

The Value of the Standard

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Introduction

- SSOs often encourage or require members to license their SEPs on FRAND terms, but SSO themselves do not set the amount of a FRAND royalty.
- In some recent cases in the U.S. and elsewhere, courts have had to determine the amount of a FRAND royalty.
- In doing so, they have articulated various principles, including:
 - (1) A FRAND royalty should reflect the incremental ex ante value of the technology in comparison with alternatives.
 - (2) The royalty should be proportionate to the technology's importance to users of the standard.
 - (3) The royalty should not reflect "any value added by the standardization of that technology," that is, "by the standard's adoption of the patented technology" — or, as another court puts it simply, the "value of the standard."
 - (4) The royalty should prevent SEP owners from exercising patent "holdup."
 - (5) The royalty should be adequate to preserve the patent incentive (the "incentive to invent" principle).
 - (6) The royalty should provide an adequate incentive to participate in the standard setting process (the "incentive to participate" principle).
 - (7) Courts should minimize the risk of "royalty stacking."
- What do these principles mean? Are they mutually consistent and coherent?

Introduction

- We argue that each of these principles has its appropriate place in determining FRAND royalties, as long as one understands what each principle is intended to achieve and how it relates to the other principles;
- The key lies in focusing on principle (3)'s reference to the “value of the standard.”
- Courts and others have used terms such as “value of the standard” in reference to three distinct phenomena, which we refer to as “sunk costs holdup,” “standard value appropriation,” and the “apportionment problem.”
- Distinguishing among the three enables us to reconcile the seven principles (with some modifications) and promises a unified framework for calculating FRAND royalties.
 - Sunk costs holdup:
 - An injunction would enable the patentee to extract some of the user's sunk costs/ switching costs.
 - Standard value appropriation:
 - An injunction would enable the patentee to extract a higher royalty ex post than ex ante, due to network effects.
 - The apportionment problem:
 - Because each patent is essential to the standard, an injunction might enable the owner of any one patent to capture the full value of the standard from a user, even if the patent at issue adds only a small part of the value of the standard.

Table 1

	Transaction-specific investment by users	Network effects	More than one patent
Sunk costs holdup	Y	N	N
Standard value appropriation	N	Y	N
Apportionment	N	Y	Y

Thesis

- Sunk costs holdup has adverse effects on both user and inventor behavior.
 - Address by use of an ex ante hypothetical negotiation framework, in which the parties are assumed to bargain before any sunk costs are incurred.
- Standard value appropriation does not have any adverse effects on either user or patentee behavior, other than those that are inherent in the patent system generally.
 - Consequently, standard value appropriation is not a concern that should be addressed in determining FRAND royalties.
- To better align the SEP owner's reward with the social value of the invention—including some portion of the network effects (if any) arising from standardization—the ideal theoretical approach is a “contingent ex ante” framework.
 - More consistent with the “incentive-to-invent” and “incentive-to-participate” principles, while also precluding damages awards based on sunk costs.
- Improper apportionment has adverse effects on patentee behavior by potentially overcompensating minor inventions and contributing to royalty stacking.
 - Address by “ex post Shapley pricing,” which satisfies both the proportionality principle and the “avoid royalty stacking” principle.
- Like most idealized models, our proposal will be impossible to implement in practice.
 - Nonetheless useful as a conceptual benchmark for assessing the merits of more practical methodologies and comparators, which should serve as proxies for the theoretical ideal.

Sunk Costs Holdup and Standard Value Appropriation

- Sunk costs holdup is not limited to standards or even patents.
 - May arise whenever a transaction is subject to “durable investments in transaction specific human or physical assets” made by at least one party.
 - If the rights of the party who has made asset-specific investments are not fully defined prior to those investments being made (“ex ante”), that party may be subject to having the terms of the transaction (re-)negotiated in a way that allows the counter-party to capture some part of the value of the sunk costs.
- Standard value appropriation, by contrast, depends on network effects.
 - The value a user derives from consumption of a good increases with the number of other agents consuming the good.
 - Prior to standardization, no single patentee acting independently can capture any part of the value derived from standardization, because the users would simply coordinate on a different technology.
 - After standardization, the same patentee might be able to extract the full value added by standardization (“standard value appropriation”), because any individual user would have to move to a less valuable non-standard technology to avoid infringement.
- Sunk costs holdup and standard value appropriation may occur together, because adoption of a standard requires or invites technology-specific investments.
- And both enable patent owner to charge more ex post than ex ante.
- *But* they are distinct phenomena, with distinct implications.

An Example

- Consider a stylized WiFi technology. In Scenario 1, there are 10 firms that have developed and patented WiFi technology, A, B, . . . I, J, all of which are equally good.
- Each of the ten technologies has been adopted by 100 users who use it in isolated networks.
- Each user would be willing to pay up to \$10 annually for a license to the patented technology it has adopted.
- If patentees and users have equal bargaining power, each user licenses the technology from its respective patentee for \$5 annually, and each patentee receives \$500.
 - We'll make the assumption of equal bargaining power throughout, but nothing hangs on this assumption.
 - Whatever the parties' relevant bargaining power is, it is.
- Total consumer surplus is \$5,000, and total royalty income received by all the patentees is \$5,000.
- Total social value of WiFi in the fragmented market is \$10,000.
- Each of the 1,000 users would be willing to pay \$100 annually, however, for exactly the same technology they are currently using if all other users were also using the same technology.
- An SSO is set up and solves the coordination problem by choosing technology A, which is then adopted by all users.
- The total annual social value of WiFi technology is now \$100,000.
- If Patentee A, whose technology was adopted as the standard, were able to obtain an injunction against any party using the standard, A would be able to extract up to \$100 from each user.
- If the parties have the same bargaining power as in the fragmented market, A would be able to license the same technology to each user for \$50 annually, even though it was only able to charge \$5 to its users before standardization.
- If the patentee is entitled to recover the value of the invention, but not the value of standardization, what does this mean?

An Example

- If the patentee is entitled to recover the value of the invention, but not the value of standardization, what does this mean?
- Value of standardization = \$90K increase in social value (\$100K post-standardization vs. \$10K pre-standardization).
- Value of the invention:
 - \$500 that Patentee A was receiving pre-standardization?
 - \$1,000 pre-standardization consumer surplus?
 - The \$5,000 that all patentees would have earned pre-standardization?
 - The \$10,000 social value pre-standardization?
- Swanson & Baumol (2005) propose a model under which patentees would compete, ex ante, for inclusion in the standard by submitting bids to downstream users.
 - Royalty = incremental value over the next-best alternative that is available ex ante.
 - Here, that would be \$0.
- Now consider Scenario 2, in which initially there is no WiFi at all.
 - Firm A develops and patents the same technology A, but no other firm develops a competing technology.
 - As in Scenario 1, each user is willing to pay up to \$100.
 - With equal bargaining power, each user would pay \$50 and the patentee would earn \$50,000.
 - We wouldn't say there is anything wrong with this . . .
- Why the difference?
- Notice that, under the Swanson & Baumol model, in Scenario 2 Firm A would be entitled to \$100,000.

Critique of the Auction Model

- Swanson & Baumol identify both sunk costs holdup and standard value appropriation as creating ex post market power.
- In response, they propose the ex ante incremental (auction) model.
 - FRAND royalty = result of this ex ante auction.
- This does eliminate sunk costs holdup . . .
- But whether the patentee captures all or part of the value of standardization depends on the nature of ex ante competition.
 - In our Scenario 1, the “winning” patentee receives a \$0 royalty.
 - In Scenario 2, the winning patentee receives \$10,000.
- More importantly, the auction model has negative consequences from the standpoint of dynamic efficiency.

Sunk costs holdup

- Swanson and Baumol are right to condemn sunk costs holdup, because sunk costs holdup has negative static efficiency implications (though standard value appropriation does not have any such implications, beyond the marginal cost pricing that is inherent to the patent system).
 - Ex post, a patentee armed with an injunction can extract some portions of the user's sunk costs in addition to whatever cost saving or profit increase results from use of the invention in comparison with the best alternative.
 - The result is that a course of conduct in which sunk costs holdup is a possibility is riskier than one that is not.
 - At the margin, a user may avoid using the best technology.
 - To illustrate, suppose that ex ante U expects to earn \$100 in revenue if it invests \$80 in technology A (resulting in a \$20 profit), and a \$15 profit it uses public domain technology B
 - Ex ante, the incremental value over B is \$5, and U would agree to pay up to \$5 to use A.
 - If U were enjoined ex post from using A, A could either shut down (payoff = -\$80), switch to technology B (payoff = $-80 + 15 = -65$), or pay royalty r and earn \$100 in revenue (payoff = $20 - r$).
 - Ex post, U will agree to pay any $r \leq \$85$. At a royalty of $r = -\$85$, U's payoff is $-\$65$.
 - Knowing in advance that there is some probability p that the use of A will infringe some valid patent of which U is not aware, U will choose B, the less efficient public domain technology, unless $-65p + 20(1-p) > 15$, that is unless $p < .0588$.
- Sunk costs holdup also has negative dynamic efficiency consequences, because if the patentee can extract some part of the user's sunk costs, in addition to the cost saving or profit increase provided by the patented technology, the incentive to invent will be greater than the cost saving or profit advantage provided by the invention, and the patent incentive will be too great.

Dynamic efficiency and standard value appropriation

- On the other hand, the auction model has negative dynamic efficiency consequences, because it results in a \$0 royalty whenever two or patented inventions of equal effectiveness compete against each other ex ante.
- More generally, under the auction model the patentee receives a portion of the value of the standard depending on the nature of ex ante competition with other technologies.
 - Could be zero, as in Scenario 1.
 - This is correct when, ex ante, the patent competes against an equally effective (or more effective) public domain technology.
 - But when the patent competes ex ante against another equally effective patented technology, the auction model's zero royalty result may be insufficient from a dynamic efficiency perspective.
 - Could be the full social value where there is no ex ante competition.
 - Arguably excessive.
 - Contrary to the legal standard which assumes negotiation between a willing licensor and licensee, not an award of the entire social value of the invention.

The Contingent Ex Ante Approach

- We argue in a companion paper that the ideal framework for awarding royalties generally, and FRAND royalties in particular, is a “contingent ex ante” approach.
- The hypothetical bargain the parties would have struck ex ante . . .
 - This avoids sunk costs holdup.
- With knowledge of all relevant information that comes to light ex post.
 - This enables an award that is commensurate with the social value of the invention as revealed ex post.
 - May be higher or lower than the parties would have expected on the basis of ex ante information.
- In the SSO context, the simplest way to understand our approach is to imagine a 3-step process:
 - First, the SSO decides on the standard, including the patented technologies to be incorporated into the standard.
 - Second, the SSO negotiates a royalty for the standard with the users before the users have invested any sunk costs in reliance on the standard. In the negotiation process, the users do not have the option of adopting another standard incorporating different patented technology, but if a standard can be adopted with unpatented technology, that option can be taken into account.
 - Third, after the royalty is negotiated, the SSO divides the royalty among the successful patentees . . .

An Example

- Recall Scenario 1:
 - There are 10 firms that have developed and patented WiFi technology, A, B, . . . I, J, all of which are equally good.
 - Ex ante, each user would be willing to pay up to \$10 annually for a license to the unstandardized patented technology.
 - Ex ante, each user would be willing to pay \$100 annually for a standardized technology.
 - An SSO is set up and solves the coordination problem by choosing technology A.
 - Total annual social value of WiFi technology is \$100,000.
 - With equal bargaining power, the royalty will be \$50.
 - This reflects some portion of the value of the standard, but not sunk costs.
- Notice that:
 - The contingent ex ante model better aligns the patentee's reward with social value (while not equating it with social value), in contrast to the Swanson & Baumol incremental ex ante model, which may provide an insufficient incentive to invent and to participate in the standard-setting process.
 - A FRAND royalty is treated the same as any other reasonable royalty.

Dividing the Royalty Among the Patentees

- In our three-step approach, the user is assumed to bargain with the SSO for the right to use the standard.
- Since the user values the standard as a whole rather than the individual patents, this step is the same whether the standard requires one patent or many.
- This in itself eliminates the problem of royalty stacking, both in terms of Cournot complements and in the less general sense of excessive royalties arising from multiple licenses.
- Under the contingent ex ante approach, the patentees jointly will receive, and the user will pay, exactly the same amount as if the standard was implemented by a single technology held by a single patentee.
- Ideally, though, the division of royalties also should reflect the proportionality principle (more important technologies receive a higher royalty than less important ones).
- Our proposal involves “ex post Shapley pricing.”

Shapley Pricing

- As described by Layne-Farrar et al. (2007), the Shapley value in the standard setting context can be thought of as the outcome of a process in which:
 - “the patent owners arrive at the SSO in random order each with her patent in her pocket, with all possible arrival sequences equally likely. Now suppose that in each sequence, each patent owner receives the amount by which her patent increases the value of the best standard that can be built from the patents that are already at the SSO when she arrives. That is, if the set of patents S is at the SSO when patent j arrives, j 's owner receives the incremental value $v(SU_j) - v(S)$. The Shapley value gives j the average of such contributions over all possible arrival sequences – each patent thus receives the average (over arrival sequences) of its marginal contribution.”
- Thus, in Scenario 1, each of the ten patentees with equally good Wi-Fi technology would be entitled to one tenth of the value of the standard, or \$5 per user.
- The intuition is that if A were the first technology to arrive and was therefore selected as the standard, it would then be able to extract a royalty of \$50 from each user.
- If B arrived next, it would add nothing to the value of the standard, since A and B are purely alternatives, so it would receive zero, as would all the others except A.
- But if B happened to arrive first, it would receive \$50, and A would receive nothing, as would all the others except B.
- The average over these scenarios is the Shapley value.
- Problem: Shapley pricing would award a royalty to all patentees whose technology *might* have been included in the standard, but in reality the patent system does not (and cannot) work this way.
- Our solution: ex post Shapley pricing.
- That is, applying Shapley pricing to all patentees whose technology actually *was* selected to implement the standard.

Shapley Pricing

- Example:
 - Suppose that the standard consists of two strictly complementary functionalities, A and B.
 - Assume further that there is perfect competition ex ante for both components.
 - I.e., there are multiple patented technologies A1, A2, etc., which could provide functionality A, and multiple patented technologies B1, B2, etc., which could provide functionality B.
 - Two of these, A1 and B1, are selected by the SSO to be part of the standard.
 - Each user is willing to pay \$200 for the operational standard, and with equal bargaining power each pays \$100.
 - If A1 arrives first, the standard is not operational and no user will be willing to pay anything.
 - If B1 then arrives, a functional standard can be implemented and the value to be split between the patentees is \$100.
 - A1's marginal contribution is zero, and B1's marginal contribution is \$100.
 - But if B1 arrives first, the results will be exactly the opposite.
 - Therefore, the two patentees will share the available royalties equally.

Shapley Pricing

- Alternatively, consider a standard in which the patents are not strictly complementary.
 - For example, suppose that technology A is required for the basic transmission function, while technology B provides advanced security.
 - The standard can be implemented using technology A alone, but B is useless without A.
 - Each user would be willing to pay \$100 for the standard implemented with technology A alone, and \$120 for the standard with the additional security provided by technology B.
 - By the same methodology, the royalties would be \$110 to A1 and \$10 to B1.
 - The intuition is that A1 is entitled to more than \$100 because it supplies all of the value derived from the transmission function alone (\$100), and some of the value derived from the security function, which is worthless without the transmission function.
- In principle ex post Shapley pricing can easily be extended to any combination of patents.
- Consistent with the proportionality principle.

Implications

- Comparable licenses that may be probative of the appropriate royalty rate for the technology at issue would include licenses negotiated against the backdrop of nonpatented alternative technologies.
- Comparable licenses that are less likely to be probative would include licenses entered into ex post under the threat of an injunction.
- A “top down” approach modified from the one employed by Judge Holderman in *Innovatio* may be a reasonable method for estimating the value of the technology, because it would accord greater weight to the more significant patents and it would consider the ex post value of the component that embodies the technology.
- Courts should take into account the need to avoid royalty stacking, at least as a “sanity check” on the amount of royalties actually awarded.
- Allowing the patent owner to recover some of the value of the standard is not necessarily wrong, but the patent owner should not recover a disproportionate share of the value of the standard.
- Others?