# Factors Affecting the Power of Patent Rights*

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## Abstract

In this paper, we identify three policy instruments governments have at their disposal to affect the power of patent rights to prevent imitation: the size of the inventive step used to make the patent granting decision, the rigour of the patent examination process and the predisposition of the courts to affirm the patent office's decision. We develop a simple framework to analyse the effects of changing these policy instruments on *ex ante* investment in invention in the light of recent concerns about the potential effects of socially undesirable patents.

## 1. Introduction

Unlike property rights over tangible assets, intellectual property rights such as patents create deadweight social losses by temporarily blocking imitation and preventing others from using a non-rival resource. These deadweight losses arise because the patent system operates by creating a distortion (a monopoly right) to correct a distortion (non-rivalry).[1,2] We argue that the size of these social costs varies according to the administration of the patent rights scheme. For instance, if a patent is granted too freely or too broadly, it may stifle future (incremental) inventions, create an anti-commons or induce excessive anti-competitive behaviour (see Heller and Eisenberg 1998, for example). Conversely, if it is granted too parsimoniously, it may inhibit firms' desire to invest in easily-copied inventions. Striking the right balance between these competing effects is about both rewarding the inventor and protecting the interests of the rest of society.

Achieving this balance is only half of the story since the value of a patent to its owner lies in its ability to prevent rivals from copying their invention. Once a patent has been granted, its owner has a right to take action against alleged infringers in a court of law. However, infringement of intellectual property rights is difficult to prove. In the case of patents, the power to stop infringement is adversely affected by two factors. First, unlike titles to tangible property, patent rights are only granted if it can be demonstrated that they pass certain criteria. Since there will always be some mistakes made in the patent examination process, there exists a non-trivial probability that any given patent right will be found invalid if challenged in a court of law.[3] Secondly, articulating the boundary of a patent right is difficult to do since it requires that an idea be precisely conveyed in written form. As a consequence, disputes over ownership of patent titles are often difficult to

[1] We use the term distortion in the economists' sense of a characteristic which causes markets to under-produce the activity. This does not imply that the characteristic is bad or otherwise undesirable.
[2] Others have considered whether the benefits of the patent system outweigh the costs and whether alternative schemes provide more appropriate incentives for innovation (e.g. Gallini and Scotchmer 2002). However, we are not interested in that issue *per se* in this paper. Rather, we are interested in the effects of the administration (i.e. granting and enforcement) of those rights *given that a patent system exists*.
[3] See Lemley and Shapiro (2004) who argue that intellectual property rights should therefore be considered probabilistic in nature.

resolve which results in wasteful expenditure on litigation.[4] Taken together, these two factors may reduce the *ex ante* incentive to invest in inventive activity since they create uncertainty regarding the patent owner's ability to curb imitative behaviour.

In this article, we examine ways in which the uncertainty caused by the characteristics of patent rights may be attenuated. In section 2, we outline the basics of a system of granting and enforcing patent rights. In section 3, we develop a simple framework to analyse the effects of three policy instruments – the size of the inventive step required to pass the patent examination, the quality of patent examination and the predisposition of the courts to affirm the patent's office's decision – on the power of patent rights to curb imitation. We argue that if the inventive step threshold is too low, disputes over patent rights will be difficult (and costly) to resolve since the courts will have difficulty differentiating one patent right from another. In section 4, we provide some concluding comments and consider ways in which some of the hypotheses developed in this article could be empirically tested.

## 2. The basics of a generic patent system

Given the existence of legislation enshrining patent owners' rights, the power of a patent is determined in two stages: first, acquiring the title to the right (patent granting) and secondly, getting competitors to accede to the right by modifying their behaviour (patent enforcement). These two stages occur over a continuum of administrative, legal and quasi-legal activities including drafting the patent application, examining (and opposing) the application at the patent office, and enforcing the patent. Each stage is associated with varying administrative costs for processing the claim (or dispute) and wider social costs which arise from erroneous decisions or behaviours. In this section, we discuss the issues associated with the administration of both the patent granting and enforcement stages.

Three main administrative criteria – novelty, inventive step (or non-obviousness) and utility – are commonly used to form the threshold differentiating those inventions that

[4] The same isn't true for tangible assets since the boundaries around what are (and are not) part of the asset can be precisely articulated and title to the ownership is mostly complete. As a result, very few tangible asset titles are found invalid when challenged.

should be patented from those that should not.[5] From a social welfare perspective, only inventions that would not have been made in the absence of a patent system should be patented since patenting all other inventions involves a deadweight loss. Since these inventions are hard to identify, the convention in practice is that these inventions require significant *ex ante* investment which subsequently constitutes a large inventive step.[6] For this reason, we focus most of our attention on the decision regarding the appropriate size of the inventive step.

Articulating a general rule for measuring the size of the required inventive step is not an easy thing to do since inventiveness is a continuous variable, and it must apply to numerous types of rapidly changing technologies. Nevertheless, countries must adopt a position (and an examination rule) to determine whether any specific invention is non-obvious. The size of the inventive step is determined internally within the patent office as part of its policies and procedures although it must be consistent with the intent of the law.[7] We expect that the higher is this examination threshold, the more certain it is that patents granted will be affirmed if challenged in a court of law. Raising the size of the inventive step may also reduce administrative costs in cases where it becomes easier to reject patent applications that are clearly non-conforming.

Given the difficulties in defining the boundaries of a patent right and ascertaining whether a specific invention satisfies the inventive step threshold, there will always be some random error associated with the outcome of the patent granting process. However, the quality of examination has an impact on the size of this error. In general, a less rigorous examination is cheap to administer but induces uncertainty regarding the patent's validity and thus diminishes the power of patents to prevent imitation. This may result in anticompetitive behaviour such as the creation of patent thickets which have been alleged to give rise to unnecessary license fees, forgone research opportunities and

[5] There are other minor criteria such as clarity, sufficiency and fair basis which we do not consider here.
[6] For evidence that the scale of investment in research is used as an indicator of inventive step, see O'Sullivan and Rolls (2003) at p.93.
[7] The intent of the law is consistent with a range of administrative interpretations and a range of *ex post* judicial determinations. Court decisions on patent validity may feed back to the patent office's examination procedures. For example, if the patentability threshold is lower than the intent of the law, this may lead the patent office to raise the threshold. However, if the patentability threshold is too high, the rejected patent applications are unlikely to be the subject of a dispute and no feedback will take place.

projects abandoned by competitors who unjustly fear infringement litigation (Merges 1999; Beard and Kaserman 2002; Shapiro 2003). Conversely, a rigorous examination process attenuates the problems of uncertainty about whether the patent embodies the required inventive step, but it is costly to administer. These costs are incurred because the inventive step and novelty aspects of the examination process require significant resources to substantiate given the vast body of prior art that must be searched.

Since the ultimate objective of applying for a patent is to curb rivals' behaviour, there must also be some legal mechanism for enforcing the rights of a patent holder. This may involve informally enforcing the patent through letters of warning to alleged infringers, filing an infringement claim with the court, negotiating out-of-court settlements over the patent and undertaking a complete court proceeding through to judgment. Each of these stages involves considerable costs since legal representatives – patent attorneys, lawyers and judges – are required to resolve the dispute at each stage of the enforcement process. While the relative costs for each stage of enforcement are unknown, it is clear that the small proportion of disputes that end up going all the way through to judgment are very expensive and lead to heightened levels of business uncertainty since some cases take years to resolve.[8] We expect that the degree of legal certainty over the outcome of any given dispute affects the stage at which the dispute is resolved. Assuming that economic wealth does not influence the outcome of the dispute resolution process, a high level of certainty means that disputes will be settled more quickly (and therefore more cheaply) since it is relatively easy to determine which party is in the wrong.

## 3. The trade-off among objectives

In pursuit of the ultimate goal of optimising the rate of invention and successful innovation, the patent system should aim to minimise first, the amount of desirable inventions that are not granted a patent; secondly, the amount of undesirable inventions that are granted a patent; thirdly, the uncertainty over the power of granted patent titles to

[8] According to a 2003 survey conducted by the American Intellectual Property Law Association, the median cost of litigating a single-patent case all the way through a trial is US$2 million where the amount at risk is between $1 million and $25 million, and $4 million where the amount at risk exceeds $25 million.

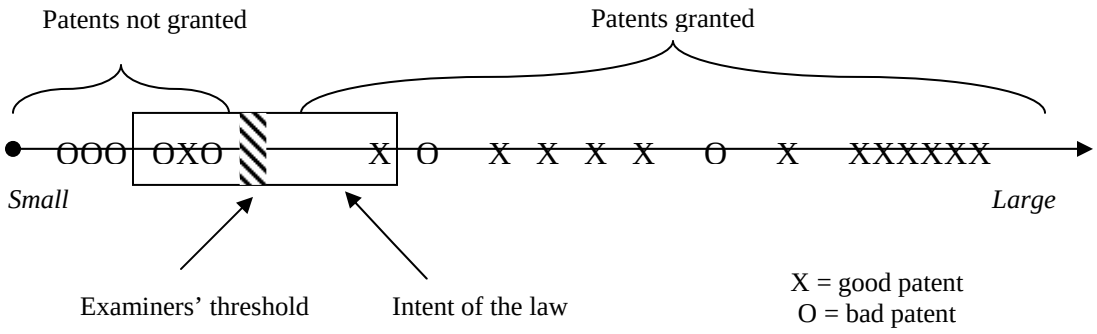
stop infringement; and finally, the costs of administering the system. These intermediate objectives however involve trade-offs. To achieve the best mix of these objectives the government has three main policy instruments: the size of the inventive step; the rigour of the patent examination and opposition process; and the predisposition of the courts towards affirming the patent office's decision. In this section, we discuss the trade-offs associated with changing each of these policy instruments.

### *3.1 Granting a patent: Type I and Type II errors*

The first two intermediate objectives of the patent system relate to providing appropriate incentives for the development of socially beneficial new products and processes while excluding those which cause either deadweight losses or give rise to unfair competition. An economically desirable or 'good' patent has three properties: it must represent an invention which incurred significant costs to create since a costless invention would have been invented in the absence of a patent system; it must create social benefits when used; and it must be able to be defined without trespassing on existing property rights. An undesirable or 'bad' patent does not possess all of these attributes. Given the difficulty of precisely identifying good and bad patents, there will always be some positive rate of rejection of good patents (Type I errors) and acceptance of bad patents (Type II errors).

Assuming that we can objectively and cardinally rank potential inventions according to the size of their inventive step and that we know the distribution of good and bad patents in the world, Figure 1 illustrates the relationship between the size of the inventive step embodied in an invention and the incidence of Type I and Type II errors. Although there is likely to be some positive correlation between the size of the inventive step and whether an invention is good or bad, it is unlikely that the relationship would be monotonic. Hence, some good patents may embody lower inventive steps than some bad patents. Nevertheless, the size of the inventive step will affect how many good patents (marked 'X') are not granted (the Type I error rate) and how many bad patents (marked 'O') are granted (the Type II error rate). Essentially, the position of the examiners' inventive step threshold produces a direct trade-off between Type I and Type II errors: increasing the inventive step threshold reduces Type II errors but increases Type I errors.

**Figure 1: Size of inventive step spectrum**




Allocating more resources to the examination (and opposition) process should unambiguously reduce both Type I and Type II errors since it reduces the random error associated with examination.[9] Of more interest however, is the interaction between the size of the inventive step and the quality of the examination process. In order to analyse this, Table 1 presents a typology of the effects of different patent granting regimes. The weak regime consists of a cursory examination process and small inventive step and results in a low Type I error rate and a high Type II error rate.

By contrast, a strong regime is where examinations are rigorous and the inventive step is large, which results in low Type I and Type II error rates.[10] However, it is unclear which of the weak and strong regimes has lower Type I errors since the random error arising from the cursory examination process in the weak regime is not clearly larger or smaller than the error produced by the large inventive step in the strong regime. Although there is no definitive empirical evidence on the incidence of Type I and Type II errors, there is some evidence to suggest that at least one type of error exists since the patent grant rates across the US, Japan and the European patent offices are different (see Quillen et *al*. 2002 for evidence of this), implying that different patent granting decisions may be being made for the same invention.

[9] Factors such as the nature of the incentives provided to patent examiners will also affect the quality of examination. For example, there is some evidence to suggest that US examiners are provided incentives for each application that is disposed of, which provides a perverse incentive to grant "bad" patents (see Lemley 2000). However, the issue of examiners' incentives is not considered here.

[10] Note, however, that even in the strong regime, both types of error are still non-zero since there is always some random error in the examination process. Thus, even in the strictest regime, there is always a chance that some patent granted by a patent office will be found invalid in a court of law.

**Table 1: A typology for the extent of Type I and Type II errors in the patent granting process**

| Quality of examination | Size of required inventive step | |
|---|---|---|
| | Small | Large |
| Cursory<br>(high random error) | WEAK<br>Low Type I error<br>High Type II error | SEMI-STRONG<br>Medium Type I error<br>Medium Type II error |
| Rigorous<br>(low random error) | | STRONG<br>Low Type I error<br>Low Type II error |

Between these cases is the semi-strong regime, which is a combination of a cursory examination process with a large inventive step. This unambiguously has a higher level of Type I errors but an intermediate level of Type II errors compared with the other two regimes. Since a regime with a small inventive step is unlikely to benefit from a rigorous examination as most inventions will pass on the threshold criterion alone, the fourth case is excluded from consideration. On the Type I and Type II criteria alone, we can see that a rigorous examination and a large inventive step regime produces the best patent system. However, these are not the sole intermediate objectives of the system since it is also desirable to minimise administrative costs and rigorous patent examination is costly. Moreover, conducting a rigorous examination of every patent application may be wasteful since the vast majority of patents granted have no *ex post* commercial value whatsoever (see Lemley 2000; Allison et *al.* 2003). Although a high inventive step may reduce the overall number of patent applications, the costs of any increase in the rigour of the examination process will be multiplied by the number of applications which may still number many thousands per year in Australia.

### *3.2 Uncertainty over the power of patent titles*

Uncertainty has been identified as one of the main forces inhibiting the development and commercialisation of inventions (Leifer et *al.* 2000). The ability to prevent imitation is one aspect of this overall uncertainty. However, the ability to stop imitation (i.e. 'infringement') generally requires proof that the patent should have been granted in the

first place (i.e. that the patent is 'valid'). Uncertainty over the validity of a patent is a function of the size of the inventive step since patents which are granted for very small incremental improvements over the existing state of the art make the task of distinguishing one property right from another difficult and also place a question mark over whether the improvement is a large enough increment to warrant a patent. Thus, patents which have been required to pass a higher inventive step should produce fewer titles which are more legally defensible than those from smaller inventive step regimes. Similarly, patent offices that invest in more rigorous examination and opposition processes are expected to grant clearer patent titles.

Uncertainty, however, principally lies in the enforcement process. If an infringer believes with confidence that the patent owner would not pursue them to court, or that the validity of a patent would be revoked if challenged in a court of law, then the patent owner has little power to prevent imitation. The power of the patent, therefore, is increasing in the belief that the validity of the patent will be affirmed in a court of law. The government has some discretionary power to affect firms' beliefs about the protection offered to patent owners by the legal system. For example, the presumption of validity test that is used in US courts means that if a patent granted by the United States Patent and Trademark Office ends up in court, the onus of proof is on the alleged infringer to show "clear and convincing evidence" that the patent is invalid (Quillen and Webster 2001). Since no such presumption exists in Australia, alleged infringers must satisfy a lower test (the "balance of probability") in order to demonstrate that a patent is invalid. The uncertainty over the power of patent rights to prevent expropriation is rarely found when dealing with tangible property because the boundaries around physical assets are transparent and ownership rights are granted upon proof of purchase.

Given these issues, we argue that there are two factors that affect the outcome of the patent enforcement process: the density of bad patents in the population (which is determined by the extent of Type II errors in the granting process),[11] and the prevailing view of the court's predisposition with regard to whether they would affirm the decisions

[11] Note that Type I errors do not enter into the analysis of the patent enforcement process since they have already been (unjustifiably) excluded from the patent system by this stage.

made by the patent office.[12] The relevant view in this case is with respect to the *whole* patent population, not the very small and unrepresentative number that end up going all the way to judgment.[13] The perception that the courts are predisposed to either affirm or revoke the validity of patents granted by the patent office will affect the vigour with which parties to a dispute pursue the range of legal (and quasi-legal) activities directed at resolving the dispute. The effects of these factors on the power of patents are presented in Table 2.

**Table 2: A typology for understanding the power of patent titles**

| **Proportion of bad patents** | **Court's predisposition on validity** | |
|---|---|---|
| | Revoke patent office decision | Affirm patent office decision |
| Large<br>(high Type II errors) | CERTAIN LOSS<br>Convergent expectations of loss in court for patent owner | UNCERTAIN – POOR PATENTS<br>Divergent expectations of court judgment |
| Small<br>(low Type II errors) | UNCERTAIN – SCEPTICAL COURTS<br>Divergent expectations of court judgment | CERTAIN WIN<br>Convergent expectations of win in court for patent owner |

In regimes where there is a large proportion of bad patents granted, it is expected that the quasi-legal methods used to scare away alleged infringers will not be credible. If the *perceived* predisposition of the courts is overwhelmingly to revoke patents, this will cause both parties' expectations of a court's decision to converge on a likely loss for the patent owner. In this environment, we expect a small proportion of disputes to go to court because patent owners have little chance of taking on alleged infringers to court and winning (certain loss). Juxtaposed with this is a regime with a small proportion of bad patents and where it is perceived that the courts overwhelmingly affirm patent office decisions. In this case, expectations are convergent and informal letters of warning will

[12] It does not matter whether this belief is objective or not since an irrational belief about the power of a patent may also affect firms' strategies. In Australia, some have argued that the courts have an "anti-patent" bias (see Eliades 2001), which may or may not be true, but it no doubt affects firms' beliefs about the likelihood of a patent being found invalid. For the record, recent empirical evidence suggests that patent owners that have disputes determined in court are just as likely to have a patent's validity affirmed as they are to have it revoked (see Weatherall and Jensen 2004).

[13] For more on the selection bias associated with dispute resolution, see Cooter and Rubinfeld (1989) and Priest and Klein (1984).

be more effective (since the patent's validity is assured), and legal cases will generally settle out-of-court with a very small number of cases making it to judgment (certain win). The key point to make about both of these cases is that the certainty of the environment means that few disputes regarding patent validity arise and those that do are settled quickly.

Between these cases – where the number of bad patents and the perceived court bias are countervailing forces – are environments of divergent expectations. Under uncertain – poor patents, the patent owner's major weakness is the quality of the patent which, in an environment where the courts are supportive of patent owners, generates an incentive to mask the true quality of the patent. The patent owner may do this by creating a thicket of patents, so other parties are swamped with so much complex technical documentation that they cannot separate the chaff from the wheat. Developing patent thickets is relatively easy to do in this regime since the patent examination process is cursory. The opposing case of uncertain – sceptical courts, has similar divergent expectations, but in this situation the patent owner generally has an incentive to signal the strength of the patent. In both of these cases, the uncertainty over the way the courts will judge the average patent, and thus a divergence between the parties' anticipated outcomes, results in a high proportion of disputes progressing to final judgment. Thus, the average cost of dispute resolution will be very high.

Each of these situations assumes that both parties to a dispute have equal financial resources and neither is able to force the other to settle out of court through the threat of an extended and commercially costly series of negotiations. The extent to which the legal process rewards parties which are prepared to invest heavily in the legal dispute is however a fourth policy instrument which we do not consider here.

## 4. Concluding comments

The challenge with respect to designing a socially beneficial system of property rights for intangible assets is to formulate a series of rules and parameters that can harness imprecise concepts and convert them into recognisable incentives for inventors, while minimising their incentive to obstruct inventive effort by others. In other words, we want

to design a system that provides certainty for innovative firms while attenuating the impact of unfair competition. This involves minimising both Type I and Type II errors and the cost of administration. In this article, we developed a simple framework to analyse these issues.

On the face of it, the regime involving a high inventive step, a rigorous examination procedure and courts predisposed to affirm the patent office decision involves the lowest Type I and Type II errors and the most certainty for firms. Accordingly, it maximises the incentive to inventors and innovators by giving them the best *ex ante* chance that their investment in an inventive activity will be rewarded with a patent that has a high probability of recognition by rival firms. It also minimises the unfair use of patents by firms to lock other firms out of their technology space. However, this regime may also be more expensive since it requires an expensive examination and opposition process. Counterbalancing this is the fact that this regime probably results in lower enforcement costs since it should be easier to prove infringement given the certainty over the validity of the patent right.

At the other extreme, the worst regime appears to involve a small inventive step, a cursory examination system and a court system that is predisposed to affirm patents. Such a system may be inexpensive to administer but is potentially deleterious to the incentive to invent since it heightens unfair competition by affirming numerous bad patents and results in long-running, costly legal disputes. This scenario seems to bear some resemblance to the current patent system in the United States, where some have recently expressed concerns about the effects of bad patents and unfair competition on inventive activity (see Federal Trade Commission 2003 for an overview). In a similar vein, a regime with a high inventive step, a rigorous examination process and a court system which frequently revokes patents may undermine the value of the whole patent system for genuine inventors since their patents may be easily expropriated by rival firms.

Whether it is socially beneficial to change the existing settings for the policy instruments identified here ultimately depends on estimates of behavioural responsiveness to the proposed changes. For example, how responsive is the rate of Type I and Type II errors to changes in the inventive step and increases in resources spent on the examination and

opposition process? At present, we have little empirical evidence to guide us on these issues: we do not know what the elasticity of supply of bad patents is, nor do we know whether there are diminishing returns from examination. In addition, we do not know what the prevailing view is (and its distribution) regarding the predisposition of the courts towards patents, what influences it, how this affects what patent attorneys and lawyers tell their clients and how this affects the latter's behaviour. Moreover, the effect of differential wealth between the opposing parties on dispute resolution outcomes is unknown. In future research, we intend address some of these issues by examining the incidence and effects of Type I and Type II errors in Australia.

## References


Allison, J.R., Lemley, M.A, Moore, K.A. and R.D. Trunkey (2003), 'Valuable Patents' *UC Berkeley Public Law Research Paper* No. 133.

American Intellectual Property Law Association (2003), *Report of the Economic Survey*.

Beard, R.T. and Kaserman, D.L. (2002), 'Patent Thickets, Cross-licensing and Antitrust', *The Antitrust Bulletin*, 37, 345-368.

Cooter, R.D. and Rubinfeld, D.L. (1989), 'Economic Analysis of Legal Disputes and their Resolution,' *Journal of Economic Literature* 27(3), 1067-97.

Eliades, D. (2001), 'Intellectual Property – What Went Wrong?' *Australian Intellectual Property Bulletin* 14.

Federal Trade Commission (2003), *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*, October.

Gallini, N. and Scotchmer, S. (2002), Intellectual Property: When is it the Best Incentive System? In A. Jaffe and J. Lerner and S. Stern (Eds), *Innovation Policy and the Economy, Vol 2*, MIT Press.

Heller, M.A. and Eisenberg, R.S. (1998), 'Can Patents Deter Innovation? The Anticommons in Biomedical Research', *Science* 280, 698-701.

Leifer, R., McDermott, C., O'Connor, G., Peters, L., Price, M. and Veryzer, R. (2000) *Radical Innovation,* Harvard Business School Press, Boston: Massachusetts.

Lemley, M.A. (2000), 'Rational Ignorance at the Patent Office', *UC Berkeley Law and Economics Working Paper* 2000-16.

Lemley, M.A and Shapiro, C. (2004), 'Probabilistic Patents', *Journal of Economic Perspectives* (forthcoming).

Merges, R.P. (1999), 'As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform', *Berkeley Technology Law Journal* 14, 577-615.

O'Sullivan, C. and Rolls, C. (2003), *Practical Guide to Australian Patent Law*, LawBook Company: Sydney.

Priest, G. and Klein, B. (1984), 'The Selection of Disputes for Litigation,' *Journal of Legal Studies* 13.

Quillen, C.D. Jr and Webster, O.H. (2001), 'Continuing Patent Applications and Performance of the US Patent Office', *Federal Circuit Bar Journal* 11(1), 1-21.

Quillen, C.D. Jr, Webster, O.H. and Eichmann, R. (2002), 'Continuing Patent Applications and Performance of the US Patent and Trademark Office - Extended', *Federal Circuit Bar Journal* 12(1), 35-55.

Weatherall, K.G. and Jensen, P.H. (2004), 'An Empirical Investigation into the Scope of Patent Protection in Australian Courts, 1997-2003', mimeo, Intellectual Property Research Institute of Australia, University of Melbourne.