{1}{2}$ $K_2 < \frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}(1 - K_2)$	$K_2$	$\frac{1}{4}(1 - K_2)^2$	$\frac{1}{2}K_2(1 - K_2)$
D	$K_1 > \frac{1}{2}$ $K_2 > \frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{9}$	$\frac{1}{9}$
E	$\frac{1}{3} < K_1 < \frac{1}{2}$ $K_2 > \frac{1}{3}$	$K_1$	$K_1(1 - K_1)$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{9}$	$\frac{1}{9}$
F	$K_1 < \frac{1}{3}$ $K_2 > \frac{1}{2}(1 - K_1)$	$K_1$	$K_1(1 - K_1)$	$K_1$	$\frac{1}{2}(1 - K_1)$	$\frac{1}{2}K_1(1 - K_1)$	$\frac{1}{4}(1 - K_1)^2$

Figure 1: Net profits for patent holder and infringer under different indemnification rules. Case of small capacity of the patent holding firm 1 ( $K_1 = 0.1$ ). Profits are given in multiples of firm 1's monopoly profits  $\Pi_1^{\text{Mon}}$ , as functions of firm 2's capacity  $K_2$ .

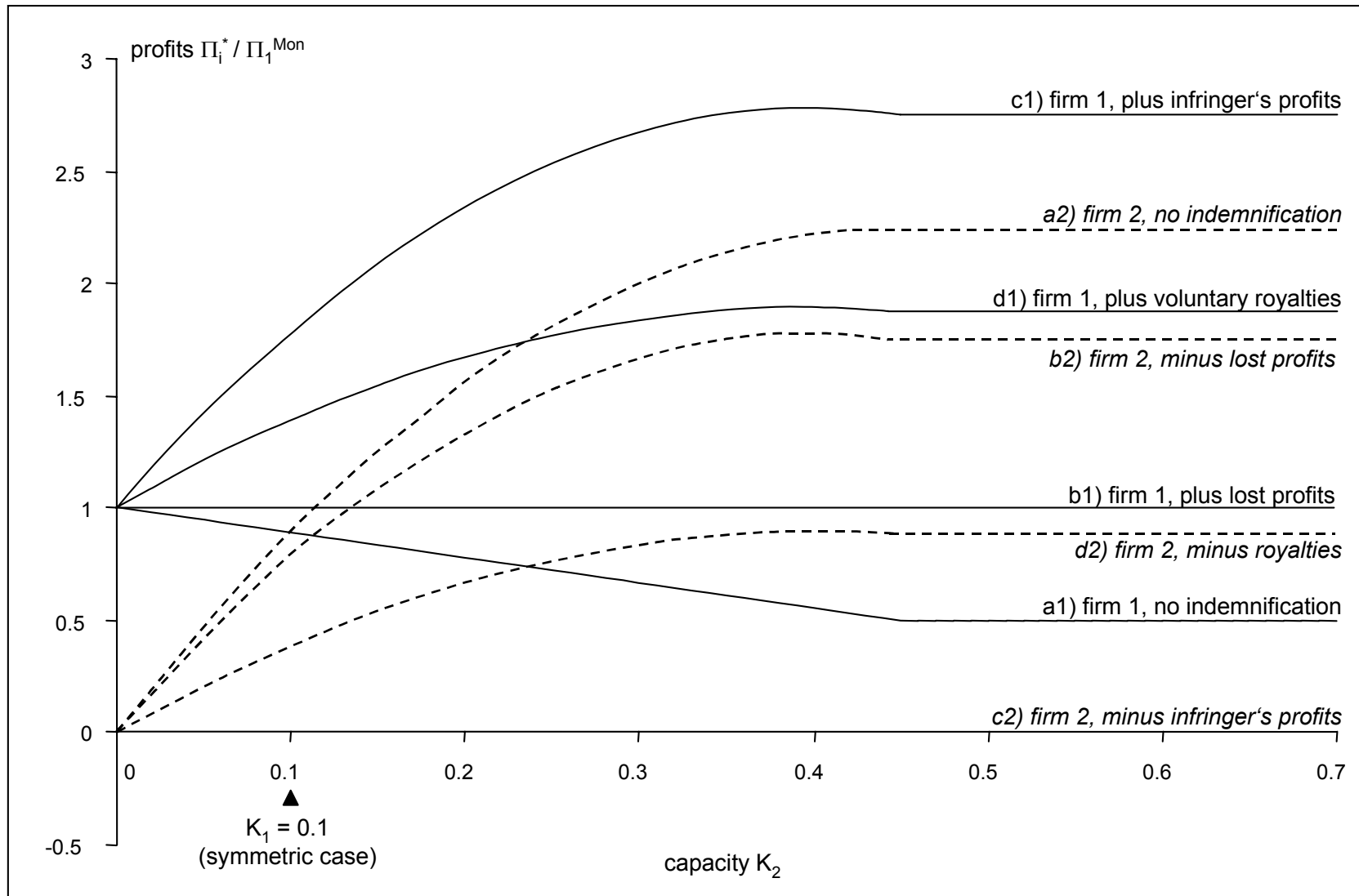


Figure 2: Net profits for patent holder and infringer under different indemnification rules. Case of large capacity of the patent holding firm 1 ( $K_1 = 0.6$ ). Profits are given in multiples of firm 1's monopoly profits  $\Pi_1^{\text{Mon}}$ , as functions of firm 2's capacity  $K_2$ .

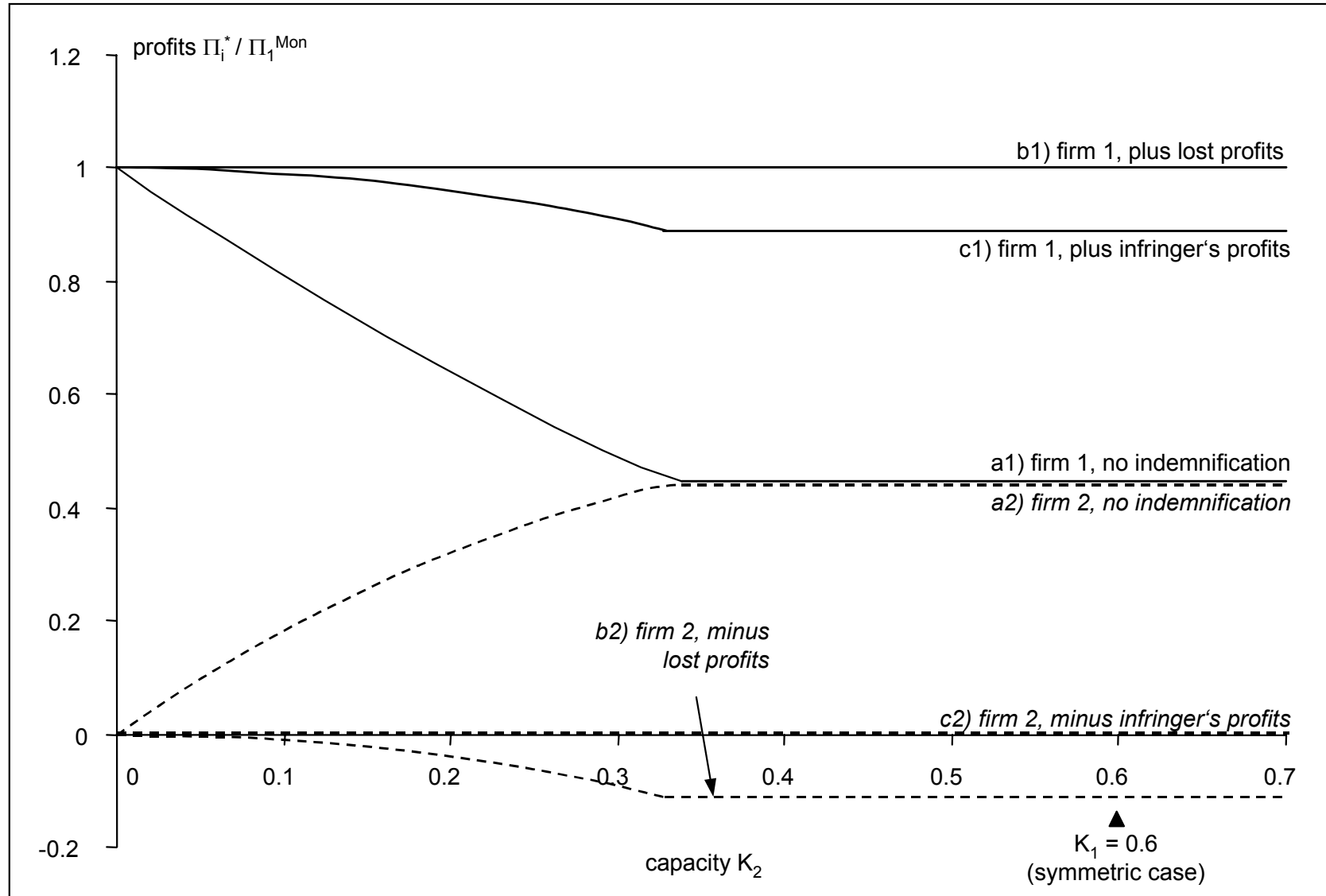


Figure 3: Profits for patent holder and infringer under different indemnification rules, for the case of identical capacities. Left:  $K_1 = K_2 = 0.1$  („small“); right:  $K_1 = K_2 = 0.6$  („large“). Profits are given in multiples of firm 1’s monopoly profits  $\Pi_1^{\text{Mon}}$ .

