# PATENT REFORM, INNOVATION, AND THE SCOPE OF COMPETITION POLICY

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# I. INTRODUCTION

Competition policy agencies have begun to pay more attention to innovation. This is a positive, and long overdue, development. Innovation is the engine of growth, and a more dynamic perspective in the formulation and application of competition policy is essential.[2] To date most of the attention has been on how mergers may affect the incentives for innovation of the merging, and perhaps other, parties. However, there is another important dimension – the diffusion of innovation. In the context of patented technologies, the key channels for diffusion are the licensing and sale of patents, i.e. the "market for innovation."

While competition policy has always intervened against certain types of provisions in licensing agreements, competition authorities have recently expanded their scope of operation, with interventions against, e.g. pay-for-delay settlements and failure to comply with FRAND commitments in the context of standard-essential patents. This more interventionist approach has coincided with a perceived decline in the quality of issued patents in recent decades. Perhaps it is this decline that has led competition authorities to be more skeptical of patents in general, and to try to address the patent-quality problem by curbing patent enforcement. We believe that this approach may not be the most effective, as it attacks the symptoms rather than the causes of the problem.

The need for competition policy intervention in licensing depends in part on whether private parties, such as potential licensees or third parties, have effective means for learning about, and if necessary, challenging the validity of patents. If they do, the scope for potential anti-competitive licensing behavior by patentees may be more circumscribed. Specifically, if licensees had more confidence that patents were valid and would be upheld by the courts, the market for technology would be strengthened. Uncertainty around this issue undermines licensing and thus the diffusion process. We argue that greater certainty can be achieved by a combination of patent, and perhaps also legal reforms – which affect the quality of patent screening – and which in turn can reduce the need for expansive competition policy intervention.

The patent system is perhaps the most important institution for providing innovation incentives in modern economies. Yet, academic scholars and policymakers have begun to voice concerns that patent rights may be more of an impediment, rather than an incentive, to innovation. They point to the potential for the proliferation and dispersed ownership of patents to raise the transaction costs of doing R&D, since this may require securing many separate licenses on patented technologies owned by others. The problem is exacerbated when patents held by others are of questionable validity but it is costly and risky to use the courts to challenge them. Then, as Farrell &

2 For an expression of this new direction in the U.S. Department of Justice, see various recent speeches by Makan Delrahim, Assistant Attorney General, Antitrust Division, available at https://www.justice.gov/atr/staff-profile/meet-assistant-attorney-general.

Shapiro (2008) argue, "weak patents" – those with low probability of being upheld as valid – may end up being unduly strong, creating greater opportunity for rent extraction.[3] Public policy makers and courts have weighed in on these issues, e.g. the U.S. Supreme Court in its decision in *eBay Inc. v. MercExchange*, 547 U.S. 338, 2006 and others, and the U.S. Congress in the Leahy-Smith America Invents Act of 2011 – the most significant statutory change to the U.S. patent system in half a century.

We argue that these problems arise in large part from ineffective patent office screening, granting patents to obvious inventions that do not represent a substantial "inventive step." If effective patent reform were introduced to address this "patent quality problem," it is our contention that the need for competition policy intervention would be mitigated, perhaps substantially. But before public policy embarks on major reform, it is important to know whether there really is a patent quality problem, and if so, how severe it is. Not only that, but in order to design appropriate remedial reforms, we also need to identify the source(s) of the problem. Is screening by the patent office inadequate (either because the patent office is not effective or because it is applying patentability standards that are too lax)? Is it that low quality patents, which should be challenged in court, are able to pre-empt potential challenges by strategically setting licensing royalty rates? Or is the court review system ineffective because of high costs or high error rates?

In order to investigate these issues systematically, we argue that one needs an analytical framework that encompasses the full range of patent screening institutions, including the patent office, the potential for validity challenges in the presence of strategic licensing by patent owners, and the courts. Moreover, in order to be useful for assessing counterfactual policy reforms, we need to calibrate the model so it matches observed outcomes in the real world. This is what we have developed in our recent research.[4]

## II. ILLUSTRATING THE PATENT QUALITY PROBLEM

The prevailing view is that there exists a serious patent-quality problem. One high-profile example that illustrates the problem is the Amazon "one-click" shopping patent. The year 2017 marked the expiration of Amazon's patent on a "Method and system for placing a purchase order via a communications network" (U.S. Patent 5,960,411). This patent gave Amazon the right to exclude other online retailers from using a checkout method whereby repeat customers can complete a purchase in a single click. This conferred a considerable competitive advantage: other online retailers could only offer the same convenience if they licensed the patent from Amazon for use in their business, as Apple reportedly did for its iTunes music store.

While the one-click patent created substantial value for Amazon, many observers are skeptical as to whether it ever should have been granted. To be patentable, an invention needs to satisfy novelty and non-obviousness criteria, and the one-click patent could arguably have been struck down on either account. Yet we will never know whether a court would have considered the patent valid, as its validity was never adjudicated. Shortly after the patent was granted in 1999, Amazon sued Barnes & Noble, claiming that its "Express Lane" checkout procedure infringed the one-click patent. But the two parties wound up settling the case, so that the uncertainty about the validity of the patent remained unresolved.

Amazon's one-click patent illustrates a number of important but troubling points. First, patents can be privately very valuable even though the underlying inventions are obvious, in the sense that the patent incentive would not be required to bring forth the investment to develop them. Second, the fact that a patent does not get litigated does not mean that it is not causing social costs: the one-click patent was used by Amazon to prevent competitors from improving their customers' shopping experience and/or to extract licensing revenue through royalties, presumably raising the prices of final products. Third, disputes over low-quality patents tend to settle out of court, so that their legal status often remains uncertain.

Is the Amazon patent an isolated case – an egregious but unrepresentative example – or part of a more general phenomenon? How severe is the patent-quality problem? This is a surprisingly hard question. Although studies show that about half of all litigated patents for which a final court decision on validity is made are held to be invalid, there is a matter of "selection": litigated patents are different from other patents. Patents that aren't worth fighting over won't be litigated; thus, litigated patents tend to be of higher than average value. But there is also reason to believe that patents litigated all the way to a court decision are of higher than average validity. As the example of the one-click patent suggests, and economic theory confirms, disputes involving low-quality patents are often settled. In that case, the court outcomes – half of all patents being judged invalid – would actually underestimate the extent of the problem, possibly by a large margin.

3 Joseph Farrell & Carl Shapiro (2008), "How Strong are Weak Patents," *American Economic Review*, 98: 1347-1369.

4 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2885197.

What is needed to measure the severity of the patent quality problem, and to evaluate counterfactual policy reforms, is an integrated model that encompasses all the stages from applications to and screening by the patent office, royalty setting and its consequences for the likelihood of validity challenges in the courts, and the outcome of such court reviews. Such a model would need to endogenize these various decisions and thus would, among other things, take account of the selection problems alluded to in the previous paragraph.

## III. AN ANALYTICAL FRAMEWORK

In our recent research (see footnote 4), we developed an analytical framework that allows us to address several policy-driven research questions. First, how serious is the patent quality problem? Second, if the problem is serious, what to do about it? In other words, how can we improve patent screening? Our research is an attempt to provide the first integrated analytical framework for evaluating policy reforms in the patent area.

We focus on four key policy instruments: the intensity of patent office examination, pre-grant (application) fees paid before patent examination, post-grant (issuance/renewal) fees paid by inventions that have passed the examination, and review by the courts for patents challenged by a competitor. For most of the analysis, we assume that courts are perfect in that they invalidate patents on obvious inventions with certainty. But we also show that the key theoretical results of the model, and the simulations of counterfactual policy reforms, are similar when we allow for imperfect courts.

We are able to use this framework to conduct simulations, calibrated on U.S. patent and litigation data, in order to provide estimates of the severity of the current patent-quality problem. As we pointed out above, it is hard to know how many low-quality patent applications and grants there are. First, the quality of applications is unobservable, so the grant rate does not directly tell us how good a job the patent office is doing. Second, litigated patents are highly selected and litigation outcomes are not representative of the general population. Thus, the frequency of court invalidation does not directly tell us what share of all patents is of low quality (even if courts were perfect). By putting structure on the problem and exploiting an equilibrium framework, our approach allows us to get around both of these issues.

In our model, we impose the patentability requirement that R&D costs must exceed the profits the inventor can appropriate without a patent. This corresponds to the notion that patents should be given only to those inventions that require the patent incentive to be developed, and not to those that society would have benefited from even absent a patent (this abstracts from any social gains from the disclosure requirement in patenting).[5] Of course, while this theoretical patentability criterion makes economic sense, the courts have struggled with the practical aspects of how to implement it. In our view, the statutory definition of patentability, and the various judicial standards for non-obviousness, novelty etc., reflect an attempt by the courts to do this, the basic presumption being that if an invention is obvious to those skilled in the relevant scientific arts then it is probably cheap to develop, and one does not need a patent to induce it.

In our framework, inventors hold private information about the quality (validity) of their patents. They know more (even if not perfectly) about whether an invention was obvious than their competitors and third parties, such as the patent office and the courts – whether the invention was easy to make, or whether it took years of R&D to come up with. After R&D investment, an inventor chooses whether to pay a pre-grant fee and, if subsequently approved (patent office screening is imperfect), whether to pay a post-grant fee to activate the patent (issuance and renewal fees). If the patent is activated, the inventor may choose to license the invention to the competitor, and the competitor chooses whether to challenge the validity of the patent in court. The baseline model has a perfect court that always invalidates an obvious patent and upholds a non-obvious one. In an appendix and in the simulations we also analyze a generalized version of the model in which both the patent office and the court make two-sided errors – granting/upholding an obvious patent and rejecting/invalidating a non-obvious one. Formally, our model is a signaling game in which each decision by the inventor can reveal information about the invention type, and the competitor Bayesian updates.

Our model yields three key theoretical, but policy-relevant, results. First, the equilibrium always involves a degree of randomization in patentee behavior – in particular, inventors with non-obvious inventions ("high type") always apply for patents and charge high license fees, while inventors with obvious inventions that should not be patented ("low types") either randomize between offering low and high license fees, or between applying and not applying for patents. Second, *even if the courts are mistake-free*, they cannot eliminate all bad patents. This is because of selection into litigation: in equilibrium not all low-type patents are challenged by the competitor. This result raises serious doubts about over-reliance on the court system to weed out bad patents.

5 Importantly, this perspective is in line with the rationale courts and legal scholars typically give for the non-obviousness requirement in patent law (Rebecca Eisenberg (2004), "Obvious to Whom: Evaluating Inventions from the Perspective of PHOSITA," *Berkeley Technology Law Journal*, 19(3): 885-906). For example, in the landmark case of *Graham v. John Deere*, (383 U.S. 1 (1965)) the U.S. Supreme Court stated: "The inherent problem was to develop some means of weeding out those inventions which would not be disclosed or devised but for the inducement of a patent."

Third, we show that the socially optimal structure of fees involves frontloading, i.e. relying on pre-grant rather than post-grant fees. The intuition is that the low type prefers post-grant fees to pre-grant fees more strongly than the high type because the low type has a smaller chance of passing examination. As we explain later, this is very different from the way in which patent fees are now structured.

Equipped with this theoretical framework, we calibrate the model so that the equilibrium predictions of the model match observed outcomes in the U.S. from the patent office and litigation in the courts. We simulate the calibrated model in order to assess the severity of the current problem with patent quality and screening, and to study the welfare impact of various counterfactual policy reforms. The simulations reveal some striking findings about the patent quality problem: 75 percent or more of patent applications are "low quality" in the economically relevant sense that they are made on inventions that would be developed even without patent rights (as a society, we don't want to grant patents unless they are needed to induce the innovations). Not only that, but the patent office screens out about 30 percent of these low-quality applications. As a consequence, we conclude that between 65 and 81 percent of granted patents are invalid. These findings highlight the crisis in patent screening and the need to develop effective policies to address it. Indeed, many of the problems associated with the patent system – such as patent thickets and patent assertion entities, pejoratively referred to as "patent trolls" – can be traced back to a lack of patent quality.

## IV. HOW TO FIX IT?

How do we improve patent screening? Which policy reforms could help ensure that deserving inventions receive patent protection and undeserving ones don't? Our theoretical framework emphasizes the importance of integrated thinking which captures the linkages between the different parts of the system: patent office screening, licensing, and validity challenges in the courts. In recent years, reform efforts have focused mainly on the courts. For example, the Leahy-Smith America Invents Act ("AIA") of 2011 and recent Supreme Court decisions have implemented a variety of measures to make it harder to enforce low-quality patents.

We think that this focus on the courts to limit the patent quality problem is misplaced, and that renewed emphasis should be put on patenting fees and patent office examination. The reason is that screening of patent validity by the courts must be initiated by someone. Usually, the only one in position to do so is the (alleged) infringer, who counters an infringement suit by challenging the validity of the asserted patent. Often the infringer has no incentive to challenge at all: given the enormous costs of patent litigation, only high-value patents will be worth fighting over. That low-value patents will usually not be challenged does not mean they don't cause damage, however: our research suggests that only the 10 percent most valuable patents are potentially worth challenging, due to the costs of litigation. Would-be infringers are better off taking a license, resulting in higher prices for consumers.

Even when a patent is sufficiently valuable, the alleged infringer's incentives to challenge typically aren't aligned with society's interests. First, the holder of a high-value, but low-quality, patent sometimes simply pre-empts challenges. This can be achieved by offering a license fee that leaves the infringer better off accepting the patent license rather than incurring the cost of going to court, even if the infringer is reasonably sure of winning at trial. (Such a strategy is said to be followed by many patent assertion entities.) But it is precisely in such a case, where the patentee reveals himself as having a low-quality patent by charging this "challenge pre-empting licensing fee," that society would want a challenge to be brought.

Second, even if this challenge pre-emption licensing strategy is not adopted by the patent holder, the infringer is uncertain about the prospects of winning at trial and – from society's point of view – may challenge either too little or too much. The conventional wisdom is that there are too few patent challenges, due to the "free-rider" problem: when there are many potential licensees, all of them would benefit from the patent being invalidated but each of them would prefer somebody else bear the cost of the challenge. This is the view emphasized by Joe Farrell & Carl Shapiro, among other leading antitrust scholars, and it has gained wide acceptance.

Yet our research shows that this view is too narrow, and that the market can also generate socially excessive patent challenges. The argument is easiest to see in the case where there is a single potential licensee, so that free-riding concerns are absent. The incentive to challenge (whether private or social) is determined by a comparison between the gains from the patent being invalidated and the costs of the challenge. For the licensee, the gain consists in eliminating the competitive advantage the patent confers on its holder; the cost consists in its own litigation expenses. For society, the gain consists in eliminating distortion due to higher prices from patents (deadweight loss); the cost consists of the sum of litigation expenses for both parties – the licensee and the patent holder. Economics suggests that the competitive advantage typically exceeds the deadweight loss. Thus, in this case the private incentive to challenge exceeds the social incentive.

The ambiguous nature of the comparison between social and private incentives to challenge makes it hard to design appropriate policies targeting litigation. At its core, the problem stems from the fact that challenges must be initiated by a potential licensee, who acts strategically, and whose incentives in general aren't aligned with society's interests. By contrast, patent office examination has the advantage of screening all applications. Low quality patents that are screened out by the patent office do not impose costs on society. They lead to neither royalties that inflate price, nor costly litigation. In our counterfactual policy experiments using the simulated model, we find that ramping up the rigor of examination from 30 percent to 50 percent would generate a sizeable increase in the welfare benefits from innovation. In our view these are strong arguments for focusing reform efforts on improving patent examination.

The counter argument is that improving examination would be expensive. The USPTO received almost 600,000 patent applications in 2015. Tighter examination would mean spending more time on each of them, which would require hiring more examiners. However, there is a way to finance tighter examination that wouldn't cost taxpayers a cent, and also wouldn't undermine high-quality applicants. Currently patent office fees are relatively low and largely back-loaded: the bulk of them is due after the patent is granted. A typical U.S. patent costs the applicant $1,740 in pre-grant fees and – if renewed to full term – about $13,560 in post-grant fees. Decreasing post-grant fees while simultaneously increasing pre-grant fees would disproportionately hit low-quality applicants. This is because low-quality applicants have a lower probability of passing examination; thus, many of them never pay the post-grant fees. Frontloading fees – shifting fees forward from post-grant to pre-grant – would thus raise more money from low-quality applicants. At the same time, it could be done in such a way as to keep the expected total fee payments for high-quality applicants constant.

This argument of course relies on low-quality applicants continuing to file applications, in spite of higher expected fee payments. But in some sense, this is a worst-case scenario: if low-quality applicants instead drop out, even better – we have made screening more effective without spending more on examination!

What is more, improving examination may not have to involve hiring lots of new examiners. Some of it could be achieved through better databases and improvements in the patent office's IT systems. Economics also suggests that improved performance could be achieved by putting in place better incentives for patent examiners, e.g. by tying bonuses to the quality of examination (not just quantity, as is the case now) through random review of their decisions. Improvement may also need to involve developing stricter patentability standards, which would require actions by the Congress and/or the courts.

The table below summarizes the simulated welfare effects of three counterfactual policy reforms: (1) frontloading fees and using the extra fee revenue generated to intensify patent examination (so the reform is revenue-neutral); (2) the introduction of a post-grant review within the patent office, such as the Patent Trials and Appeals Board ("PTAB") instituted by the AIA; and (3) moving to a registration system without any substantive patent examination.

The first and second columns show the results under the assumption that courts are perfect. Frontloading would lead to a substantial welfare gain of close to 2 percent. Post-grant review, which involves replacing courts with a substantially cheaper, but also less accurate challenge procedure, generates even greater welfare gains. By contrast, a registration system would be associated with major welfare losses. The table also shows the percentage of invalid patent holders that pre-empt challenges by charging low royalties. Importantly, there is no correlation between such "trolling" and the size (or sign) of welfare changes. Thus, focusing reform efforts on reducing trolling would seem to be misguided.

The third and fourth columns show the results under the assumption that courts are only slightly better than the patent office at distinguishing valid from invalid patents. The results are qualitatively similar in this more realistic scenario. The effects of all patent reforms considered are actually even larger in size than under perfect courts. Of course, one can envision other ways to model the post-grant review under the PTAB – e.g. the quality of the review could be changed to be more like the courts (here it is modelled as equivalent to the initial patent office review). But the analytical framework we develop can easily be used to evaluate the impacts of such alternatives.

Simulations of Counterfactual Policy Reforms

| | Perfect Courts | | Low quality courts | |
|---|---|---|---|---|
| | % Welfare Gain | Prob. of "trolling" | % Welfare Gain | Prob. of "trolling" |
| **Policy Reform** | | | | |
| **Status quo** | --- | 0.85 | --- | 0.65 |
| **Frontload fees** | 1.90 | 0.76 | 3.89 | 0.34 |
| **Post-grant review** | 3.66 | 0.9 | 6.24 | 0.92 |
| **Pure registration system** | -3.10 | 0.86 | -4.2 | 0.77 |

Note: Welfare change is relative to the case of no invention. Prob. of trolling is the probability that a low type (invalid patent) charges a royalty rate to pre-empt a validity challenge.

## V. CONCLUDING REMARKS

Our paper develops a framework to examine how governments can improve the quality of patent screening, incorporating four policy instruments: patent office examination, pre- and post-grant fees, and challenges in the courts. Perhaps the most important message to emerge from the theoretical analysis is that patent office fees should be frontloaded, and that we should not overly rely on the court system to screen patents *ex-post*. Even if courts are mistake-free, they cannot eliminate all bad patents that are issued because, in equilibrium, not all such patents are challenged. The calibrated simulations of the model indicate that the patent quality problem is real: the vast majority of patent applications are on inventions that would be developed even without patent protection, and only about 30 percent of these are effectively screened out by the patent office.

But all is not lost. Our simulations of counterfactual policy reforms highlight some feasible changes that will improve welfare: most importantly, intensifying patent office examination, front-loading patent fees, and introducing post-grant review (or reducing litigation costs by other means).

Finally, we believe that the framework developed in this paper can also be used to study the welfare impacts of legal reforms that may help in improving patent quality and screening, such as adopting the "loser pays rule" for litigation costs, changing the presumption of validity used by courts, and patent litigation insurance, all of which have featured prominently in the public debate.

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