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**INTELLECTUAL PROPERTY AND STANDARD SETTING**

-- Note by Anne Layne-Farrar (Charles River Associates, United States) --

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*This paper by Anne Layne-Farrar (Vice-President, Antitrust & Competition Economics Practice, Charles River Associates, United States) was submitted as background material for Item VII of the 122nd meeting of the OECD Competition Committee on 17-18 December 2014.*

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## **PATENT HOLDUP AND ROYALTY STACKING THEORY AND EVIDENCE: WHERE DO WE STAND AFTER 15 YEARS OF HISTORY?**

*Note by Dr. Anne Layne-Farrar<sup>1</sup>*

1. The debate over the related concepts of patent holdup and royalty stacking in standard setting contexts is nearing its 15<sup>th</sup> anniversary, having started in the early years of the new millennium. And there is still no resolution. The debate is even older if we include the holdup and license stacking debate in biotech from the 1990s that laid the ground work for the standards' branch of the arguments.<sup>2</sup> After this many years of discussion, where do we stand in terms of understanding the theory and supporting that theory with empirical evidence? Certainly the theories have been developed, but the empirical support is still lacking. Despite the 15 years proponents of the theories have had to amass evidence, the empirical studies conducted thus far have not shown that holdup or royalty stacking is a common problem in practice, as I explain in this note.

### **1. The Theory: Holdup**

2. Let us first review the theory. As a general economic theory, holdup is a well-known idea in the economics literature on traditional physical product investments and contracting.<sup>3</sup> The basic concept is the exploitation of "lock-in" to charge a price higher than the value of the good conveyed; a price that also captures at least some of the buyer's costs of moving to an alternative.

3. Holdup requires two conditions. First, investments must be asset specific and thus difficult to shift to other opportunities once made. Second, the party that has contracted to buy the goods must take advantage of the opportunity for holdup by exploiting the seller's switching costs. In short, both opportunity and action must be established. The same two conditions hold when the theory is applied to patent licensing.<sup>4</sup> In standard setting, technology selection – done during the development phase, when more than one technical option often competes for defining a given component – is typically separated in time from license negotiations – often concluded after the standard has been defined and standard implementers are locked into given technologies to comply with the standard. As a result, co-operative standard setting can offer opportunities for holdup as licensing takes place after both technology investments have been made and product commercialisation has begun.

4. In order to ensure the availability of key patents for standard implementers, most standard setting organisations (SSOs) established guidelines for handling intellectual property rights (IPRs) fairly early.<sup>5</sup>

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1. Vice President, CRA

2 Geradin, Damien, Anne Layne-Farrar, and A. Jorge Padilla. "The Complements Problem within Standard Setting; Assessing the Evidence on Royalty Stacking." *BUJ Sci. & Tech. L.* 14 (2008): 144.

3 Williamson, Oliver E. "Credible commitments: Using hostages to support exchange." *American Economic Review* (1983): 519-540.

4 Kieff, F. Scott, and Anne Layne-Farrar. "Incentive Effects from Different Approaches to Holdup Mitigation Surrounding Patent Remedies and Standard-Setting Organizations." *Journal of Competition Law and Economics* (2013).

5 Layne-Farrar, Anne. "Proactive or Reactive: An Empirical Assessment of IPR Policy Revisions in the Wake of Antitrust Actions." *The Antitrust Bulletin* 59 (2014): 373.

Indeed, by the 1990s most of the key global SSOs had established rules both for the disclosure of patents covering technologies that could be essential for the practice of the standard (so-called standard essential patents, or SEPs) and for the fair, reasonable and non-discriminatory (FRAND) licensing of patents that turn out to be actually essential for the practice of the standard. Nevertheless, in the early 2000s academic debate began to express concerns that FRAND commitments to SSOs might not have enough teeth to prevent patent holdup.<sup>6</sup> The issues considered have been many, but the main points relevant for the discussion here are that i) “fair and reasonable” are rather ambiguous words that SEP holders could easily promise but not meet and that ii) other legal remedies (namely, injunctions for patent infringement) could provide SEP holders with leverage to holdup licensees implementing the standard.<sup>7</sup> These theoretical propositions have received little empirical attention, as discussed below after royalty stacking.

## 2. The Theory: Royalty Stacking

5. Royalty stacking is related to holdup, but considers the aggregate licensing “stack” that an implementer must pay for the full set of complementary SEPs underlying a standard, rather than considering just one license in isolation. The economic concept underlying the royalty stacking theory for the licensing of patents essential for the practice of standards is Cournot’s complements problem, which dates back to a physical goods pricing theory developed by Augustin Cournot in 1838.<sup>8</sup> Cournot observed that when inputs to a downstream good are complementary to one another, but are controlled by separate and independent entities, each input will be priced without regard to the other. This results in the downstream manufacturer facing higher input prices which can then lead the end good to be priced even higher than the monopoly rate charged by an entity controlling all inputs.

6. The complements theory offers an exploration of firm boundaries: what drives firms to vertically integrate and how is product pricing affected by such decisions? The example that Cournot focused on was the production of brass. Copper and zinc are inputs that must be combined in fixed proportions to make brass, but both copper and zinc have other uses and hence their suppliers are unlikely to co-ordinate their pricing for use in brass production. Put differently, each input supplier will unilaterally charge a profit margin (referred to as double marginalisation), ignoring the impact on complementary input suppliers. Were the brass maker to integrate upstream into copper and zinc, however, double marginalisation would be eliminated and the unilateral, uncoordinated prices would be replaced with lower internal transfer prices enabling the brass maker to achieve the monopoly profit for brass production.

7. As patented technologies are inputs to products and services just like physical metals are, and considering the potential for patent holdup that might accumulate across SEP licensors, the conditions would seem ripe to apply Cournot’s complements theory to patent licensing. And indeed, starting in the 1990s the academic literature began applying the complements theory to intellectual property inputs. The concerns raised in the literature initially revolved around biomedical and biotech research, areas heavily reliant on cumulative and sequential innovation. For instance, Kiley (1992) worried that “dense thickets of patents” were “stunting” the development of biomed/biotech products and services.<sup>9</sup> Later that same

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<sup>6</sup> Swanson, Daniel G., and William J. Baumol. "Reasonable and Nondiscriminatory (RAND) Royalties, Standards Selection, and Control of Market Power." *Antitrust Law Journal* (2005): 1-58; see also Lemley, Mark A., and Carl Shapiro. "Patent Holdup and Royalty Stacking." *Tex. L. Rev.* 85 (2006): 1991.

<sup>7</sup> On the former, see Layne-Farrar, Anne, A. Jorge Padilla, and Richard Schmalensee. "Pricing Patents for Licensing in Standard-Setting Organizations: Making Sense of FRAND Commitments." *Antitrust Law Journal* (2007): 671-706. On the latter, see, e.g. Shapiro, Carl. "Injunctions, Hold-Up, and Patent Royalties." *American Law and Economics Review* (2010).

<sup>8</sup> Cournot, Antoine Augustin, and Irving Fisher. "Researches into the Mathematical Principles of the Theory of Wealth." Macmillan Co. (1897).

<sup>9</sup> Kiley, Thomas D. "Patents on Random Complementary DNA Fragments?." *Science* (1992): 915-918.

decade, Michael Heller developed the anti-commons theory, positing that when intellectual property rights (IPRs) are highly fragmented – that is, held by numerous distinct parties – the transaction costs involved in co-operating can reduce innovation and development.<sup>10</sup> Refining those arguments and applying them to biomed research, Heller and Eisenberg (1998) worried that there were “too many upstream patent owners to stack licenses on top of the future discoveries of downstream users.”<sup>11</sup> Such a stack, it was reasoned, could grind all innovative developments to a halt.

8. From the biomed theories of research patent stacks and thickets, it was a short hop to royalty stacking in standard setting. Modern interoperability standards involve far more than the two complementary inputs of brass production, and patent counts are likely to eclipse even biomed given that standards often have thousands of patented technologies reading on the standard components. As a result, Shapiro (2001) concluded that “[t]he need to navigate the patent thicket and holdup is especially pronounced in industries such as telecommunications and computing in which formal standard-setting is a core part of bringing new technologies to market.”<sup>12</sup> The key question to ask is whether the theory is validated by the facts and whether there are antitrust issues attached, which I turn to below after reviewing agency and court treatment of both holdup and stacking.

### 3. Competition Agencies and the Courts: More Theory

9. Taking their cue from the debates in academia and in policy spheres, manufacturers implementing standards moved patent holdup and royalty stacking arguments into court filings, complaints at competition agencies, and proposals to change standard setting rules.<sup>13</sup> Thus, beginning in the mid-2000s and continuing through today, there have been several private lawsuits filed on breach of FRAND claims, in Europe<sup>14</sup> and in the US.<sup>15</sup> In addition, several competition agencies have weighed in either directly or indirectly via merger approvals, including the European Commission (EC),<sup>16</sup> the US Federal Trade Commission (FTC),<sup>17</sup> and China’s MOFCOM and NDRC agencies,<sup>18</sup> among others.

<sup>10</sup> Heller, Michael A., “The Tragedy of the Anticommons: Property in the Transition from Marx to Markets.” *Harvard Law Review*, Vol. 111, No. 3 (Jan., 1998), pp. 621-688.

<sup>11</sup> Heller, Michael A., and Rebecca S. Eisenberg. “Can Patents Deter Innovation? The Anticommons in Biomedical Research.” *Science* (1998): 698-701.

<sup>12</sup> Shapiro, Carl. “Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting.” *Innovation Policy and the Economy*, Volume 1. MIT Press (2001): 119-150.

<sup>13</sup> See, e.g. [http://www.itu.int/net/pressoffice/press\\_releases/2012/45.aspx](http://www.itu.int/net/pressoffice/press_releases/2012/45.aspx).

<sup>14</sup> Evans, Jonny. “Samsung Ends FRAND Litigation Against Apple in Europe – is Peace Near?” *Computer World* (2012), available at: <http://www.computerworld.com/article/2473872/smartphones/samsung-ends-frand-litigation-against-apple-in-europe---is-peace-near-.html>. See also “Ericsson v. TCT Mobile (standard essential patents; injunction)” *EPLaw Patent Blog* (2014), available at: <http://www.eplawpatentblog.com/eplaw/2014/02/fr-ericsson-v-tct-mobile-standard-essential-patents-injunction.html>.

<sup>15</sup> *Microsoft Corp. v. Motorola, Inc.*, 696 F.3d 872 (9th Cir. 2012); *Apple Inc. v. Samsung Electronics Co., Ltd.*, 888 F. Supp. 2d 976 (N.D. Cal. 2012); *Realtek Semiconductor Corp. v. LSI Corp.*, 946 F. Supp. 2d 998 (N.D. Cal. 2013).

<sup>16</sup> European Commission. “Standard-essential Patents” *Competition Policy Brief Issue 8* (2014), available at: [http://ec.europa.eu/competition/publications/cpb/2014/008\\_en.pdf](http://ec.europa.eu/competition/publications/cpb/2014/008_en.pdf).

<sup>17</sup> Federal Trade Commission. “FTC Approves Final Order Settling Competition Charges against Robert Bosch GmbH.” *Press Release* (2013), available at: <http://www.ftc.gov/news-events/press-releases/2013/04/ftc-approves-final-order-settling-competition-charges-against>. See also Federal Trade Commission. “FTC Issues Final Opinion and Order in Rambus Matter.” *Press Release* (2007), available at: <http://www.ftc.gov/news-events/press-releases/2007/02/ftc-issues-final-opinion-and-order-rambus-matter>. See also Federal Trade Commission. “FTC Finalizes Settlement in Google Motorola Mobility Case.” *Press Release* (2013), available at: <http://www.ftc.gov/news-events/press-releases/2013/07/ftc-finalizes-settlement-google-motorola-mobility-case>.

10. To date, the analysis presented in either court cases or before agencies has been largely theoretical, with little empirical basis. This is troubling, given the long history of the debate as summarised above. Instead of pointing to solid evidence of market failure or persistent and widespread problems, there has been a tendency to focus on one or two examples of abuse to support broad sectoral regulation – with little to no attention given to potential adverse impacts. For example, the *In Re Innovatio* case in U.S. district court is highly fact specific and should not be used as a benchmark for ecosystem reform.<sup>19</sup> As another example, in its *Motorola* and *Samsung* decisions the EC relied simply on the argument that anticompetitive distortions *can* result by SEP holders seeking injunctions, explaining in its FAQs as follows:

*Today's action by the Commission clarifies that it is anti-competitive to use injunctions in relation to SEPs in the following circumstances: when in a standardisation context, a SEP holder has committed to license the SEP on FRAND terms and the licensee is willing to take a licence on such terms. In these circumstances, the seeking of injunctions can distort licensing negotiations and lead to licensing terms with a negative impact on consumer choice and prices.*

11. Taking these two cases as policy prescription for FRAND licensing within all of standard setting, the Commission notes that the *Motorola* decision provides a “safe harbour” for willing licensees. But given the lack of guidance, in any jurisdiction, on what being an “unwilling licensee” entails, the practical import of the EC rulings (along with similar ones in the US) is a *de facto* prohibition on seeking injunctions for infringement of SEPs. In the current environment, firms are unlikely to seek injunctions on SEPs for fear of being accused of anticompetitive holdup and breach of FRAND licensing. As explained below, this could lead to detrimental consequences, such as reduced arm’s length licensing and increased SEP litigation.

12. Determining whether a SEP holder has actually practiced (or is attempting to practice) holdup is a difficult, fact intensive task. Comparable licenses can shed light, but are rarely perfect, and when such comparables do not exist the calculations require even more complex apportionment exercises.<sup>20</sup> If valuing patents is hard to do well, determining when a particular rate exceeds a “fair and reasonable” level is equally hard. As a result, setting rules to limit the circumstances in which holdup might emerge is a sensible approach. In setting such rules to limit holdup, however, we must keep in mind that holdup is not limited to SEP holders, or even to patent holders more generally. As the original holdup theory discussed above makes clear, any time there are asset specific investments that can be exploited, there is a risk of holdup. That means holdup can also run in the other direction within standard setting, with licensees holding up SEP holders. So-called reverse holdup or holdout occurs when a firm implementing a standard refuses to take a license or to negotiate in good faith, exploiting the fact that the SEP holder is locked into the standard and has sunk R&D investments. In this case, the SEP holder either has to litigate to obtain any royalties at all or simply gives up and lets the implementer free ride.<sup>21</sup>

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<sup>18</sup> Ministry of Commerce. “The Ministry of Commerce Holds a Special Press Conference on Anti-Monopoly Work” Press Release (2014), available at: <http://english.mofcom.gov.cn/article/newsrelease/press/201404/20140400554324.shtml>. See also Ministry of Commerce. “Spokesman of Chinese Commerce Ministry Answers Media Questions on Investigating and Punishing Foreign Enterprises.” Press Release (2014), available at: <http://english.mofcom.gov.cn/article/newsrelease/policyreleasing/201408/20140800696993.shtml>.

<sup>19</sup> *In re Innovatio IP Ventures, LLC Patent Litig.*, MDL 2303, 2013 U.S. Dist. LEXIS 144061 (N.D. Ill. Oct. 3, 2013).

<sup>20</sup> See, e.g. Goldfarb, Brent, and Magnus Henrekson. “Bottom-up Versus Top-down Policies Towards the Commercialization of University Intellectual Property.” *Research Policy* 32.4 (2003): 639-658.

<sup>21</sup> Geradin, Damien. “Reverse Hold-ups: The (Often Ignored) Risks Faced by Innovators in Standardized Areas.” *Working Paper* (2010).

13. While an injunction is a strong penalty, these have rarely ever been granted for SEP infringements. If injunctions are to be effectively prohibited for SEP holders, some other deterrent for reverse holdup must be instituted. Prohibitions on injunctions for SEPs are meant to alter the bargaining field by taking away this strong lever from SEP holders, but the end result could well be a tilt in that bargaining field too far in the direction of implementers. If the worst penalty a SEP infringer ever has to pay is the FRAND royalty it would have otherwise paid beforehand, then reverse holdup and holdout offer implementers highly profitable deferred tax strategies that are highly detrimental to SEP holders. Note that injunctions were rarely ever granted on SEPs, even before the EC issued its Motorola and Samsung decisions.<sup>22</sup> This fact calls into question how credible a threat it was for an SEP holder to seek an injunction and how much leverage it ever provided for holdup. Without balance between SEP holders and standard implementers, we could easily see increased reverse holdup, reduced arm's length SEP licensing, increased SEP litigation, a reduction in SSO participation, and/or a shift in R&D investments away from SEPs and toward unencumbered non-essential technologies.

14. Balance is important in court and agency tests for the presence of holdup and royalty stacking. One common exercise in assessing both is estimating the aggregate royalty rate assuming every SEP holder charges the same rate the firm under investigation has offered. At least two US courts have relied on "evidence" of this sort.<sup>23</sup> The problem, however, is that this approach suffers from both false negatives and false positives. A simple numeric example makes this clear. Suppose that a standard has 5 SEPs (patents 1 – 5), each held by a distinct patent holder. The value that the set of 5 patents contribute to the standard (as embodied in the downstream product) is known to be "10" per unit. Patent 1 accounts for 50% of the value of the full set of SEPs, patent 2 accounts for 20% of the value, while patents 3 – 5 each accounts for 10%. Each patent is actually essential and the 5 patents are perfect complements. Nevertheless, the values of the contributed SEPs are not equal, as is typically true in the real world.<sup>24</sup>

15. In this example, FRAND would dictate that patent holder 1 should charge a per-unit royalty of 5, patent holder 2 should charge 2, and patent holders 3 – 5 should charge 1 each, with the aggregate rate equalling 10, matching the value that the 5 patents contribute to the end product compliant with the standard. Patent holder 1 is the first to seek a license and asks for 5 per unit. The downstream manufacturer then accuses that patent holder of holdup. Suppose the judge knows the aggregate value of the 5 patents to the manufacturer's product is 10, but does not properly investigate the value individually contributed by patent 1 to the standard. Were the judge to calculate the aggregate royalty by multiplying the offered rate of 5 by the 5 SEP holders, she would mistakenly conclude that the cumulative rate was 25, two and a half times larger than the known value contributed by all 5 patents together. She would therefore, wrongly, conclude that patent holder 1 was attempting holdup and was creating or contributing to a royalty stack. Suppose instead that SEP holder 5 is the first to seek a license and it sets its offer at 2. The judge multiplying this rate by the 5 essential patents would conclude, again wrongly, that this rate was FRAND, as the aggregate rate of 10 implied by the individual rate of 2 exactly equals the known value of the 5 patents – even though SEP holder 5 is asking for twice the value that its patent contributes to the product compliant with the standard. Put differently, this common thought experiment for testing whether an individual SEP holder is attempting holdup and contributing to a royalty stack is not informative at all: it yields both false positives and false negatives.

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<sup>22</sup> Camesasca, Peter, et al. "Injunctions for Standard-Essential Patents: Justice is Not Blind." *Journal of Competition Law and Economics* 9.2 (2013): 285-311.

<sup>23</sup> *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823JLR, 2013 U.S. Dist. LEXIS 138786, (W.D. Wash. Sept. 24, 2013); *In re Innovatio IP Ventures, LLC Patent Litig.*, MDL 2303, 2013 U.S. Dist. LEXIS 144061 (N.D. Ill. Oct. 3, 2013).

<sup>24</sup> See, e.g. Silverberg, Gerald, and Bart Verspagen. "The Size Distribution of Innovations Revisited: an Application of Extreme Value Statistics to Citation and Value Measures of Patent Significance." *Journal of Econometrics* 139.2 (2007): 318-339.

#### 4. Holdup and Royalty Stacking: The Evidence

16. Despite the 15 years proponents of the theories have had to amass evidence, the empirical studies conducted thus far have not shown that holdup or royalty stacking is a common problem in practice. Some have pointed to historical examples to establish holdup, citing early aviation and vacuum tube radio patent litigation involving numerous patent holders and government intervention.<sup>25</sup> However, careful historical sleuthing demonstrates that while these famous cases are indeed examples of heated IPR disputes over blocking rights, they are not examples of holdup or royalty stacking.<sup>26</sup> Instead, the aviation battle emerges as a government taking and the blocking vacuum radio tube patents ended up widely licensed and cross-licensed for industry-wide commercial success.

17. The modern examples meant to prove royalty stacking is a real and common problem are essentially anecdotal stories that come up with guesstimates of the cumulative stack facing implementers for certain key standardised industries – with mobile telecom a frequent target.<sup>27</sup> The most recent entry in this category is a paper by two lawyers at Wilmer Cutler Pickering Hale & Dorr LLP (“WilmerHale”) and one inside counsel at Intel.<sup>28</sup> This paper does gather data for its calculation: the authors estimate a royalty stack of \$120 for a \$400 smartphone, equivalent to a 30% cumulative royalty rate. However, there are a number of serious problems with their estimate.

18. First, the authors take maximum rates publicly declared by SEP holders as reflective of the actual rates that these SEP holders charge implementers. As is true for any negotiation, though, the seller will state an opening offer that allows room for bargaining down, just as the buyer will counter with a low offer of its own to leave room for bargaining up. Taking public offers as if they were actual agreed upon rates ignores these universal bargaining rules. Moreover, it also ignores that any publicly disclosed rate must cover all foreseen uses of the SEPs, such as for deployment in base station or infrastructure equipment, in semiconductor chips, in mobile handsets, tablets, or laptops, for use by mobile network carriers, and so on. Thus any single publicly disclosed rate must reflect the maximum rate for the highest value use. Both of these points will bias any estimated “stack” upwards – likely significantly so.

19. Second, the authors flesh out the unilaterally declared maximum rates with rates taken from court proceedings. Rather than take the rates the courts set in these matters, however, the authors take the rates offered by the SEP holders that were challenged by the implementers as unreasonable. This approach not only suffers from the same issues as noted above for unilaterally announced maximum rates (i.e. the rates were opening offers meant to initiate negotiations), but it also ignores that once the court has determined and announced lower rates (often far lower rates) in a public decision, implementers will point to the adjudicated rates as the upper bound of FRAND for their own licenses to the SEPs.

20. Third, the authors set the royalty base as the smallest saleable patent practicing unit (SSPPU), which they argue is the baseband processor. It seems unlikely that baseband components would capture all of the value conveyed by all actually essential patents. Some courts have ruled that chips, chipsets, and other small components capture certain essential features, while others have found that the value of the

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<sup>25</sup> See, e.g. Szakalski, Dustin R. "Progress in the Aircraft Industry and the Role of Patent Pools and Cross-Licensing Agreements." *UCLA Journal of Law and Technology* 15 (2011): 1-34; see also Merges, Robert. "Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents." *Tenn. L. Rev.* 62 (1994): 75.

<sup>26</sup> Howells, John & Ron Katznelson. "The Coordination of Independently-Owned Vacuum Tube Patents in the Early Radio Alleged Patent 'Thicket'." *Working Paper* (2014); Howells, John & Ron Katznelson. "The Myth of Early Aviation Patent Hold Up." *Working Paper* (2013).

<sup>27</sup> Lemley, Mark A., and Carl Shapiro. "Patent Holdup and Royalty Stacking." *Tex. L. Rev.* 85 (2006): 1991.

<sup>28</sup> Armstrong, Ann, Joseph Mueller and Timothy Syrett. "The Smartphone Royalty Stack: Surveying Royalty Demands for the Components within Modern Smartphones." *Working Paper* (2014).

SEPs at issue far exceeds such narrow components. In addition, many essential features have not been litigated and have no public record of which base reflects their value best. The assumed royalty base is a key element of any royalty stack estimate as it forms the benchmark against which the stack will be judged to be “too big” or “reasonable”. Whereas the authors took maximum royalty rate declarations for their rate calculations, they appear to take the smallest possible component for the smartphone royalty base. Moreover, they focus on cost not value, finding that the baseband processor can “cost as little as \$10 to \$13” for a \$400 smartphone. These assumptions are likely to bias the estimated royalty stack upwards.

21. Finally, the authors explicitly ignore market mechanisms that work to reduce royalty rates in practice, like cross licensing between parties who each hold valuable SEP portfolios and patent exhaustion, where an upstream party’s licensed rights pass through to its downstream customers. These omissions have two important implications. As a practical matter, ignoring the common practices of cross licensing and patent exhaustion will bias any estimated stack upwards. Further, as a general matter of equity, is a higher cumulative rate for those implementers that have contributed nothing to the development of the standard and yet who stand to profit from the creation of the market for standardised goods and services really evidence of a stack? These are the firms for whom cross licenses and exhaustion will not apply; any cumulative rate will be considerably lower for other implementers that have contributed to standard development.<sup>29</sup>

22. Taking all four of the above issues into account, it seems clear that the empirical work to estimate a royalty stack for mobile telecom is biased upwards, likely significantly so. But is it simply that the estimated number is wrong, while the conclusion is right that runaway licensing costs are hindering industry innovation and raising prices for consumers? If it were, we would expect to see prominent signs of holdup and royalty stacking in the marketplace. More specifically, we should see evidence that prices are rising, innovation has stagnated, and market entry is limited. We see none of these effects, however. To the contrary, we see exactly the opposite. Mobile phone prices have been either flat or falling relative to the CPI since 2005;<sup>30</sup> features and innovations for mobile devices continue at a rapid pace;<sup>31</sup> and competition between mobile device manufacturers has been highly dynamic with meaningful entry over time.<sup>32</sup>

23. With neither convincing direct (aggregate royalty estimates) nor indirect (price, innovation, and entry) evidence that holdup and royalty stacking are indeed common problems in mobile telecom – one of the industries held out as a top candidate for the emergence of these problems – it is hard to find more than potential theoretical support for these issues.

24. An important reason for the disconnect between the theory and the evidence is the existence of a number of market mechanisms that work to mitigate the emergence of holdup and royalty stacking. First, patent enforcement is a costly and time consuming endeavour. According to the American Intellectual Property Law Association, the cost of an average patent lawsuit in the U.S. (where \$1 million to \$25 million in damages is at risk) is \$1.6 million through the end of discovery and \$2.8 million through final

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<sup>29</sup> For a discussion of this point, see Geradin, Damien. “What’s Wrong with Royalties in High Technology Industries?” *Competition Policy and Patent Law under Uncertainty* 12 (2011).

<sup>30</sup> As reported by Keith Mallinson, see <http://ipfinance.blogspot.com/2013/05/theories-of-harm-with-sep-licensing-do.html>.

<sup>31</sup> As PC Magazine observed in September 2014, “If you thought choosing a cell phone was difficult before, it’s even tougher today. That’s a good thing, though, because it demonstrates how innovation in the wireless industry has skyrocketed.” See <http://www.pcmag.com/article2/0,2817,2347798,00.asp>.

<sup>32</sup> Entry has not stagnated: Apple entered in 2007, Samsung and others entered in 2010. Reflecting the entry, industry concentration measures have fallen steadily since 2006, see <http://ipfinance.blogspot.com/2013/05/theories-of-harm-with-sep-licensing-do.html>.

disposition.<sup>33</sup> Without the threat of enforcement, a patent is worth nothing. As a result of the cost, most patents are never enforced (only 1.5% of all patents granted are ever litigated<sup>34</sup>) and it is widely recognised that infringement is rampant in most jurisdictions, not just the ones with reputations for weaker IPR enforcement regimes. Furthermore, and in part due to the cost, some SEP holders choose to focus on earning profits in downstream product markets and therefore do not actively manage their SEPs. If a SEP holder does not enforce its patents, for whatever reasons, that portfolio will not be included in any stack. This, of course, does not imply that those SEP holders that do enforce their patents should be given a greater share of the royalties, but it does imply that estimates of royalty stacks based on positive rates from all SEP holders will greatly exaggerate the cumulative rates actually paid.

25. Second, cross licensing cannot be ignored. It is a widespread practice in many industries, particularly high technology ones.<sup>35</sup> For vertically integrated firms – with R&D departments, patent licensing, and downstream products – cross licensing is a crucial means of holding royalty costs down and ensuring freedom to operate. This mechanism does not work for downstream specialists, though it does create incentives for these firms to expand into upstream innovation markets. The separation of IPRs from their practice allows firms to enter markets more easily, as we have seen in mobile, with firms entering on the manufacturing side first without having to invest in large R&D operations or patent portfolios.<sup>36</sup> Firms entering markets this way can then expand into R&D over time, as several Asian smartphone makers have done.

26. Lastly, patent pools are a ready option for reducing IPR licensing costs. With this solution, multiple SEP holders band together to license their truly essential patents as a bundle. This lowers both transaction costs, as the number of SEP holders for which bilateral negotiations must be conducted can be dramatically reduced, and it also tends to yield lower royalties.<sup>37</sup> Moreover, patent pools are available for all to license, whether they have patents to offer in a cross license or not. When SEP holders' goals are not aligned, it can be hard for successful pools to form,<sup>38</sup> but where the risk of holdup or a royalty stack is great, that risk provides strong motivation to overcome such hurdles as all of the standard setting players (SEP holders and implementers alike) suffer if a royalty stack kills or slows a market down.

## 5. Concluding Remarks

27. In sum, while the potential for patent holdup and royalty stacking remains, given the presence of lock-in and opportunities for its exploitation throughout the economy for entities of all sorts (not just SEP holders), there is no evidence that either holdup or royalty stacking emerges in practice in anything more than isolated instances. That is, the second necessary condition – that those with an opportunity for holdup or stacking regularly act on it within standard setting contexts – lacks empirical support. With 15 years and counting of history, it is not unreasonable to expect several solid, concrete examples of holdup and stacking for interoperability standards.

<sup>33</sup> See [www.ipwatchdog.com/2013/02/05/...costs-of-patent-litigation/id=34808/](http://www.ipwatchdog.com/2013/02/05/...costs-of-patent-litigation/id=34808/)

<sup>34</sup> Lemley, Mark A., and Carl Shapiro. "Probabilistic Patents." *Journal of Economic Perspectives* (2005): 75-98.

<sup>35</sup> Grindley, Peter C., and David J. Teece. "Managing Intellectual Capital: Licensing and Cross-Licensing in Semiconductors and Electronics." *California Management Review* (1997): 8-41.

<sup>36</sup> Geradin, Damien, Anne Layne-Farrar, and A. Jorge Padilla. "Elves or Trolls? The Role of Nonpracticing Patent Owners in the Innovation Economy." *Industrial and Corporate Change* (2011).

<sup>37</sup> Lerner, Josh, and Jean Tirole. "Public Policy Toward Patent Pools." *Innovation Policy and the Economy, Volume 8* (2008). In addition, in *Microsoft v. Motorola*, Judge Robart notes "For its part, Motorola presented significant evidence that patent pools generally have lower rates than those that can be achieved through bilateral, private negotiations." See supra note 20.

<sup>38</sup> Layne-Farrar, Anne, and Josh Lerner. "To Join or Not to Join: Examining Patent Pool Participation and Rent Sharing Rules." *International Journal of Industrial Organization* 29.2 (2011): 294-303.

28. In these circumstances, any agency or legislative intervention must be cautiously considered due to the danger of unintended consequences. Without careful attention to such consequences, policymakers could end up facilitating unjustified rent-shifting, with resultant shifts in investment and innovation. The absence of any evidence of the widespread emergence of either holdup or royalty stacking indicates that the market mechanisms for limiting holdup and royalty stacking are working well and the need for intervention is limited to case specific investigations for clear individual violations.