

Debunking the Royalty Stacking Theory: Real-World Evidence From the Mobile Wireless Industry

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Introduction

The mobile wireless industry has experienced explosive technological and economic growth in the past two decades. The evidence is plain across the world every day, as billions of people use their mobile devices to access cellular telephone services, the internet, and computer programs. One reason for the spread of mobile devices is likely their rapidly falling prices, a reality confirmed by a recent study showing that the mobile wireless industry has experienced some of the fastest consumer price drops for products and services in the United States economy.¹

Yet, in recent years in the United States, the mobile wireless industry has been the focus of concerns about large royalties from manufacturers of products that integrate patented innovation. Since smartphones, tablets, and other mobile devices must incorporate technologies owned by many different developers, it has been argued that manufacturers face a “stack,” or a high aggregate royalty, due to the addition of separate royalty demands, driving up their costs, driving up prices for consumers, and preventing innovation from being brought to the market.

The royalty stacking theory is based on certain models of economic competition that have not been tested empirically. The primary reason for this lack of empirical evidence is that royalties are typically negotiated bilaterally between firms that have no desire to make the rates publicly available. However, in order to understand whether royalty stacking is occurring and causing *competitive harm*, specific instances or anecdotes of licensing rates are not required. What matters is whether there is a *systemic problem* in the market due to this purported royalty stacking.

There is no empirical verification of market failure or competitive harm due to patent licensing in the mobile wireless industry. Even more important, evidence from this industry actually shows an increasingly competitive market based on the usual measures of competition—falling market concentration, higher number of entrants and products, and dropping consumer prices. All of this evidence in fact points to a market that is functioning properly.

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In their recent working paper, *Royalty Stacking and Standard Essential Patents: Theory and Evidence from the World Mobile Wireless Industry*, economists Alexander Galetovic and Kirti Gupta collect and examine data from the mobile wireless industry, and they find that *none* of the market disruptions predicted by the royalty stacking theory have occurred.² This finding is dramatic given the chorus of complaints about “royalty stacking” one often hears inside the Beltway and in the broader patent policy debate.

In particular, Galetovic and Gupta show that, from 1994 to 2013, as the number of standard-essential patents and unique standard-essential patent owners in the mobile wireless industry have steadily grown:

1. The average selling price of a handset device (*i.e.*, mobile phone) has fallen sharply.
2. The number of handset devices sold has risen.
3. The number of handset device manufacturing firms has increased as the average sales per firm have remained relatively steady.
4. The average gross profit margins for implementers of standard-essential patents (*i.e.*, component, device, and infrastructure manufacturing firms) have remained relatively constant.

A theory is valid if its predictions are borne out in real-world data. For this reason, the fact that real-world data from the mobile wireless industry refutes the royalty stacking theory’s prediction of market failure is extremely important. Over the last two decades, we have seen an explosion of rapidly-updated products and services in the mobile wireless industry with simultaneously falling prices for consumers. It’s clear that different assumptions and a

different theory may be needed to explain these real-world phenomena.

This policy brief first looks at the royalty stacking theory, which garnered much attention beginning in 2007. The theory predicts that royalty stacking will be especially apparent in the 3G/4G mobile wireless industry, where numerous patents must be licensed to produce a single product. The brief then looks at the real-world data from this market showing that none of the predicted anticompetitive results have actually occurred. Finally, the brief calls into doubt recent efforts to curb the supposed problem of royalty stacking for the simple reason that there is no evidence that competitive harm or market failure has occurred in the first place.

The Royalty Stacking Theory

The royalty stacking theory was made popular by Professors Mark Lemley and Carl Shapiro in 2007.³ They argued that two intertwined problems allow patent owners to collect exorbitant royalties: patent holdup and royalty stacking. Many modern products are comprised of numerous patented inventions. For example, one smartphone reflects many individual patents that must be licensed. Patent holdup refers to the theory that the owner of a patent on just one part of a larger product might demand a disproportionate royalty by leveraging the threat of an injunction against the manufacturer that would block the sale of the entire product.⁴ Likewise, royalty stacking refers to the theory that each licensor might demand an excessive royalty for its component part, thereby raising the price of the entire product as the royalties metaphorically stack up to an excessive height.⁵

The belief underlying both the patent holdup and royalty stacking theories is that patent owners will generally use their patent rights to obtain compensation that is disproportionate to their contribution to the final product. Unfortunately, proponents of these theories have been gaining ground. For example, the Supreme Court in *eBay* fundamentally altered the availability of injunctions in patent cases, especially where the patented invention at issue is but one component of a larger product.⁶ Antitrust regulators now regularly invoke these theories to scrutinize business relationships for anticompetitive effects,⁷ and courts frequently award royalty rates far below those sought by licensors.⁸

Modern technologies are based on technical specifications set by standard-setting organizations (SSOs), ensuring that products made by different manufacturers work together. Many standards set by SSOs incorporate patented technologies, called standard-essential patents (SEPs). Once a patent has been adopted as part of a standard, any manufacturer implementing that standard must obtain a license to use the patented technology. The theory is that this creates opportunities for anticompetitive behavior, such as patent holdup and royalty stacking, because the owner of an SEP might have leverage over a manufacturer that must use the patented technology in order to comply with the standard.

In another paper from 2007, Professor Lemley argued that the theoretical problem of royalty stacking was particularly troublesome when it came to 3G cellular technology.⁹ He claimed that the royalties sought by SEP owners stacked up to an excessive amount:

Time and time again, we have seen this sort of royalty-stacking problem arise. One great example is 3G telecom in Europe. The standard-setting organization (the "SSO") put out a call for essential patents, asking which they must license to make the 3G wireless protocol work and the price at which the patent owners would license their rights. 3G telecom received affirmative responses totaling over 6000 "essential" patents and the cumulative royalty rate turned out to be 130%. This is not a formula for a successful product.¹⁰

The difficulty with this example is that it described very early moves in a game with many turns yet to be played. The claims of SEP status by various patent owners at that point were simply the first, rather than the last, word on whether the 3G standard would actually include those 6,000 patents. In that context, there was little cost to making such claims. They represented hopeful attempts to preserve options, and they signified far less commitment and serious intent than costlier acts such as negotiating licenses or initiating lawsuits. Moreover, these numbers only considered the sum total of potentially applicable patents without considering the size and scale of the underlying technologies.

Perhaps most important, a 130% cumulative royalty rate would have been in nobody's interest, whether licensor, licensee, or SSO. In such a situation, the interested parties would have had every incentive to anticipate the potential difficulties and negotiate practicable rates. In reality, not

every SEP owner is a licensor. The distribution of patent ownership is heavily skewed, and it was likely that only a handful of licensors with strong portfolios would have ever negotiated royalty rates. And they would have done so with the full expectation of a potential reduction in their own profits if the aggregate royalty rates turned out to be excessive.¹¹

Furthermore, if Professor Lemley’s prediction of royalty stacking had transpired as he warned, the 3G standard simply would have failed. As we now know, the 3G standard manifestly did not fail, and it appears clear that all involved were able to overcome the prospective obstacles to its adoption and continued use. However, since Professor Lemley’s supporting example merely addressed an early-stage, potential problem with the 3G standard, rather than an actual problem that had come to fruition, the question still remains: Has real-world practice matched up to the royalty stacking theory? The answer, it turns out, is a resounding “no.”

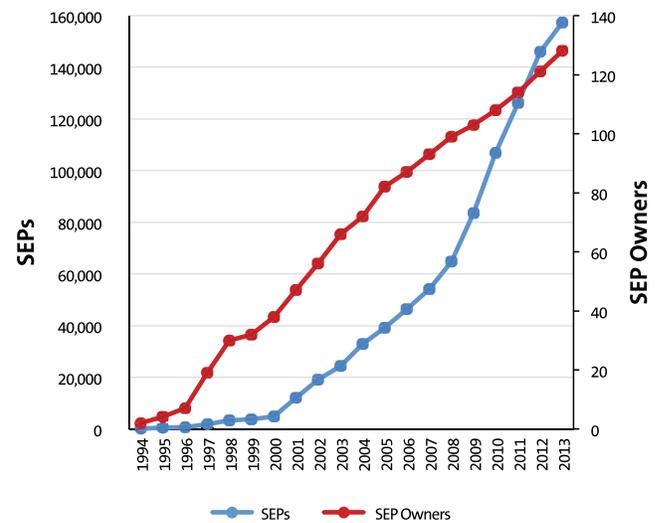
Real-World Evidence From the Mobile Wireless Industry

In *Royalty Stacking and Standard Essential Patents: Theory and Evidence from the World Mobile Wireless Industry*, economists Alexander Galetovic and Kirti Gupta look at the data from the 3G/4G mobile wireless industry.¹² Since the number of SEPs in 3G and 4G handset devices has risen to exceptionally large numbers, the royalty stacking problem here should be particularly acute—if the theory bears out.

The theory predicts these four things: (1) the average selling price of a handset device will rise, (2) the number of handset devices sold will fall, (3) the number of handset device manufacturing firms will fall, and (4) the average gross profit margins of manufacturing firms will fall. Galetovic and Gupta show that none of these things has happened as predicted—the royalty stacking theory is simply not supported by the real-world evidence in the mobile wireless industry.

The number of SEPs and SEP owners has grown by leaps and bounds since the early 1990s. Between 1994 and 2013, the number of SEPs rose from 139 to over 157,000, while the number of SEP owners grew from 2 to 128. Figure 1 shows the massive growth of SEPs and SEP owners over this twenty-year period.

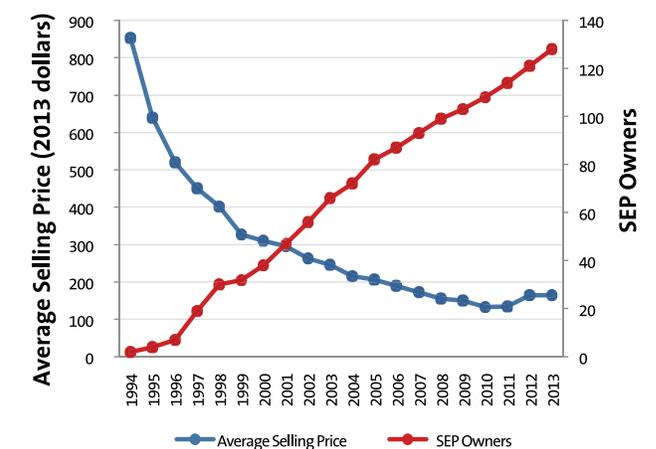
Figure 1: Number of SEPs and SEP Owners (1994–2013)



Data Source: ETSI

The royalty stacking theory predicts that the average selling price of a handset device should rise as more SEP owners try to leverage their SEPs for greater royalties. Galetovic and Gupta show that the opposite has happened: Even though the number of SEPs and SEP owners has risen dramatically, handset prices have fallen dramatically as well. In 1994, the average price of a handset device was \$853, while in 2007, it was \$173. The average price thus fell by an average of 10.8% per year between 1994 and 2007.

Figure 2: Average Selling Price of Handset and Number of SEP Owners (1994–2013)



Data Sources: Strategy Analytics & ETSI

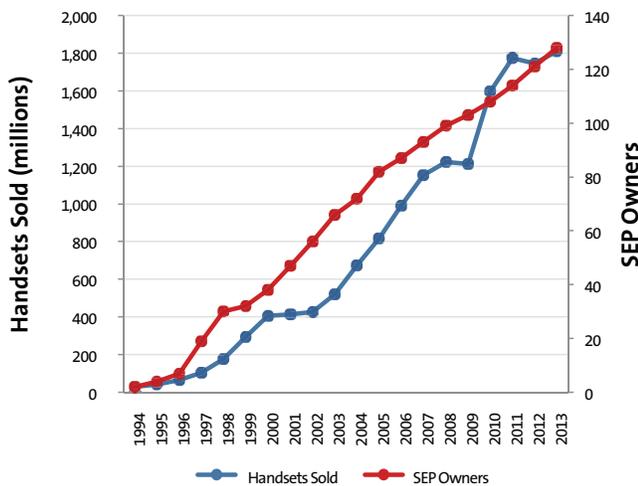
Has real-world practice matched up to the royalty stacking theory? The answer, it turns out, is a resounding “no.”

Since 2007, the average price of a handset device from the same generation has fallen between 12.2% and 30.5%. Galetovic and Gupta conclude that, contrary to what the theory predicts, there is no evidence of rising handset device prices due to royalty stacking. Figure 2 shows how the average selling price of a handset device has fallen even as the number of SEP owners has risen.

According to the royalty stacking theory, as the number of SEPs and SEP owners rises, the sales of handset devices should fall. However, since the average selling price of a handset device has fallen, the sales of those devices have actually skyrocketed. Back in 1994, the sole handset device manufacturer, Ericsson, sold only 29 million handset devices. By 2007, there were 44 manufacturers that sold a total of 1.153 billion handset devices—a 39-fold increase, or an average increase of 30.1% per year.

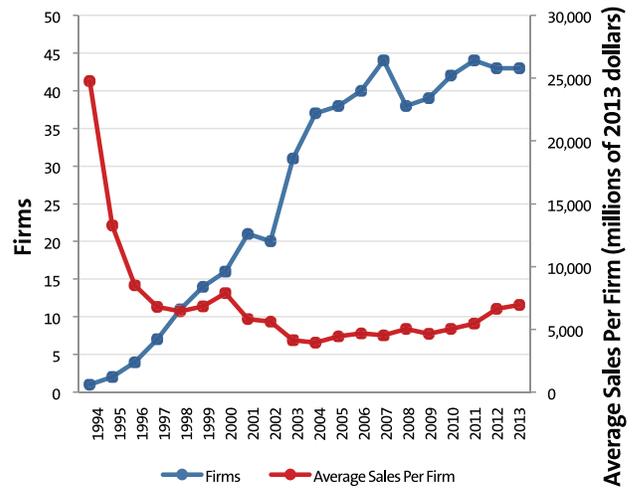
Since 2007, that number has continued to rise, with 1.81 billion handset devices being sold in 2013. Galetovic and Gupta conclude that the royalty stacking theory is wrong, and sales of handset devices have only increased as the

Figure 3: Number of Handsets Sold and SEP Owners (1994–2013)



Data Sources: Strategy Analytics & ETSI

Figure 4: Number of Firms and Average Sales Per Firm (1994–2013)



Data Sources: GSMArena & Strategy Analytics

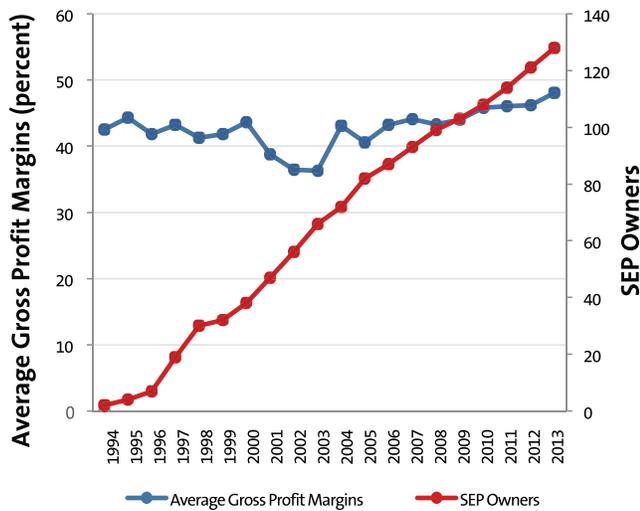
number of SEPs and SEP owners continues to grow. Figure 3 shows how the number of handset devices sold has risen even as the number of SEP owners rises.

Royalty stacking theory predicts that the number of handset device manufacturing firms will fall as the number of SEPs and SEP owners rises. Galetovic and Gupta demonstrate that this market concentration has not happened: Even though the number of SEPs and SEP owners has risen dramatically, the number of manufacturing firms has risen as well. In 1994, there was only one handset device manufacturer—Ericsson. That number rose to 20 in 2002, and then it jumped to 40 in 2006. Since then, the number has stabilized and remains at just over 40.

Contrary to what one would expect under the royalty stacking theory, Galetovic and Gupta show that market concentration has not occurred. Figure 4 shows how the number of handset device manufacturing firms has increased as the average number of handset devices sold by each manufacturer has remained relatively steady.

Finally, the theory of royalty stacking predicts that as the number of SEPs and SEP owners rises, the gross profit margins for implementers of the standard (i.e., component, device, and infrastructure manufacturing firms) should fall as each additional SEP and/or SEP owner takes an additional bite out of the firm’s revenues.

Figure 5: Average Gross Profit Margins and Number of SEP Owners (1994–2013)



Data Sources: Thomson ONE Analytics & ETSI

Galetovic and Gupta find that the predicted effect on gross profit margins never materialized: The average gross profit margins for manufacturing firms has remained steady at around 42%. Figure 5 shows how the average gross profit margins for manufacturing firms has stayed relatively the same, while the number of SEP owners has risen dramatically.

Conclusion

The 3G/4G mobile wireless industry involves numerous owners of thousands of standard-essential patents. If the royalty stacking theory had any truth to it, we would expect the portended evils to be particularly noticeable in this industry. The royalty stacking theory predicts that SEP owners will leverage their position to demand excessive royalties—far more than their fair share of the total pie. It predicts competitive harm and market failure that will lead to rising prices, falling sales, increased market concentration, and reduced manufacturer profits.

Reality has not matched the royalty stacking myth. The reason is simple: If everyone seeks excessive royalties, everyone loses.

Looking at real-world data from the last two decades, Galetovic and Gupta show that the 3G/4G mobile wireless industry reality has not matched the royalty stacking myth. The reason is simple: If everyone seeks excessive royalties, everyone loses. Patent owners know that it's not in their best interest to demand excessive royalties, and as rational market actors, they work with other SEP owners to reach equitable solutions.

SSOs have long had intellectual property rights policies in place to mitigate the risks of anticompetitive behavior while at the same time rewarding patent owners for their valuable innovations. Moreover, SSOs for decades have required patent owners to commit to licensing their technologies on fair, reasonable, and nondiscriminatory terms. The lack of empirical evidence to support the royalty stacking theory calls into question the recent efforts by SSOs, government agencies, and courts to crack down on the allegedly-abusive “stacking” behavior of SEP owners.

The real-world evidence collected by Galetovic and Gupta demonstrates that the royalty stacking theory simply does not match up to the reality in the 3G/4G mobile wireless industry. And if the theory doesn't apply in an industry where one product has thousands of SEPs, one wonders if it applies anywhere.

Acknowledgements

The authors would like to thank Adam Mossoff, Mark Schultz, and Kirti Gupta for their valuable comments and feedback.

ENDNOTES

- 1 See Alexander Galetovic, Stephen H. Haber, & Ross Levine, An Empirical Examination of Patent Hold-Up (Hoover IP2, Working Paper No. 15010, Mar. 31, 2015), <http://hooverip2.org/wp-content/uploads/ip2-wp15010-paper-051115.pdf>.
- 2 See Alexander Galetovic & Kirti Gupta, Royalty Stacking and Standard Essential Patents: Theory and Evidence from the World Mobile Wireless Industry (Hoover IP2, Working Paper No. 15012, May 1, 2015), <http://hooverip2.org/wp-content/uploads/ip2-wp15012-paper.pdf>.
- 3 See Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 Tex. L. Rev. 1991 (2007).
- 4 See *id.* at 1993 (“[T]he threat of an injunction can enable a patent holder to negotiate royalties far in excess of the patent holder’s true economic contribution. Such royalty overcharges act as a tax on new products incorporating the patented technology, thereby impeding rather than promoting innovation.”); see also *Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201, 1209 (Fed. Cir. 2014) (“Patent hold-up exists when the holder of a [standard-essential patent] demands excessive royalties after companies are locked into using a standard.”); *Microsoft Corp. v. Motorola, Inc.*, 795 F.3d 1024, 1031 (9th Cir. 2015) (“The tactic of withholding a license unless and until a manufacturer agrees to pay an unduly high royalty rate for [a standard-essential patent] is referred to as ‘hold-up.’” (citation omitted)).
- 5 See *id.* (“The term ‘royalty stacking’ reflects the fact that, from the perspective of the firm making the product in question, all of the different claims for royalties must be added or ‘stacked’ together to determine the total royalty burden borne by the product if the firm is to sell that product free of patent litigation. As a matter of simple arithmetic, royalty stacking magnifies the problems associated with injunction threats and holdup, and greatly so if many patents read on the same product.”); see also *Ericsson* at 1209 (“Royalty stacking can arise when a standard implicates numerous patents, perhaps hundreds, if not thousands. If companies are forced to pay royalties to all [standard-essential patent] holders, the royalties will ‘stack’ on top of each other and may become excessive in the aggregate.”).
- 6 See *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391 (2006) (rejecting the Federal Circuit’s “general rule in favor of permanent injunctive relief” upon a finding of patent infringement); see also *id.* at 396-97 (Kennedy, J., concurring) (“When the patented invention is but a small component of the product the companies seek to produce and the threat of an injunction is employed simply for undue leverage in negotiations, legal damages may well be sufficient to compensate for the infringement and an injunction may not serve the public interest.”); *Apple Inc. v. Samsung Electronics Co.*, 801 F.3d 1352, 1369 (Fed. Cir. 2015) (Reyna, J., concurring) (“Where the patentee is an entity that uses patents primarily to obtain licensing fees, its business objectives are premised on monetary relief being sufficient to compensate for infringement.”).
- 7 See, e.g., Business Review Letter from Hon. Renata B. Hesse, Acting Assistant Att’y Gen., U.S. Dep’t of Justice, to Michael A. Lindsay, Esq., Dorsey & Whitney LLP (Feb. 2, 2015), <http://www.justice.gov/atr/response-institute-electrical-and-electronics-engineers-incorporated>.
- 8 See, e.g., *Microsoft Corp. v. Motorola, Inc.*, 795 F.3d 1024, 1040-42 (9th Cir. 2015) (upholding the district court’s determination of royalties significantly below the licensor’s asking price).
- 9 See Mark A. Lemley, *Ten Things to Do About Patent Holdup of Standards (And One Not To)*, 48 B.C. L. Rev. 149 (2007).
- 10 *Id.* at 152 (footnotes omitted).
- 11 In other words, the simple Cournot complements model relied on by many proponents of the royalty stacking theory may not reflect the full market dynamics here.
- 12 See Galetovic & Gupta, *supra* note 2.

ABOUT THE AUTHORS

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