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# Do Standard-Essential Patent Owners Behave Opportunistically? Evidence from U.S. District Court Dockets

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## ABSTRACT

*Do owners of standard-essential patents (SEPs) “holdup” companies that produce standard-compliant products? To explore this question, we use detailed information from the dockets of all U.S. patent cases filed 2010-2019 that assert or challenge SEPs to construct measures of opportunistic conduct by SEP licensors, including actions that took place before the lawsuit was filed. We find evidence of opportunistic behavior by the SEP enforcer in at least 75% of SEP assertions in court, and we analyze various factors that determine which opportunistic behaviors SEP enforcers rely on. We also show that opportunistic behavior can affect case outcomes, although the effect on settlement is ambiguous. Some behaviors increase the likelihood of a settlement, while others decrease it.*

**KEYWORDS:** Litigation, standards, patents, holdup, U.S.

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# 1 Introduction

How should patent owners be compensated when they obtain patent rights that cover some aspect of a widely used technology standard? Perhaps no issue has drawn more attention from the international patent community in the last decade. However, despite years of scholarly debate, multi-national litigation, and scrutiny from competition regulators, no consensus answer has emerged. On one side of the divide, scholars, courts, and policymakers have urged the adoption of special rules and procedures for licensing standard-essential patents (SEPs), given the (at least theoretical) ability of SEP owners to leverage their patent rights (post-standardization) to extract royalties that exceed the (pre-standardization) value of their inventions by “holding up” companies that sell standard-compliant products and services.<sup>1</sup> On the other side, additional commentators, judges, and regulators have urged, often citing an incentive for licensees to “hold out” and delay licensing SEPs absent rules with substantial coercive effect, a more *laissez faire* approach consistent with traditional patent enforcement.<sup>2</sup>

A key reason for this divide in the literature is that, while theory predicts the existence of holdup (Shapiro, 2001; Lemley and Shapiro, 2007), verifying its existence empirically has proven challenging. At present, “actual evidence of holdup remains scant” (Delrahim, 2019)<sup>3</sup> and mixed at best (Contreras, 2019), with some suggesting that holdup does not exist at all or has no significant impact on innovation (Galetovic et al., 2015; Barnett, 2017).

In turn, a fundamental reason for this lack of empirical evidence is a paucity of readily available, public information on the behavior of SEP licensors.<sup>4</sup> The market for licensing SEPs—like the market for transferring patent rights more generally—largely operates in the dark. As private contracts, virtually all deals are negotiated in secret and thereafter rarely come to light. Consequently, data on SEP licensing positions and tactics, proposed and agreed upon terms, and royalty structures and amounts are dispersed among myriad companies that are generally obligated to keep what they know confidential.

In this paper, we explore a heretofore underutilized source of information about SEP licensing behavior: U.S. court dockets. While SEP licensing often takes place outside of court, a significant fraction of disputes between SEP licensors and licensees lead to litigation, and these court cases in turn produce a trove of public information about

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<sup>1</sup>See for example Lemley (2007); DOJ/FTC (2007); FTC (2011); Scott Morton and Shapiro (2016).

<sup>2</sup>See for example Epstein and Noroozi (2017) and USPTO/NIST/DOJ 2019 joint policy statement on remedies for standards-essential patents. Teece (2018) additionally considers incentives to participate in the standard development process itself.

<sup>3</sup>Speech by Assistant Attorney General Makan Delrahim at the Licensing Executives Society 2019 Annual Meeting, Phoenix, AZ, October 21, 2019.

<sup>4</sup>There are, of course, other explanations. For one, potential licensees may anticipate holdup and structure their activities so as to avoid or minimize it (e.g., by abandoning plans to produce standard-compliant products or engage in cross-licensing). In addition, holdup is inherently hard to measure. While potential SEP licensees commonly allege that SEP licensors charge unreasonably high royalty rates, it is no easy task to assess whether a royalty rate is indeed unreasonable and, if so, to what degree holdup is responsible.

the positions and behaviors of the litigants.<sup>5</sup> We review the dockets of the population of patent cases filed in U.S. district courts between 2010 and 2019 to assert or challenge one or more patents declared essential to a large number of technology standards administered by a total of 16 standard setting organizations (SSOs) and patent pools.

While others have analyzed SEP litigation in the U.S., the existing literature has largely focused on a small number of highly selected cases that were litigated to appellate decisions.<sup>6</sup> In a recent noteworthy exception, Lemley and Simcoe (2019) analyze 537 U.S. district court cases that involve 355 SEPs declared to 13 SSOs. They compare these suits with a matched sample of cases involving non-SEPs, and find that declared SEPs are significantly less likely to be found infringed (and, thus, commonly appear not to actually be “essential” to the standard). In another exception, Contreras (2017) studies 118 U.S. district court cases filed by NPEs between 2000 and 2015 to enforce SEPs declared to seven SSOs.

Our work expands upon existing studies of SEP litigation to examine dockets in much greater detail and for a much larger set of SEPs litigated over the entire last decade. Beyond case-level outcomes, we (i) collect and analyze data on holdup related allegations made in court pleadings and motions, (ii) incorporate richer data on accused products and litigants, (iii) identify and incorporate data from parallel U.S. International Trade Commission (ITC) proceedings, and (iv) expand all data to the patent-party-level.<sup>7</sup> Using this detailed data, we are able to quantify the extent to which SEP licensors rely on a variety of opportunistic conduct to place pressure on prospective SEP licensees. Our data also allow us to identify the circumstances under which SEP owners engage in opportunistic conduct and to analyze whether what we observe is consistent with theories of patent holdup. This analysis also allows us to validate our measures of opportunistic conduct, which are in part constructed using data drawn from (potentially unreliable) allegations made in court pleadings.<sup>8</sup>

The measures that we construct take a broad view of potential holdup behavior by SEP owners. They include not only injunction requests and parallel ITC investigations, but also strategic choices concerning SEP declarations and the specific methods used to compute royalty rates. To be clear, we do not claim that the presence of any of

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<sup>5</sup>With the notable exception of evidence on royalty rates paid by third parties to license SEPs. Details concerning specific licensing negotiations and terms are virtually always redacted or filed “under seal.”

<sup>6</sup>Most commonly, *Microsoft, Inc. v. Motorola, Inc., In re Innovatio IP Ventures*, and *TCL Communication Technology v. Ericsson, Inc.*, which have been oft cited as evidence of holdup, and *Ericsson, Inc. v. D-Link Systems Inc.*, which is frequently cited as evidence of the opposite (Contreras, 2019).

<sup>7</sup>While studies of litigation typically collect a single set of data for each case (i.e., collect data at the case level), patent enforcers commonly assert multiple patents against multiple accused infringers in the same case. To account for within-case variation across patents and defendants, we collect data for each unique patent-defendant pair (i.e., we collect data at the patent-party level). For example, if an SEP enforcer sued two companies for allegedly infringing two patents each, we collect data for all four unique SEP-company infringement allegations.

<sup>8</sup>That said, we caution that our analysis cannot reveal what the “right” royalty rate is for any given case, and thus we do not claim to show that the royalties demanded by SEP licensors are too high due to the evidence of opportunistic behavior that we observe. Nonetheless, a fundamental distinction between licensing SEPs and other patents is that there are generally no adequate substitutes to standardized technology. The potential licensee must pay, risk a lawsuit, or abandon the product altogether. Accordingly, opportunistic behaviors are likely to be more effective in the SEP licensing context.

these behaviors constitutes, in itself, empirical proof of holdup. Instead, we simply quantify the extent to which these different behaviors occur (or are alleged to occur) when SEPs are asserted in court. To better interpret these measures in the context of patent holdup theory, we explore different factors that correlate with the different opportunistic behaviors displayed by SEP owners.

Overall, we observe that allegations of opportunistic conduct are very common in SEP litigation. There is at least some specific evidence of opportunistic behavior in 83% of SEP assertions by practicing entities (PEs) and 73% of assertions by non-practicing entities (NPEs). In fact, we find that NPEs engage (or are alleged to engage) less often in opportunistic conduct not only in terms of injunctions but across all measures that we explore, with the sole exception of asserting patents that were declared in an “untimely” fashion (i.e., not until after the standard was adopted). Among SEP assertions by PEs, we find that requests for injunctions are commonly included in the pleadings, as are responsive allegations of overdeclaration and patent exhaustion.

In light of ample evidence of opportunistic licensing behavior by SEP enforcers, we ask whether these behaviors affect case outcomes. Our outcome data (collected at the patent-party level) reveals that, conditional on not settling a case, accused infringers are surprisingly successful at defending SEP enforcement cases. Overall, accused infringers prevail in about 66% of decided PE cases and 80% of decided NPE cases. However, the reflections of opportunistic conduct that we observe in the record do not appear to have a consistent effect on case decision. While we find that several opportunistic licensing behaviors have a significant impact on settlement, we also find that those effects point in both directions. Some opportunistic behaviors, such as pursuing an importation ban at the ITC or an injunction in foreign litigation, increased the likelihood of settlement. In contrast, other behaviors with a more direct link to royalty demands, such as using the entire market value of the accused product (rather than the price of the smallest salable patent-practicing unit (SSPPU)) as the royalty base, decreased the likelihood of settlement. We show that these opposing effects can be explained by a simple model of patent litigation. Specifically, our model predicts that opportunistic behaviors that mainly aim to increase the accused infringer’s litigation costs tend to increase the settlement rate, while opportunistic behaviors that primarily increase the accused infringer’s losses if the SEP holder wins in court tend to decrease the settlement rate. A potential implication of this finding (which we do not study in this paper) is that the welfare effects of opportunistic behaviors may depend on the specific type of behavior.

The remainder of this paper is organized as follows. In Part 2, we briefly summarize the current debate related to the licensing of SEPs, and in Part 3 we describe our measures of opportunistic conduct in the SEP context. In Part 4, we describe our data collection methodology, and in Part 5 we present our empirical and theoretical results. Section 6 offers a few concluding remarks.

## 2 Technology Standards and Patents

Broadly speaking, a technology standard defines a common set of rules or guidelines—typically selected by a group of companies working together, voluntarily, under the auspices of a standard-setting organization (SSO)—to foster interoperability among products in a particular domain. In the context of networking, for example, communications standards such as WiFi, Bluetooth, and LTE have in recent years been widely adopted across the globe to connect computers, smartphones, and a growing list of other devices to both one another and an ever-changing variety of related peripherals, equipment, and services.

### 2.1 FRAND Licensing

While interoperability has many beneficial (and pro-competitive) effects, competition concerns nonetheless arise when standards are protected by intellectual property rights. When competitors come together to collaborate, there may be a temptation to engage in exclusionary conduct, and patent rights to standardized technology may provide a convenient mechanism to exclude future market entrants and competitors that did not participate in the standard-setting process.

To assuage these concerns (and put competition authorities at ease), many SSOs require their members to both (i) publicly declare what patent rights (if any) they own that cover some aspect of the standard and (ii) commit to license those patents on “fair, reasonable, and non-discriminatory” (FRAND) terms. If the declaration requirement is observed, SSO participants can assemble standards that take licensing costs into account and can better assess the extent to which a company’s support for a particular proposal is rooted in its technological superiority, rather than its ability to generate patent royalties. Likewise, if FRAND licensing commitments are honored, standards can be widely adopted, with no segment of the market excluded by virtue of a flat refusal to license or an offer to license only on terms that no reasonable competitor would accept.

However, FRAND commitments are no panacea. While outright exclusionary conduct is rarely observed,<sup>9</sup> more subtle problems persist. One source of concern is that SEP licensing takes place only after the standard is adopted and generally only after it has been widely deployed. This sequence of events raises the possibility of holdup because potential licensees are effectively “locked in” to using the standard—i.e., no reasonable alternatives exist. Accordingly, SEP licensors can (in theory at least) leverage the value of standardization itself to extract royalties from licensees that exceed the incremental pre-standardization value of the patented invention.

Another related concern flows from the fact that patents essential to a given standard are typically owned by many firms. As a result, potential licensees must generally negotiate and execute multiple licenses to acquire rights to use the standard free and clear. In addition to the transaction costs involved, executing multiple licenses in an

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<sup>9</sup>Even when it is observed, courts may not recognize it as *unlawful* conduct, as illustrated by a recent decision in *FTC v. Qualcomm, Inc.* (9th Cir. 2020).

environment where holdup is possible can lead to “royalty stacking”—i.e., an accumulation of inflated royalties demanded by multiple firms (Lemley and Shapiro, 2007). Indeed, it has been alleged that some SEP holders further exacerbate this problem by intentionally divesting assets to multiple “privateer” firms that can, collectively, extract a larger aggregate royalty than one firm licensing one unified portfolio of SEPs (Rubinfeld, 2018).

On the other hand, FRAND commitments limit an SEP licensor’s ability to enforce their patent rights, which can provide incentives for potential licensees to hold out—i.e., to unreasonably delay or refuse licensing SEPs (Heiden and Petit, 2017). Since the SEP licensor has already incurred sunk investment in the technology standard, in this context it is the SEP licensor that is exposed to holdup by the potential licensee (indeed, holdout is also sometimes referred to as “reverse holdup”). While potential licensees’ ability to holdout is itself an important and related topic, in this study we observe only the actions of SEP licensors and, thus, by necessity focus on behaviors associated with holdup.

## 2.2 SEP Holdup vs. Economic Holdup

In contrast to how the term is commonly used in the context of SEP licensing, the economic literature has traditionally taken a narrow view of what constitutes holdup. The standard economic definition refers to a situation where: (i) two parties come to an incomplete agreement about a future transaction, (ii) one party makes irreversible relationship-specific investments in anticipation of the transaction’s consummation, and (iii) the other party unexpectedly attempts to extract quasi-rents from the transaction by opportunistically exploiting the first party’s earlier investment (Williamson, 1975, 1976). SEP licensing activities arguably fail to meet this definition due to the absence of an ex ante agreement between the parties combined with the absence of an ex post surprise (except for rare instances of “patent ambush”);<sup>10</sup> at best, the potential licensee is a third-party beneficiary of the original SEP owner’s FRAND commitment to the SSO.

However, in the law and economics literature, holdup has been used more expansively to encompass a variety of behaviors by which patentees may be able to extract “unreasonably high royalties” by leveraging the fact that the accused infringer or potential licensee has made investments that cannot (easily) be “redeployed to non-infringing products” (Shapiro and Lemley, 2020). While broader, this definition nonetheless tracks the general economic definition of holdup, in that once a party has made relationship specific investments, the other party can extract a higher price than it could have before (regardless of the existence of a specific ex ante agreement). However, this does not imply that “[t]he proof that patent holdup has occurred is simply that a patent holder demands royalties from an unhappy licensee who made a relation-specific investment” (Galetovic and Haber, 2017, p. 24). Properly defined, holdup in the SEP context still requires that SEP enforcers engage in opportunistic conduct after potential licensees have made specific, sunk investments (Cotter et al., 2019).

In the specific context of SEP licensing, the main argument in the literature for

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<sup>10</sup>See, e.g., *Rambus, Inc. v. FTC*, 522 F.3d 456 (D.C. Cir. 2008).

the existence of holdup is that SEP owners have more post-standardization bargaining power (relative to similarly situated non-SEP owners) because there are usually no adequate substitutes for the standard. As a result, the SEP owner can charge royalties in excess of the economic value of the patented technology, which can have two negative effects. First, some accused infringers and prospective licensees will accept excessive royalty rates and either pass on the increased cost to consumers or see profit margins reduced. And second, companies that anticipate holdup will proactively avoid it—e.g., by abandoning or avoiding standard-compliant product markets—which implies less technology adoption, lower output, and ultimately less innovation. The literature has additionally identified a number of different behaviors that can result in holdup, a fact that we explore in greater detail in the section below. Lemley and Shapiro (2007), for example, focus on the threat of a preliminary injunction as a way for the SEP owner to exert pressure on companies accused of patent infringement.

However, despite the clear theoretical appeal of holdup, empirically demonstrating its existence has proven challenging. One source of difficulty is the fact (already mentioned above) that, if companies understand the risk of holdup, they will avoid or mitigate it. In addition, directly measuring holdup (to the extent that it cannot be avoided) requires a comparison between the (typically confidential) royalty rate demanded by the SEP owner and the (often practically incalculable) royalty rate that would prevail in the absence of holdup. Moreover, while there have been instances in which individual SEP owners clearly attempted holdup—most notably cases involving “patent ambush”<sup>11</sup> or in which SEP owners preemptively sought injunctive relief before trying to negotiate a license<sup>12</sup>—such cases are relatively rare and, alone, are not convincing proof of systematic holdup.

In fact, to the contrary, Galetovic et al. (2015) test indirectly for holdup’s effect on innovation and conclude that the evidence is lacking. Looking at changes in quality-adjusted prices over time and across industries that do and do not rely heavily on standards, they find no evidence that prices for standard-compliant products fall at slower rates than prices for other products. Accordingly, they conclude that to the extent that holdup exists, it has no discernible impact on innovation.

### 3 Measuring Holdup

Our empirical approach also focuses on collecting and quantifying indirect evidence of holdup, but our approach otherwise differs greatly from Galetovic et al. (2015). Rather than studying aggregated product market data, we hew much closer to the SEP licensing ecosystem by examining the actions of specific SEP licensors and licensees in specific licensing disputes that resulted in litigation.

We begin by defining a set of eleven indicators of opportunistic behavior that SEP

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<sup>11</sup>See, e.g., *Rambus, Inc. v. FTC*, 522 F.3d 456 (D.C. Cir. 2008).

<sup>12</sup>See, e.g., *Realtek Semiconductor Corp. v. LSI Corp.*, 946 F. Supp. 2d 998 (N.D. Cal. 2013) (“[T]he court holds that defendants breached their contractual obligations to IEEE and to Realtek as a third-party beneficiary of that contract by seeking injunctive relief against Realtek before offering Realtek a license.”).



licensors may take in an attempt to exert holdup power, broadly defined. In the existing literature and case law, a wide variety of conduct has been associated with potential holdup—i.e., have been identified as strategies that an SEP licensor could employ to obtain excessive royalties, possibly in violation of competition law or its FRAND obligations. Combining this existing evidence with information gleaned from court records (as detailed below), we construct a variety of measures of opportunistic conduct by SEP licensors, which we summarize in Table 1. While these behaviors have all been associated with holdup, we stress at the outset that many are not *per se* unlawful and none are, standing alone, conclusive proof of holdup. Nonetheless, measuring the frequency with which these behaviors occur (actually or allegedly) in litigation can shed light on the prevalence with which holdup occurs.

Our measures of opportunism begin with strategic behaviors concerning patent declarations and filings. As noted above, an SEP holder has an incentive *before* a standard is finalized to declare as few patents as it plausibly can. All else equal, a technology is more likely to be incorporated into the standard if it is covered by fewer patents. Moreover, a company’s advocacy for the adoption of a particular technology is, all else equal, more likely to be persuasive if the company holds few (or no) patent rights covering that technology. However, once a standard is finalized, incentives change. Now, an SEP holder has an incentive to aggressively pursue and declare as essential as many patents as possible in hopes of inflating its share of the future stream of royalties.<sup>13</sup> In the analysis below, we refer to these two opportunistic behaviors as *untimely declaration* and *overdeclaration*, respectively.

Post-standardization, SEPs licensors can engage in many other opportunistic behaviors in an attempt to increase royalty revenue. First, SEP licensors can push or exceed the boundaries of their FRAND commitments. While FRAND is designed to ensure that licenses are widely available on a “non-discriminatory” basis, SEP licensors naturally face strong incentives to engage in discriminatory or exclusionary licensing and, moreover, can generally do so while maintaining a facially neutral licensing policy. For example, a consistent royalty rate applied to each standard-compliant product can lead to royalties that vary greatly among companies and that capture value attributable to features and components completely unrelated to the standard. Even with a flat dollar-value-per-unit royalty, it is possible for an SEP holder to select a rate that it knows some competitors cannot afford to pay. Below, we refer to both practices as *discriminatory licensing*.

Moreover, despite committing to license SEPs on FRAND terms, SEP holders may nonetheless pursue (or threaten to pursue) injunctive relief, just as they would if asserting non-essential patents. A sizeable theoretical literature explores the effect of injunctions on incentives to settle patent cases and license patent rights (e.g. Shapiro, 2010), and in their 2013 joint policy statement the U.S. Department of Justice (DOJ) and USPTO stated expressly that in the FRAND context an “injunction or exclusion or-

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<sup>13</sup>In a “top-down” approach to calculating royalties, the share of SEPs of a given standard held by a company affects directly the amount of royalties received. Moreover, Righi and Simcoe (2020) find that a majority of SEPs issue from continuation applications filed after standard publication and, “[c]onsistent with opportunistic behavior by patentees,” additionally observe a large increase in SEP continuations immediately after standards are finalized.

der may be inconsistent with the public interest.” We capture SEP enforcers’ assertion of entitlement to an injunction in a measure referred to as *injunction*. In addition to requesting injunctive relief in U.S. district courts, SEP holders may also pursue an importation ban, or “exclusion order,” in administrative litigation before the ITC. If an SEP holder initiates an ITC investigation in parallel with a district court case, we refer to this as *parallel ITC litigation*. Further, an SEP holder may pursue an injunction in parallel litigation filed in another country. Particularly if the parties’ dispute arises from negotiation of a global SEP license, the prospect of a sales ban in a major foreign market can affect licensing negotiations in the U.S. We refer to this measure as *relevant litigation abroad*.

Next, SEP licensors may take strategic advantage of the lack of complete vertical integration among technology firms. Because standards implementation is typically carried out by a component (such as a chipset or module) that is incorporated into a larger end product, SEPs (if valid and truly essential) are commonly infringed by multiple firms along the supply chain. This fact opens the door for a number of related opportunistic behaviors. For one, SEP licensors can strategically elect to sue (or target for license demands) downstream firms. Relative to upstream component manufacturers, downstream firms generally sell larger products at higher price points and, moreover, are often disadvantaged due to a lack of familiarity with the technical details of the standard and the standard-compliant component. While in theory the same royalty can be calculated by applying both a relatively small rate to a relatively large base and a relatively large rate to a relatively small base, patent owners in practice are likely to recover more in damages when they sue firms that sell end products.<sup>14</sup> In response to this concern and in recognition of the long-standing requirement that patent damages be properly “apportioned” to cover only the patented technology at issue in the case,<sup>15</sup> U.S. courts have ruled that reasonable royalty damages should ordinarily be calculated using the “smallest salable patent-practicing unit” (SSPPU) in an accused multi-component product as the royalty base, rather than the price of the end product under the so-called “entire market value rule” (EMVR).<sup>16</sup> Nonetheless, this general rule has many exceptions, including when the patentee has a history of negotiating and executing licenses based on the sales price of end products.<sup>17</sup> We capture situations where the SEP enforcer bases its royalty calculations on the EMVR instead of the SSPPU in a measure called *EMVR vs. SSPPU*.

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<sup>14</sup>See Chao (2012) at pp. 119-25, 134-38 for a summary of the relevant literature. See also *LaserDynamics, Inc. v. Quanta Comp., Inc.*, 694 F.3d 51, 68 (Fed. Cir. 2012) (“Admission of . . . overall revenues, which have no demonstrated correlation to the value of the patented feature alone, only serve to make a patentee’s proffered damages amount appear modest by comparison, and to artificially inflate the jury’s damages calculation beyond that which is ‘adequate to compensate for the infringement.’”).

<sup>15</sup>See *Garretson v. Clark*, 111 U.S. 120, 121 (1884) (“The patentee . . . must in every case give evidence tending to separate or apportion . . . the patentee’s damages between the patented feature and the unpatented features.”).

<sup>16</sup>See, e.g., *VirnetX, Inc. v. Apple Inc.*, 767 F.3d 1308 (Fed. Cir. 2014); *LaserDynamics*, 694 F.3d at 67 (“[I]t is generally required that royalties be based not on the entire product, but instead on the ‘smallest salable patent-practicing unit.’”)

<sup>17</sup>*CSIRO v. Cisco Sys., Inc.*, 809 F.3d 1295, 1301-04 (Fed. Cir. 2015); *Ericsson, Inc. v. D-Link Sys.*, 773 F.3d 1201, 1225-29 (Fed. Cir. 2014).

In addition to strategically targeting downstream firms that earn the most revenue, licensors can make licensing demands from companies at *multiple* levels of the supply chain. While in principle patent rights are said to “exhaust” once one level of the supply chain is licensed,<sup>18</sup> SEP licensors with large portfolios and complex, confidential licensing histories can attempt to “double dip” by seeking overlapping royalties from firms at different levels of the supply chain. We capture this type of behavior in a measure referred to in Table 1 as *exhaustion*. Moreover, licensors can increase pressure by pitting firms at different supply chain levels against one another; for example, by threatening to sue the customers of a potential licensee that has not accepted a licensing demand. We refer to this as *threats to sue customers*.

Finally, SEP licensors may take strategic advantage of the lack of a (thick) market for pricing SEP licenses and any resulting information asymmetries that cut in their favor. For example, in negotiations or litigation, SEP licensors may selectively reveal prior licenses that support what, in reality, is a relatively high royalty demand. While it is a common practice in litigation to reference existing “comparable” licenses in calculating a reasonable royalty, the extent to which any given license is truly “comparable” is often controversial due to differences in patents covered, the duration of the agreement, geographic coverage, licensee type, etc. This provides the opportunity for the SEP enforcer to rely on existing licensing agreements that result in more favorable royalty calculations than what would result from accounting for any relevant differences in the technology use. We capture this type of behavior in our *prior licenses not comparable* measure. Relatedly, SEP licensors may simply refuse to disclose any information justifying the requested royalty payment (or place conditions on the receipt of such information that no reasonable licensee would accept). This situation is captured by our *no disclosure* measure in Table 1.

## 4 Data

### 4.1 Standards and SEPs

To identify SEPs, we utilized the Searle Center Database on Technology Standards and Standard Setting Organizations, which includes 139,620 patents declared essential to one or more standards developed by 16 SSOs and patent pools, including ETSI, IEEE, and ITU (Baron and Spulber, 2018; Baron and Pohlmann, 2018). In addition, because the declaration of a single patent is generally regarded as a declaration of the patent’s entire family,<sup>19</sup> we identified all family members of the specific patents included in the Searle database using EPO’s Patstat database (version September 2019)<sup>20</sup> and added to our data all such patents that were not already included.

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<sup>18</sup>See *Impression Prods., Inc. v. Lexmark Int’l, Inc.*, 137 S.Ct. 1523 (2017).

<sup>19</sup>ETSI’s [IPR FAQ](#), for example, instructs that “[t]he recommended practice is to declare only one member in a patent family . . . and let the system expand automatically as new members appear under this patent family.”

<sup>20</sup>We use the DOCDB family definition.

Table 1: Overview of measures of opportunistic conduct by SEP enforcers

Opportunistic behavior	Description
Any opportunistic behavior	Did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation?
Untimely declaration	Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the standard was adopted?
Overdeclaration	Did the accused infringer (specifically) allege that the patent enforcer required licensees of relevant SEPs to additionally pay royalties for rights to patents that were either not essential to the relevant standardized technology generally or not relevant to the accused infringer's specific products?
Discriminatory license	Did the accused infringer make a specific allegation that the patent enforcer adopted discriminatory or exclusionary licensing terms or practices?
Injunction	In the complaint (or counterclaim) did the patent enforcer expressly request an injunction?
Parallel ITC litigation	Did the patent enforcer initiate an investigation against the accused infringer at the ITC in parallel to the district court litigation?
Relevant litigation abroad	Did the patent enforcer seek injunctive relief against the accused infringer in related litigation filed outside the U.S. (e.g., in Germany)?
EMVR vs. SSPUU	Did the accused infringer argue that the patent enforcer improperly attempted to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU).
Exhaustion	Did the accused infringer (specifically) allege that the patent was already licensed (e.g., by an upstream component supplier)?
Threats to sue customers	Did the patent enforcer bring the accused infringer's customers into the licensing dispute, either by contacting them, threatening to sue them, or actually suing them?
Prior licenses not comparable	Did the accused infringer argue that the patent enforcer improperly attempted to base the royalty owed on prior licenses that were not reasonably comparable (due to differences in patents, duration, geographic scope, licensee type, etc).
No disclosure	Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies?
Other	Did the accused infringer specifically allege that some other action might constitute a FRAND violation?

## 4.2 SEP Litigation Data

To identify all U.S. patent suits involving SEPs, we first extracted from the MaxVal Patent Litigation Databank<sup>21</sup> basic case-level data on all patent cases filed in U.S. district courts between 2010 and 2019. We then identified all such cases in which a declared SEP or its family member was asserted or challenged.<sup>22</sup> In addition to simply matching our databases by patent number, we reviewed each match by hand to verify its accuracy.<sup>23</sup>

Next, we conducted an in depth analysis of each case involving at least one verified, declared SEP. To do this, we reviewed each case’s docket, including all pleadings filed in the case, all motions filed in the case,<sup>24</sup> court rulings on those motions, trial verdicts, and post-trial motions practice.<sup>25</sup>

During this review, we identified all parties to each case and confirmed which party or parties were enforcing (or attempting to license) each patent and which party or parties were accused of infringing each patent (or seeking a declaration of non-infringement or invalidity). Further, we determined how and when each patent-party infringement allegation was resolved, and additionally made note of all substantive rulings (whether dispositive or not) concerning each patent-party pair.<sup>26</sup>

In addition, we identified all cases that were created by virtue of a prior case’s transfer or the severance of patents or parties from a prior case. We further identified all cases that were dismissed and subsequently re-filed in substantially identical form or merged into another case. Accordingly, our data allows us to follow each patent-party pair across multiple “cases” (i.e., unique case numbers) and identify the initial filing date, final termination type and date, and all other relevant data aggregated across all intervening case dockets.

To provide one relatively simple example, consider *Princeton Digital Image Corp. v. Canon, Inc.*, No. 2:10-cv-00029 (E.D. Tex. Jan. 25, 2010). Princeton Digital filed this case to enforce two patents against five accused infringers. Two defendants, Kodak and Canon, settled with Princeton Digital in 2010 and 2011, respectively, and the case against the remaining three defendants was later transferred to the Southern District of New York in 2012. In this “new” case, *Princeton Digital Image Corp. v. Hewlett-Packard Co.*, No. 1:12-cv-00779 (S.D.N.Y. Feb. 1, 2012), one additional defendant, Xerox, settled in 2013, and the remaining two defendants, HP and Fujifilm, continued to litigate to a decision on the merits in 2015 (in which they proved that the asserted patents were not infringed due to a prior license to Microsoft). Thus, while a standard

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<sup>21</sup><https://www.maxval.com/litigation-databank/>

<sup>22</sup>Accordingly, our data does not include cases enforcing “undeclared” standard essential patents—that is, patents that were not declared to the SSO but nonetheless were alleged by their current owner to be infringed by the standard.

<sup>23</sup>In the process, we dropped a number of erroneous matches caused by inaccuracies among Chinese patent numbers included in the Searle database.

<sup>24</sup>Including all motions to dismiss, motions for summary judgment, motions concerning expert witness reports or testimony, and all pre-trial reports and motions in limine.

<sup>25</sup>However, we did not collect data on appeals.

<sup>26</sup>Our patent-party-level data is current as of June 2020. Accordingly, we observe cases for different lengths of time, and some cases remained unresolved at that time. We take potential truncation into account in our analysis.

case-level database would include one 2010 case that was transferred in 2012 and a second 2012 case that was resolved on the merits in 2015, our data provides a richer, more accurate view of what transpired. In our data, this litigation is represented by ten patent-party pairs, all of which were initiated in 2010, and two of which were settled in 2010, two of which were settled in 2011, two of which were settled in 2013, and four of which were litigated to a decision on the merits in 2015.

### 4.3 Party, Technology, and Product Data

In addition to data on litigation events, we identified the relationship between each set of litigants, as well as the technology and product(s) or service(s) at issue in each patent-party-level infringement allegation. Using the Stanford NPE database we categorized each patent enforcer as an operating technology company (i.e., a “practicing entity” (PE)), a “non-practicing entity” (NPEs), a university, or a sovereign patent fund.<sup>27</sup> For each operating technology company, we further classified its relationship to the accused infringer as one of the following: (i) direct product market competitor, (ii) upstream of the accused infringer, (iii) downstream of the accused infringer, or (iv) participant in a different product market. We also recorded whether court filings indicated that the litigants had previously been parties to an SEP licensing agreement. Finally, using the USPTO’s Patent Assignment Search and the Searle database, we constructed each patent enforcer’s complete SEP holdings throughout our sample period, as well as each individual SEP’s chain of ownership from filing to assertion.

Next, using both the standard declarations in the Searle database and the pleadings filed in each case, we categorized the type(s) of standardized technology that was accused of infringement in each case. Our technology classification methodology, which is described in detail in Appendix A, distinguishes among cases that involve wireless communication, data compression and encoding, and digital broadcasting standards (among others).

For each patent-party pair, we also determined whether the accused infringer was alleged to have sold the technology in a product or service or whether instead the accused infringer was alleged to have used the technology in a context substantially unrelated to its core products or services (e.g., if infringement was limited to a non-tech company’s website or advertisements).

For each patent-party pair where the accused infringer was alleged to have sold the technology, we classified the accused infringer’s product(s) or service(s) and made note of whether the infringing technology was substantially confined to a component of each product or whether instead each product was, itself, a component (such as a chip, chipset, or module) designed to implement the infringing technology. Our product and service classification methodology, which is described in detail in Appendix A, distinguishes among infringement allegations against mobile devices, network hardware, network/Internet/wireless service providers, televisions, set-top boxes/DVRs/video disc players, media service providers, cameras, and software (among others).

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<sup>27</sup><https://npe.law.stanford.edu/>

## 4.4 Data on Opportunistic Behaviors

To complete our database, we collected data on the measures of opportunistic conduct listed in Table 1. We began by collecting data on requests to ban the sale of allegedly infringing products. For each patent-party pair, we noted whether the patent enforcer specifically requested an injunction in the complaint (or counterclaim) alleging infringement of the relevant patent.<sup>28</sup> In addition, we identified (using DocketNavigator<sup>29</sup>) whether the patent enforcer filed a (parallel) complaint with the U.S. International Trade Commission requesting that the accused infringer’s products be excluded from importation into the U.S. because they infringe the relevant patent. Finally, we noted whether the accused infringer alleged in U.S. case filings that the patent enforcer attempted to obtain a sales ban in litigation filed in a foreign jurisdiction (primarily Germany).<sup>30</sup>

Next, we searched the pleadings and motions filed in each case to determine whether the accused infringer alleged that the patent enforcer otherwise breached its FRAND obligations or engaged in opportunistic behavior with the aim to inflate the royalties it might recover from licensing each asserted SEP. Here, we ignored general allegations of unspecified FRAND violations and boilerplate assertions of the applicability of certain defenses, and instead only made note of *specific* factual allegations (as explained in greater detail below).

First, we observed a population of patent-party-level claims in which the accused infringer alleged, citing specific facts, that the asserted SEP rights were “exhausted” — i.e., that the SEP was, in fact, already licensed by an upstream supplier or was covered by a license that the accused infringer negotiated in the past with a prior owner or licensor of the SEP. To be clear, while generic assertions of exhaustion or license were pled in many cases, we limited our selection to only those allegations that identified specific prior agreements or specific upstream suppliers believed to hold a license. For example, we did not make note of common, generic “placeholder” allegations such as: “On information and belief, some or all of Defendant’s accused products are licensed under the patent-in-suit and/or subject to the doctrines of patent exhaustion and implied license.” Rather, the cases that we identify below as pleading exhaustion included allegations such as: “Dolby’s claims are barred by license, including a license of the patents-in-suit pursuant to a license agreement between Research In Motion Limited and Via Licensing Corporation.”<sup>31</sup>

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<sup>28</sup>To be clear, we did not count broad, boilerplate requests for “such other and further relief as the Court deems just and proper.” Our metric is limited to pleadings that expressly request, for example, “[a]n order enjoining [the accused infringer] and its officers, agents, servants and employees, privies, and all persons in active concert or participation with it, from further infringement of said [SEPs].”

<sup>29</sup><https://brochure.docketnavigator.com/>

<sup>30</sup>We did not search databases of foreign patent litigation to identify parallel foreign cases. Few such databases exist, and those that do exist are typically incomplete in temporal and/or geographic coverage.

<sup>31</sup>Answer at 9, *Dolby Int’l AB v. Research in Motion Ltd.*, No. 3:11-cv-02931 (N.D. Cal. Aug. 5, 2011). See also Answer at 17, *Genband US LLC v. Metaswitch Networks Corp.*, No. 2:14-cv-00033 (E.D. Tex. July 7, 2014) (“[B]y their participation in the PacketCable IPR agreements, GENBAND and Nortel and its affiliates have granted to all PacketCable signatories, including Metaswitch, a fully-paid, royalty-free, non-exclusive license (with a sublicense to end-users of licensed products) to their patents and other intellectual property practiced through compliance with the PacketCable specifications and technology.”).

We additionally identified a population of patent-party-level claims in which the accused infringer alleged, again citing specific facts, that the SEP enforcer sought to license the patent on a discriminatory basis in violation of FRAND commitments. Again, while generic allegations of FRAND violations were common, we limited our selection to only those cases that provided specific factual support for the allegation that the SEP enforcer's pre-suit royalty demands were discriminatory or exclusionary. To provide an example, it was alleged in one case that the SEP licensor had "offered the license to the SISVEL Patent Pool patents at different, discriminatory prices ... [with] [t]he apparent purpose of ... rais[ing] costs to competitors of Philips in the MP2-audio-enabled product and MP3-audio-enabled product markets (which includes [the accused infringer]), and to drive out competition in the MP2-audio-enabled product and MP3-audio-enabled product markets."<sup>32</sup>

We also made note of all patent-party-level claims in which the accused infringer pled with specificity that the SEP enforcer engaged in "overdeclaration" by requiring licensees—as a condition for obtaining a license to relevant SEPs—to additionally pay royalties for rights to patents that were either not essential to the relevant standardized technology generally or not relevant to the accused infringer's specific products. One such allegation, for example, stated that the SEP licensor "has periodically removed expired patents and submitted new patents to extend the lifespan of the ATSC patent portfolio ... without notice or comment from licensees and without independent third-party evaluation to ensure essentiality," including "46 patents [added] since October 2015 that relate to broadcasting and transmitting over-the-air signals to ATSC-compliant receivers ... zero [of which] are required for [the accused infringer] (or any other DTV manufacturer or seller) to make its DTVs ATSC compliant because its DTVs do not broadcast signals."<sup>33</sup>

We further identified all patent-party-level claims in defense of which the accused infringer alleged, citing specific facts, that the SEP enforcer (or its predecessor-in-interest) failed to disclose the SEP to the standard-setting organization until after the standard's adoption (or initially declared the asserted patent non-essential prior to the standard's adoption), despite actively participating in the selection of technology for inclusion in the standard. In one such example, it was alleged that "four days after the filing of the Reissue Application which later issued as the [asserted SEP], [the SEP enforcer] submitted [a] letter to the chairman of the 802.11 working group stating, inter alia, that [none of its] 'patent[s] are necessary for the implementation of devices incorporating the IEEE802.11b draft standard' ... [and when] [t]he IEEE 802.11 working group met again in November 1998 ... [the SEP enforcer's] president and CEO ... continued to represent that it believed that the Reissue Application was not necessary to the practice

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<sup>32</sup>Dell, Inc.'s Answer at 46, *Audio MPEG, Inc. v. HP, Inc.*, No. 2:15-cv-00073 (E.D. Va. July 15, 2016)

<sup>33</sup>Compl. at 21-22, *Haier America Trading, LLC v. Samsung Electronics Co.*, No. 1:17-cv-00921 (N.D.N.Y. Aug. 21, 2017). See also, HP, Inc.'s Answer, *Audio MPEG, Inc. v. HP, Inc.*, No. 2:15-cv-00073 (E.D. Va. Aug. 19, 2015) (pleading at 26 that "on information and belief, in addition to patents directed at the MP3 Standard, the SISVEL Patent Pool includes patents directed at standards clearly unrelated to and therefore not essential to MP3 Technology, including MPEG Audio Layers I and II, MPEG-2 patents, and other technology different from and unrelated to MP3 Technology," and also at 36 that "[o]ver half of the patents in the SISVEL Patent Pool have claims directed solely at encoders and/or transmission systems, neither of which relates to all of HP's products, which are mostly MP3 decoders").



of 802.11b.”<sup>34</sup> And in another, “at the time [the asserted SEPs’ original owner] was seeking to have the SSOs incorporate its proposal into the CDMA2000 Standards, [the original owner] (including one or more of its employee inventors) knew that it was simultaneously seeking patent coverage . . . [of] its technical proposal and/or the draft CDMA2000 Standards” but “did not inform 3GPP2 or TTA until November 2008 that they believe that the [7 asserted SEPs] may fully or partially cover elements of, or be essential or potentially essential to the CDMA2000 Standards.”<sup>35</sup>

Likewise, we identified all patent-party-level claims that included an allegation that the SEP licensor improperly attempted to pressure the accused infringer by involving its customers in the dispute. In one such case, the accused infringer pled that “in a blatant attempt to force [us] to pay excessive non-FRAND rates, [SEP licensor] reached out to [our] customers and downstream manufacturers,”<sup>36</sup> and in another, the alleged infringer accused the SEP holder of making “false and defamatory statements . . . during meetings with [potential customers] . . . [including] that Metaswitch’s products infringed GENBAND’s patents, . . . that Metaswitch could not sell noninfringing products[,] . . . that GENBAND would utilize this lawsuit to put Metaswitch out of business[, and] . . . that this lawsuit would prevent Metaswitch from being able to make an initial public stock offering.”<sup>37</sup>

Finally, we identified all patent-party-level claims in which the accused infringer alleged in pleadings or argued in motions that the SEP holder sought to strategically influence the calculation of the royalty itself. While we were able to identify a population of cases in which it was specifically alleged in the pleadings that the SEP holder improperly sought to base the royalty owed on the entire market value of the accused end product or by reference to a not-reasonably-comparable prior license,<sup>38</sup> this data was commonly not reflected in the case record until after the production of expert witness reports,<sup>39</sup> by which time many cases had already settled. We address in greater

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<sup>34</sup> Answer at 17, *WI-LAN, Inc. v. Apple, Inc.*, No. 6:11-cv-00453 (E.D. Tex. Nov. 4, 2011).

<sup>35</sup> Answer at 44, *SPH America, LLC v. AT&T Mobility, LLC*, No. 3:13-cv-02318 (S.D. Cal. Aug. 18, 2014).

<sup>36</sup> See, e.g., Compl. at 27, *U-Blox AG v. Interdigital, Inc.*, No. 3:19-cv-00001 (S.D. Cal. Jan. 1, 2019)

<sup>37</sup> Answer at 49, *Genband US LLC v. Metaswitch Networks Corp.*, No. 2:14-cv-00033 (E.D. Tex. filed July 7, 2014).

<sup>38</sup> See, e.g., Answer to 2d Am. Compl. at 18-19, *Sisvel Int’l SA v. Dell, Inc.*, No. 1:19-cv-01247 (D. Del. May 4, 2020) (“Sisvel does not offer any licenses to cover component-part products, and instead pursues inflated royalties by licensing end-user devices only . . . Sisvel expressly refused to offer any license to Sierra Wireless that would cover any component parts, stating that ‘Sisvel does not license components’ and . . . Sisvel maintained this position even after Sierra Wireless . . . repeatedly requested that Sisvel offer a license on FRAND terms to cover component parts.”); Answer at 28/29, *Motorola Mobility, Inc. v. Microsoft Corp.*, No. 3:10-cv-00699 (W.D. Wis.) (“Motorola has discriminatorily chosen Microsoft’s Xbox product line and other multi-function, many-featured products and software . . . for the purpose of extracting unreasonable royalties from Microsoft . . . By letter to Microsoft, dated October 29, 2010, Kirk Dailey, Motorola’s Corporate Vice President Intellectual Property, stated that a royalty for a license to its identified patents must be based on ‘the price of the end product (e.g., each Xbox 360 product, each PC/laptop, each smartphone, etc.) and not on component software (e.g., Xbox 360 system software, Windows 7 software, Windows Phone 7 software, etc.)’”).

<sup>39</sup> See, e.g., *Intellectual Ventures II, LLC v. Sprint Spectrum, LP*, No. 2:17-cv-00662, at \*5-6 (E.D. Tex. April 26, 2019) (“Defendants contend that [IV’s damages expert’s] analysis of the Ericsson licenses is unreliable because he does not account for the technological and economic differences between the hy-

detail below how we account for this effect, generally. Relatedly, we also identified a population of cases in which the accused infringer specifically alleged that the SEP licensor unreasonably refused to disclose evidence of the market value of the SEPs asserted.<sup>40</sup>

## 5 Results

### 5.1 Case filings and outcomes

Figure 1 shows the total number of court cases during our sample period 2010-2019 at the patent-party level—that is, counting each plaintiff-defendant-patent combination as a separate case (see the example at the end of Section 4.2 above). Our data includes a total of 1,809 cases, meaning that an average of 180 SEP patent-party-level infringement allegations were initiated each year during the period of our study. Figure 1 also distinguishes between cases involving NPEs and PEs, and we see that the majority of SEP assertions were initiated by NPEs (around 70%). Table A-1 in the appendix further shows that eight of the top 10 SEP enforcers (ranked by number of patent-party-level infringement allegations made 2010-2019) were NPEs. NPE Acacia tops the list with 286 cases, nearly 16% of all SEP assertions brought between 2010 and 2019.<sup>41</sup>

In the appendix, we include two additional figures and two additional tables. Figure A-1 compares the number of district court cases with the number of parallel cases filed at the ITC, and Figure A-2 shows assertions per SEP broken down by both the SEP enforcer’s NPE status and the SSO to which the SEP was declared essential. The latter figure reveals that NPEs bring many more cases per SEP than operating companies and, moreover, rarely if ever assert patents declared essential to standards organized as patent pools, such as ATSC, BlueRay, DvD, and MPEG DASH.<sup>42</sup>

Relatedly, Table A-1 shows that SEP assertions are relatively concentrated among a group of especially litigious SEP enforcers. The top 20 asserting entities alone account for almost 85% of all (patent-party level) cases. While many potential SEP licensees

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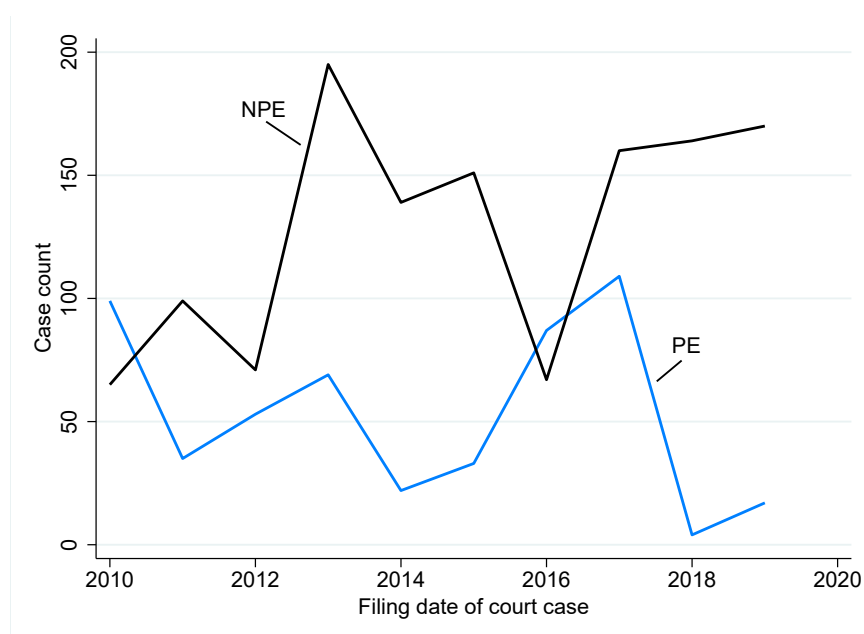
pothetical and actual licenses ... [including] that the Ericsson licenses involve royalties for third-party handset sales, whereas the hypothetical license involves functionality in the base stations and the base-band processor in the handsets ... [and] that comparing one group of patents that is representative of thousands of patents to the six patents-in-suit ignores the value of the vast majority of patents in the portfolio.”); *Saint Lawrence Comm’ns, LLC v. ZTE Corp.*, No. 2:15-cv-00349, at \*3, \*8 (E.D. Tex. Feb. 21, 2017) (“Motorola argues that [SLC’s damages expert’s] reliance on the two LG [licensing] proposals is flawed ... [because] the two LG proposals substantially differ from the ultimate agreement reached by SLC and LG, almost by a factor of ten[, and] ... Motorola challenges [SLC’s damages expert’s] discussion of other SLC licenses negotiated in the context of litigation in Germany [because] ... these licenses are unreliable indicators of a FRAND royalty because they are ‘tainted by the coercive environment of patent litigation,’ specifically, the threat of an injunction in Germany.”).

<sup>40</sup>See, e.g., Am. Answer at 38, *Nokia Tech. Oy v. Apple, Inc.*, No. 2:16-cv-01440 (E.D. Tex. March 20, 2017); Am. Compl. at 10, *Sonus Networks, Inc. v. Inventergy, Inc.*, No. 3:15-cv-00322 (N.D. Cal. March 10, 2015).

<sup>41</sup>We aggregate NPE assertions at the NPE group level. Accordingly, these are aggregate statistics for all patent-enforcing subsidiaries of Acacia Research Corp.

<sup>42</sup>The distribution of court cases across SSOs is shown in Table A-3 in the appendix.

Figure 1: Number of court cases (at the patent-party-level) of SEPs by NPE status (2010-2019)



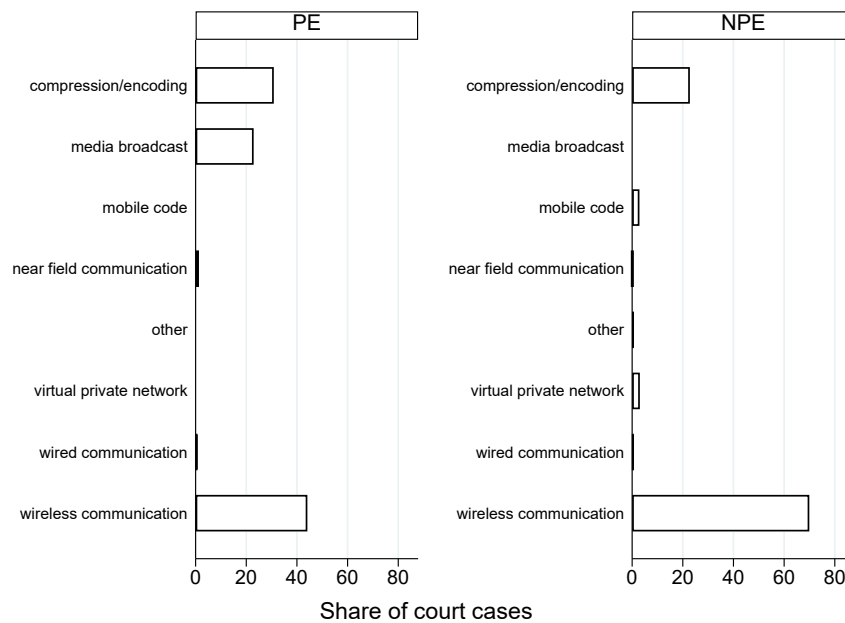
**Note:** PE: practicing entity; NPE: non-practicing entity. The graph shows the number of cases (at the patent-party-case level) that involve SEPs by NPE status between 2010 and 2019.

also find themselves in multiple litigations, Table A-2 shows that SEP assertions are a bit less concentrated on the defense side, with the top 20 accused infringers accounting for 67% of lawsuits. Viewed together, Tables A-1 and A-2 also show that some operating tech companies—including Ericsson, Huawei, Samsung, and Nokia<sup>43</sup>—regularly find themselves involved in SEP litigation on both sides of the “v.” as both SEP enforcers and accused infringers.

Figure 2 breaks down the patent-party-level case count by technology area. For both NPEs and PEs, two technology areas account for a large majority of cases: wireless communication and compression/encoding. Collectively, these two categories account for 75% of cases brought by PEs and 93% by NPEs. Among PEs, media broadcast technology also accounts for a significant share of court cases (23%).

<sup>43</sup>We categorize each SEP enforcer as a practicing or non-practicing entity based on whether the company sells goods or services, generally. We do not (and as a practical matter cannot across all cases) analyze whether each SEP was practiced by the patentee in its products or services at the time of enforcement.

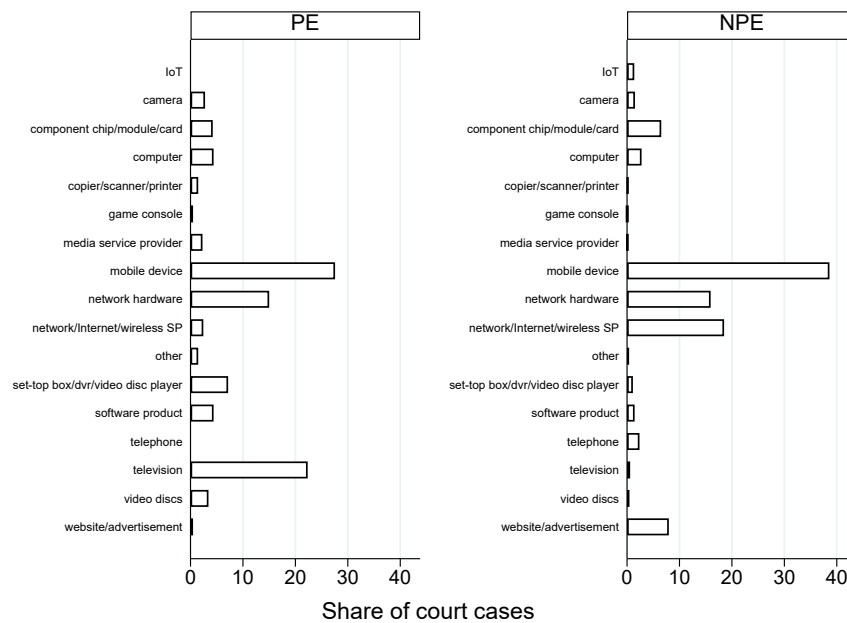
Figure 2: Case shares by technology (2010-2019)



**Note:** PE: practicing entity; NPE: non-practicing entity. The graph shows the share of cases by allegedly infringing technology in cases that involve SEPs between 2010 and 2019.

In Figure 3 we take a closer look at the products and services accused of infringement in each case. PEs enforcing SEPs most commonly target mobile devices (i.e., smartphones and tablets), televisions, and network hardware. These products are accused of infringement in 28%, 22%, and 15% of patent-party-level cases, respectively. NPEs also commonly target mobile devices (39%) and network hardware (16%), but also bring a significant share of cases against providers of wireless/network services (18%).

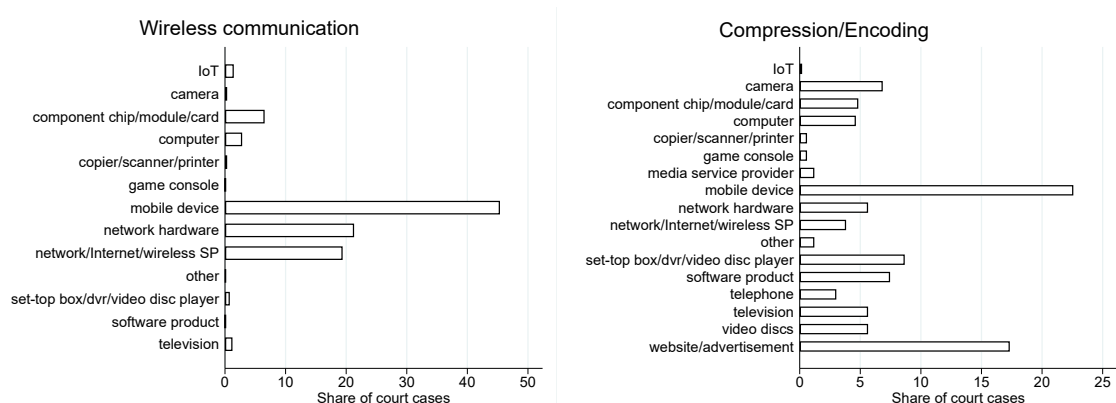
Figure 3: Case shares by product/service (2010-2019)



**Note:** PE: practicing entity; NPE: non-practicing entity. The graph shows the share of cases by allegedly infringing product/service in cases that involve SEPs between 2010 and 2019.

Figure 4 combines information on technology and products/services (from Figures 2 and 3) to present a breakdown of the products and services targeted in patent-party-level cases enforcing patents declared essential to wireless communication and compression/encoding standards. In cases involving wireless communication standards, we see that infringement allegations most commonly accuse mobile devices (45%), network hardware (21%), and wireless/network services (19%). Recall from Figure 3 that the latter is driven by NPE assertions. A relatively small share of cases (7%) are brought against companies that produce product *components* such as chips, modules, and network cards. By contrast, cases enforcing patents declared essential to compression/encoding standards specifically accuse a much broader range of products and services, though the primary target remains mobile devices here, too. In neither category do we see a significant share of cases targeting IoT products, despite the rapid growth of those markets in recent years. This is likely explained by the typical delay between product introduction and patent assertion in court.

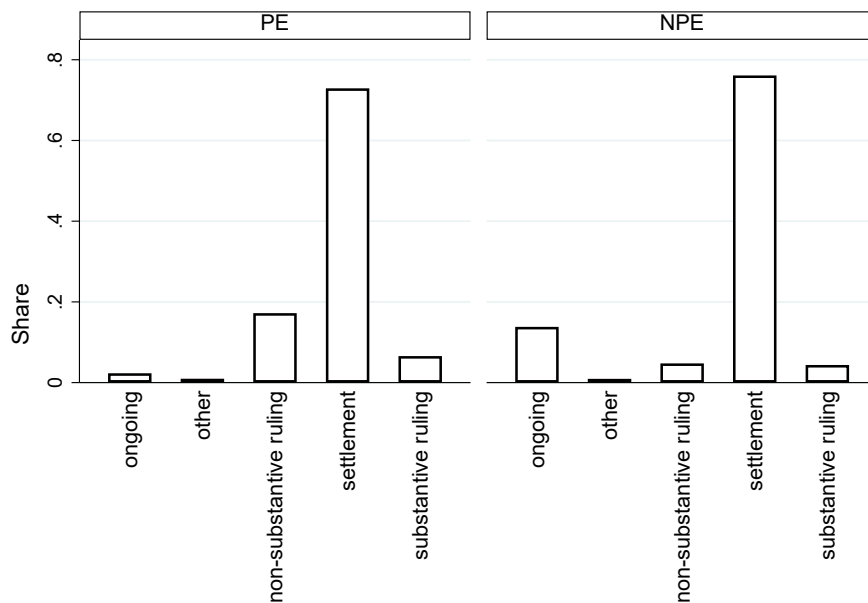
Figure 4: Case shares by selected technology and product/service (2010-2019)



**Note:** The graph shows the share of cases by allegedly infringing product/service in cases that involve SEPs between for “wireless communication” and “compression/encoding” for 2010-2019.

Next, we take a look at case outcomes. As described in greater detail above, our data allows us to track case outcomes at the patent-party level so that, for example, if a given SEP holder accuses two companies of infringing two SEPs in a single case, we track outcomes for all four company-SEP pairs. Figure 5 shows outcomes for all (patent-party level) cases in our data. Not surprisingly, the most common outcome by far is settlement (72% of PE SEP assertions and 76% for NPEs). Moreover, we observe that PE SEP assertions are slightly more likely to result in a substantive ruling—i.e., a ruling on infringement and/or validity grounds—relative to cases involving NPEs (6.8% for PEs vs. 4.3% for NPEs, a difference that is statistically significant at 5%). Cases brought by PEs are also significantly more likely to terminate due to non-substantive rulings—i.e., rulings on a basis other than infringement or validity, such as the defense of exhaustion or failure to prove ownership of the SEP (17.4% for PEs vs. 4.7% for NPEs). Figure A-4 in the appendix further breaks down our outcome data by technology area. There, the media broadcast and virtual private network technology areas stand out due to relatively large shares of cases with non-substantive and substantive rulings, respectively. However, both effects are largely driven by groups of related cases with similar outcomes: among media broadcast cases, our outcome results are largely driven by a single suit between LG and Haier that involved an exceptionally large number of SEPs, and our VPN category consists entirely of a series of high-stakes cases brought by VirnetX that were litigated with exceptional intensity.

Figure 5: Case outcomes (at the patent-party-level) of SEPs by NPE status (2010-2019)



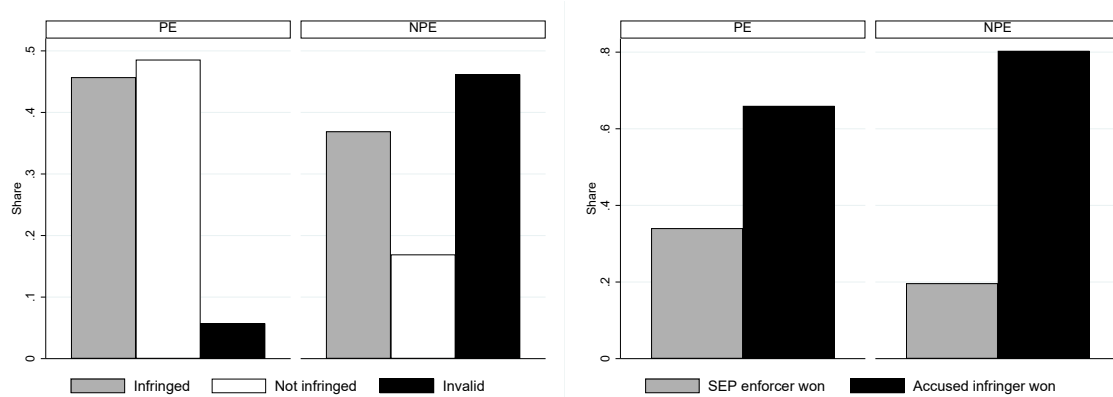
**Note:** PE: practicing entity; NPE: non-practicing entity. The graph shows case outcomes at the patent-party-case level of cases that involve SEPs between 2010 and 2019.

In Figure 6, we focus on cases that reached a dispositive decision on the issue of infringement or invalidity.<sup>44</sup> The left-hand-side figure shows stark differences in the substantive outcomes of cases brought by NPEs and PEs. Of NPE SEP cases litigated to a decision on the merits, 46% concluded because all SEP claims remaining in the case were invalidated, 17% concluded because all SEP claims remaining in the case were found not infringed, and just 37% concluded with a determination that at least one claim of the SEP was both valid and infringed. Relative to these statistics, PE SEP enforcement actions were substantially less likely to be litigated to a dispositive decision of invalidity (6%), substantially more likely to be litigated to a dispositive decision of non-infringement (48.5%), and slightly more likely to conclude with a decision that at least one SEP claim was both valid and infringed (45%).

Combining the outcome data on the left with data on cases decided on the basis of exhaustion or (lack of) ownership, the right-hand-side of Figure 6 shows case outcomes coded on a simple win/loss basis. Among SEP cases for which we could assign a win/loss designation, NPEs lost 80% of the time. By comparison, PEs prevailed more often, but still lost about two-thirds of cases for which we could assign a winner and loser. Figure A-5 in the appendix shows that the majority of decided cases (just like the majority of all cases) involve wireless communication and compression/encoding standards. Among all decided wireless communication cases, the SEP holder won 24% of the time, compared to 12% of the time in compression/encoding cases.

<sup>44</sup>To be clear, our data is limited to outcomes in the first instance. We do not observe appellate outcomes, if any.

Figure 6: Outcomes of decided cases by NPE status between 2010-2019



**Note:** PE: practicing entity; NPE: non-practicing entity. The left-hand-side graph shows dispositive case outcomes at the patent-party-case level of cases that involve SEPs between 2010 and 2019. The right-hand-side graph shows overall case outcomes coded as win/loss at the patent-party-case level of cases that involve SEPs between 2010 and 2019.

## 5.2 Evidence of opportunistic conduct by SEP enforcers

We begin by providing an overview of the prevalence with which we observed actual or alleged opportunistic behavior in our case data. Table 2 shows the share of NPE and PE cases (again defined at the patent-party level) with publicly available court filings specifically referencing each of the opportunistic behaviors described above in Section 3. In the appendix, we present identical statistics for the entire sample of cases (Table A-4) and broken down by district court (Table A-5). Figure A-3 additionally plots the share of cases in which each behavior was observed or alleged over the sample period 2010-2019.

In interpreting these numbers, it is important to keep in mind that disclosure of opportunistic behaviors is, to varying extents, a function of the information that litigation generates over time. This means that our data tends to under-count opportunistic behavior in court cases that are resolved relatively quickly, before the parties filed documents with the court revealing those behaviors. We account for this in two ways. First, we distinguish among different strategic behaviors that are commonly revealed at different stages of the litigation process. For example, while an assertion of entitlement to injunctive relief is typically made (or not) in the SEP holder's initial complaint, a majority of the behaviors that we study are not revealed until the accused infringer answers the complaint, and even then often not until the accused infringer files an amended version of the answer incorporating additional details discovered in the early stages of litigation. Second, we condition our data on multiple milestones in the litigation process. As shown further below in Tables 2, 5, 7, and 8, we separately examine the subset of cases in which the accused infringer filed at least one answer to the complaint, the subset of cases in which the court ruled on at least one substantive motion (i.e., a motion for summary judgement of noninfringement or invalidity, or motion to dismiss on patentable subject matter grounds), and finally the subset of cases that were litigated for more than one year.



Another potential challenge lies with the fact that we observe many behaviors only through *allegations* made by accused infringers in pleadings and motions. While (as discussed above in Section 4.4) we strictly limit our data to specific allegations of opportunistic behavior, there is nonetheless a risk that these allegations may sometimes be exaggerated or erroneous. We address this challenge in two ways as well. First, we distinguish between measures, on the one hand, that are based on objective information, such as the existence of a parallel ITC investigation, and on the other hand, measures that are more difficult (if not impossible) to verify, such as alleged exhaustion of the asserted patent rights. Second, we analyze variation across cases for each measure as a function of objective, observable litigant characteristics. We ask, for example, whether exhaustion is more likely to be alleged when the accused infringer merely purchased a component embodying the standardized technology, and whether overdeclaration is more likely to be alleged against SEP holders with relatively large portfolios of declared SEPs.

Returning to Table 2, the first row shows our summary measure *any opportunistic behavior*. This variable is equal to 1 if any of the measures of opportunistic behavior applies. We see that in 83% of SEP cases brought by PEs, at least one type of opportunistic behavior is observed or alleged. The share does not change much when we limit the sample to cases in which the accused infringer filed at least one pleading. However, the share increases to almost 98% if we further limit the sample to cases that were litigated through the filing of at least one substantive motion (which demonstrates the issue discussed above). We also see that this measure of opportunistic behavior is substantially lower for cases brought by NPEs (72.5%), and this difference is statistically significant at 1%.

Looking at the individual measures of opportunistic behavior, we see that PEs allege that they are entitled to an injunctions in more than half of their cases (56%), while NPEs do so in only 39%.<sup>45</sup> However, this difference likely reflects the fact that NPEs are unlikely to obtain injunctive relief following the Supreme Court's ruling in *eBay, Inc. v. mercExchange, LLC*<sup>46</sup> (Seaman, 2016). Table A-7 in the appendix also shows that PEs are much more likely to request injunctions in complaints against downstream companies, relative to complaints against direct product market competitors.

While our data suggests that opportunistic behaviors tend to arise less often in NPE cases, *untimely declaration* stands out as a major exception. Depending on the sample considered, *untimely declaration* is alleged in 22-45% of NPE cases compared to just 10-14% of PE cases. The fact that *untimely declaration* is alleged more often against NPEs is also reflected in Table A-6, which shows that untimely SEP declarations are alleged much more often in cases where there is no prior licensing relationship between the SEP enforcer and accused infringer (22%, compared to 3% when there was a prior license between the litigants), which is true in virtually all NPE cases. Moreover, Table A-8 in the appendix indicates that *untimely declaration* is not commonly alleged in cases litigated between two PEs that both sometimes enforce, and sometimes are accused of

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<sup>45</sup>To be clear, we refer here to specific requests for injunction relief made in pleadings—i.e., complaints and counterclaims—rather than motions for preliminary or permanent injunctions.

<sup>46</sup>547 U.S. 388 (2006).

infringing, SEPs.<sup>47</sup> We also find that *untimely declaration* is not alleged in any cases involving most technology categories and, instead, shows up primarily in cases involving wireless communication standards (see Table A-9).

Compared to *untimely declaration*, NPEs are far less likely to be accused of *overdeclaration*, i.e. asserting declared SEPs that may in fact not be standard-essential. PEs are alleged to engage in this strategy in around a quarter of cases. While this only reflects an allegation made by accused infringers, our data on dispositive case outcomes supports the veracity of these allegations. Overdeclaration was not alleged in a single case in which infringement was proven. By contrast, of all decided cases in which *overdeclaration* was alleged, half ended in a decision of invalidity and the other half resulted in a decision of non-infringement. Also, Table A-8 shows that *overdeclaration* is less common in cases litigated between two PEs that both sometimes enforce, and sometimes are accused of infringing, SEPs (compared to cases with a patent enforcer that also shows up in our data as an accused infringer, and an accused infringer that only shows up in our data in that role).

*Exhaustion* is specifically pled in around a third of court cases brought by PEs (compared to 17% of cases brought by NPEs). Table A-6 shows that exhaustion is claimed more often in cases where the accused infringer uses the technology in a context substantially unrelated to its core products or services (e.g., if infringement was limited to a non-tech company's website or advertisements), compared to cases with an accused infringer that sells the technology as part of its core product or service. Exhaustion is pled in 33% of the former and 20% of the latter. The table further shows that exhaustion is pled more often by accused infringers that merely incorporate in their own products an allegedly infringing component sourced from an upstream vendor. Relatedly, Table A-8 in the appendix shows that exhaustion is claimed more often by accused infringers that operate downstream from the companies enforcing SEPs against them. Additionally, and consistent with this finding, Table A-10 reports that allegations of exhaustion are particularly prevalent in cases against wireless/network service providers — firms that sit near the end of two supply chains (one for mobile devices and another for network hardware).

*Discriminatory licensing* is alleged in around 20% of cases brought by PEs and only 4% of NPE cases. Table A-6 indicates that this argument arises mostly in situations where there is a prior licensing relationship between the SEP enforcer and accused infringer. We also observe that it occurs mostly among product market competitors (Table A-7) and in situations where accused infringers are not themselves SEP licensors (Table A-8). Further, Table A-9 indicates that this behavior occurs mostly in media broadcast technologies and to a lesser extent in wireless communication and compression/encoding.

Another way in which SEP owners can exert pressure on companies that sell standard-compliant products and services is to threaten their customers with patent infringement suits. However, Table 2 indicates that this is a relatively rare move that was alleged in

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<sup>47</sup>That is, in cases where (i) the plaintiff shows up in our data asserting SEPs in one or more cases *and* shows up in our data as an accused SEP infringer in one or more cases, and (2) the defendant shows up in our data asserting SEPs in one or more cases *and* shows up in our data as an accused SEP infringer in one or more cases.

less than 3% of cases. The only products affected by *threats to sue customers* were chips, modules, network cards, and network hardware (Table A-10).

Yet another way to put pressure on accused infringers is to pursue them in more than one venue. In addition to suing in U.S. district courts, SEP holders can initiate ITC investigations in hopes of obtaining an exclusion order and can sue in the courts of one or more additional countries (e.g., UK or Germany) in hopes of securing a sales ban in a major market outside the U.S. We see that SEP enforcers additionally pursued accused infringers in parallel ITC actions about 7% of the time, and we find references to foreign litigation even less often (in just 3% of cases).<sup>48</sup> Parallel ITC investigations occur more often in cases between parties with a prior licensing agreement, 14% vs. 4% (Table A-6) and parties that operate in different product markets (Table A-7). In addition, we find that ITC investigations and foreign litigation occur most often in parallel with cases involving wireless communication standards and cases that accuse mobile devices (i.e., smartphones and tablets) with infringement (Table A-9).

The remaining three measures of opportunistic litigation behavior capture issues more directly related to the calculation of a royalty rate, which is often at the core of the parties' dispute in SEP cases. The *EMVR vs. SSPUU* variable captures situations where the accused infringer argued that the SEP licensor improperly attempted to base the royalty owed on the price of the end product (using the EMVR), rather than the price of the standard-compliant component (the SSPUU). We find that this allegation is relatively common, with accused infringers making this argument in around a quarter of cases. In Table A-7, we also see that upstream SEP enforcers are more likely to base their royalty request on the EMVR instead of the SSPUU. Additionally, as shown in Table A-9, we observe this allegation exclusively in cases involving wireless communication, compression/encoding, and VPN technologies.

Next, the *prior licenses not comparable* measure captures cases in which the accused infringer argued that the SEP licensor improperly attempted to calculate the royalty owed by reference to prior licensing agreements that were, in fact, not reasonably comparable due to differences in the set of licensed patents, duration, geographic scope, licensee type, etc. We observed this argument in less than 15% of all cases in our data. We also observe, as shown in Table A-6, that license comparability is raised almost exclusively in cases between parties that lack a prior licensing history.

Finally, the *no disclosure* measure captures situations where the infringer indicated that the SEP licensor refused to disclose the terms of prior licenses with similarly situated companies. It turns out that this is not a common occurrence, with less than 2% of cases alleging this conduct by SEP licensors. That said, our data only capture situations where this issue is highlighted by accused infringers as a tactic that was employed to exert pressure or otherwise inflate royalties.

The *other* category captures all other situations in which the accused infringer made some specific allegation of behavior that it believed might constitute a FRAND violation.

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<sup>48</sup>Note, however, that we only take into account litigation in foreign jurisdictions if it is explicitly referred to by the defendants as a way of putting pressure on them. This means we are most likely under-counting relevant litigation abroad.

Table 2: Opportunistic behavior by SEP enforcer by NPE status (2010-2019)

Opportunistic behavior	All		D Response		MSJ/MTD	
	PE	NPE	PE	NPE	PE	NPE
	(1)	(2)	(3)	(4)	(5)	(6)
1 Any opportunistic behavior	83.52	72.52	83.29	80.46	97.91	90.00
2 Injunction	56.43	39.11	53.44	40.46	89.58	37.60
3 Untimely declaration	12.68	22.40	13.98	26.82	10.41	45.60
4 Overdeclaration	25.00	2.88	27.55	3.45	6.25	8.40
5 Exhaustion	32.95	17.01	36.32	20.37	58.33	24.00
6 Discriminatory license	19.12	4.21	21.08	5.04	6.25	4.00
7 Threats to sue customers	2.65	0.93	2.92	1.12	2.08	0
8 Parallel ITC litigation	7.19	4.37	6.05	4.48	2.08	7.20
9 Relevant litigation abroad	3.03	0.85	3.34	1.02	10.41	1.60
10 No disclosure	1.70	0.62	1.87	0.74	0	0
11 EMVR vs. SSPUU	22.15	11.55	24.42	13.83	54.16	17.20
12 Prior licenses not comparable	13.44	6.08	14.82	7.28	50.00	17.20
13 Other	45.83	9.36	50.52	11.21	37.50	22.80
Total cases	528	1,281	479	1,070	48	250

**Notes:** PE: practicing entity; NPE: non-practicing entity. Unit of observation at the patent-party-case level; *D response*: only cases where the defendant filed at least one response to the complaint; *MSJ/MTD*: only cases where at least one motion, a motion to dismiss and/or a motion for summary judgment was filed; **1**) In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2**) In the complaint (or counterclaim) did the patent enforcer request an injunction? **3**) Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4**) Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5**) Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6**) Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7**) Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8**) Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation?; **9**) Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10**) Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11**) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPPU). **12**) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13**) Did the accused infringer make some other specific allegation that something might be a FRAND violation?

### 5.3 Determinants of opportunistic conduct

Next, we analyze the determinants of opportunistic litigation behavior. We start by estimating the likelihood that a given type of opportunistic behavior is present in a given case (at the patent-party level) using a linear probability model. In Appendix B, we describe the variables that serve as potential determinants.

Table 3 shows the results for each measure of opportunistic behavior (columns (1)-(13)) broken down by litigant-, case-, and patent-specific characteristics (in rows (1)-(16)). Turning first to column (1), we note that opportunistic behavior, generally, is positively associated with a prior license between the parties. This suggests that in situations where a prior agreement has broken down or is up for renewal, the SEP enforcer tends to behave more aggressively towards the accused infringer. Such cases may in fact correspond directly to the original definition of holdup described in Section 2.2 above. An SEP enforcer's overall SEP portfolio size is also positively associated with opportunistic behavior, generally<sup>49</sup>—a finding that likely reflects these enforcers' tendency to assert a larger set of SEPs. Indeed, as shown in column (4), portfolio size is positively associated with allegations of overdeclarations. On the other hand, column (1) also shows that opportunistic conduct is observed less often in cases with: an accused infringer that is both a licensor and licensee of SEP; an accused infringer that uses, rather than sells, the allegedly infringing technology; or litigants that are product market competitors.

Turning next to the litigant characteristics that comprise the first nine rows of Table 3, we see in row (1) that cases filed by NPEs are (relative to PE cases) more likely to include disputes about both the appropriate royalty base to use (*EMVR v. SSPPU*), and the comparability of prior licenses that may be introduced into evidence at trial. At the same time, NPEs are also less likely to request injunctive relief, assert potentially exhausted patent rights, or threaten accused infringers' downstream customers.

Rows (2) and (3) present results for cases with a litigant that appears in our data in some cases as the SEP enforcer and in other cases as the accused infringer. In cases with an SEP enforcer that appears in our data as both an SEP licensor and licensee (row (2)), we are less likely to observe disputes about the EMVR and the comparability of licenses. On the other hand, we find that such cases are more likely to proceed in parallel with foreign litigation. When we look instead at cases with an accused infringer that is both an SEP licensor and licensee (row (3)), our results differ. In these cases, we see fewer allegations of untimely declaration, overdeclaration, and discriminatory licensing, but greater reliance on the EMVR, licenses of questionable comparability, and parallel litigation (both at the ITC and in foreign courts).

Rows (4), (5), and (6) show that opportunistic behaviors also vary with litigants' relationship to one another. In cases with an SEP enforcer that operates upstream relative to the accused infringer (row (4)), we observe requests for injunctions less often, but see an increase in allegations of overdeclaration and greater reliance on the EMVR and

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<sup>49</sup>Note that our measure of SEP portfolio size varies over time at the case-level as we account for patent transfers; we compute the portfolio size for each case at the time the lawsuit is filed which mitigates concerns that the portfolio size reflects at least in part a SEP enforcer's response to the outcome of a given case.

licenses of questionable comparability. In cases between litigants that, instead, are direct product market competitors (row (5)), we see that SEP enforcers are more likely to be accused of overdeclaration and discriminatory licensing, but are less likely to pursue a sales ban in court or at the ITC. In addition, row (6) shows results for cases that arise from the alleged breach of, or failure to renew, a prior licensing agreement between the litigants. In these cases, we see an increased likelihood of injunction requests and ITC investigations, as well as more frequent allegations of overdeclaration and exhaustion. At the same time, these cases are less likely to include allegations of untimely disclosure and disputes concerning the appropriate royalty base or the relevance of prior licenses.

Rows (7) and (8) further reveal that opportunism varies with the accused infringer's relationship with the allegedly infringing technology. As shown in row (7), cases brought against accused infringers that *use* the standardized technology (e.g., in advertisements or their website), rather than sell it as part of a core product or service, are more likely to include specific allegations of exhaustion (as one would expect) and are more likely to include a parallel ITC investigation. At the same time, however, cases against technology users are also less likely to involve allegations of overdeclaration, discriminatory licensing, threats against the accused infringer's customer, and strategic use of licenses of questionable comparability. Further, row (8) presents results for cases filed against companies that allegedly infringe simply by virtue of incorporating another firm's (allegedly infringing) component in their own end product. In such cases, we see an increase in allegations of overdeclaration and discriminatory licensing. We also see that SEP enforcers in such cases are less likely to request injunctive relief in court, yet more likely to pursue an exclusion order at the ITC.

Finally, row (9) presents results that take into account the size of each patent enforcer's SEP portfolio. Here we see, as one would expect, that allegations of overdeclaration increase with the SEP enforcer's portfolio size. We also find that SEP enforcers with larger portfolios are more likely to pursue parallel ITC investigations and more likely to base royalties on the entire value of accused products.

Our data additionally allows us address the possibility that the results shown in Table 3 might reflect unobservables that are correlated with both opportunistic behavior and party-, case-, or patent-specific characteristics. We do so, first, by including SEP enforcer and technology fixed effects, which allow us to compare opportunistic behavior across subsets of cases the involve the same SEP enforcer and the same same technology. For example, when applying this method to Nokia, we compare across a set of six cases related to wireless communication technology and, again, across two different cases in which Nokia enforced SEPs covering compression/encoding technology.

Table 4 presents results that incorporate enforcer and technology fixed effects. Logically, our sample size and list of determinants both shrink;<sup>50</sup> however, we otherwise see little difference in the results. While some determinants lose their statistical significance, few coefficients are significant in Table 4 but not in Table 3 and, more importantly, we see only a single sign flip among all statistically significant coefficients.<sup>51</sup> On

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<sup>50</sup>Our sample size shrinks because we must drop all SEP enforcers for which there is no variation across court cases. Our variable list also shrinks because we must drop the *P is NPE* and *P is both P and D* variables, which naturally do not vary within SEP enforcers.

<sup>51</sup>SEP portfolio size is negatively associated with parallel ITC litigation in Table 4, but positively asso-

Table 3: Determinants of opportunistic behavior by SEP enforcer (2010-2019)

	Any	Injunction	Untimely decl.	Overdecl.	Exhaust.	Discrim. lic.	Sue custom.	Lit. ITC	Lit. abroad	No discl.	EMVR/SSPUU	Comparable lic.	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>P/D characteristics</i>													
(1) P is NPE	-0.165*** (0.0596)	-0.301*** (0.0752)	-0.0533 (0.0742)	-0.0222 (0.0539)	-0.141** (0.0685)	0.0120 (0.0506)	-0.0577** (0.0294)	0.0332 (0.0490)	-0.00412 (0.0236)	0.0132* (0.00728)	0.132** (0.0647)	0.0960** (0.0402)	-0.119* (0.0668)
(2) P is both P and D	-0.133*** (0.0640)	-0.0143 (0.0610)	-0.0451 (0.0554)	-0.0364 (0.0352)	-0.0232 (0.0573)	0.0143 (0.0393)	-0.0339* (0.0202)	0.0108 (0.0380)	0.0314** (0.0126)	0.0145** (0.00648)	0.198*** (0.0614)	0.071*** (0.0564)	0.217*** (0.0613)
(3) D is both P and D	-0.0686*** (0.0211)	0.0299 (0.0222)	-0.123*** (0.0190)	-0.0517*** (0.0108)	-0.00738 (0.0217)	-0.0802*** (0.0129)	0.00751 (0.00744)	0.0449*** (0.00990)	0.0340*** (0.0102)	0.0228*** (0.00688)	0.0660*** (0.0209)	0.0457*** (0.0189)	0.00271 (0.0197)
(4) P upstream of D	-0.0692 (0.0519)	-0.172** (0.0702)	0.0625 (0.0702)	0.112** (0.0519)	0.107 (0.0654)	-0.0549 (0.0464)	-0.0392 (0.0281)	-0.0222 (0.0420)	-0.0204 (0.0230)	0.00124 (0.00602)	0.404*** (0.0596)	0.225*** (0.0437)	0.0658 (0.0650)
(5) P and D competitors	-0.148*** (0.0648)	-0.270*** (0.0741)	-0.0758 (0.0797)	0.121*** (0.0455)	-0.0813 (0.0551)	0.133*** (0.0425)	-0.182 (0.0278)	-0.124** (0.0520)	0.0140 (0.0200)	0.0154 (0.0110)	0.0569 (0.0536)	-0.0212 (0.0375)	-0.128** (0.0649)
(6) D prior licensee of P	0.229*** (0.0410)	0.294*** (0.0439)	-0.255*** (0.0394)	0.111*** (0.0319)	0.321*** (0.0455)	0.0246 (0.0280)	-0.103 (0.0199)	0.127*** (0.0333)	-0.0300 (0.0293)	-0.0862*** (0.0182)	-0.156*** (0.0326)	-0.215*** (0.0285)	0.278*** (0.0429)
(7) D technology user	-0.185** (0.0753)	0.00331 (0.0635)	-0.0807 (0.0597)	-0.0620*** (0.0218)	0.218*** (0.0790)	-0.110*** (0.0316)	-0.0356*** (0.0127)	0.0612*** (0.0226)	0.00933 (0.00721)	0.00212 (0.00579)	-0.0556 (0.0435)	-0.0608** (0.0284)	-0.0700** (0.0295)
(8) Technology in component	-0.0139 (0.0461)	-0.0931** (0.0433)	0.0421 (0.0433)	0.0824*** (0.0247)	-0.0489 (0.0526)	0.0925*** (0.0292)	-0.0493* (0.0262)	0.0609*** (0.0192)	-0.0405 (0.0222)	0.0200*** (0.00759)	-0.0513 (0.0365)	-0.0319 (0.0222)	0.0593* (0.0355)
(9) Log P's SEP portfolio size	0.0324** (0.0151)	0.00120 (0.0161)	0.0150 (0.00998)	0.00957** (0.00377)	0.00451 (0.00734)	-0.0100* (0.00547)	0.000824 (0.00302)	0.0459*** (0.0106)	-0.00742** (0.00354)	0.00322** (0.00137)	0.0221*** (0.00784)	0.00389 (0.00436)	0.0273*** (0.00666)
<i>Case characteristics</i>													
(10) Declaratory action	0.112** (0.0569)	-0.384*** (0.0597)	-0.0838 (0.0534)	0.437*** (0.0451)	-0.233*** (0.0477)	0.249*** (0.0344)	0.120*** (0.0345)	-0.106*** (0.0279)	0.0603 (0.0369)	0.116*** (0.0337)	0.152*** (0.0452)	0.0308 (0.0329)	0.185*** (0.0466)
(11) D answer count	0.0836*** (0.0130)	0.0253* (0.0143)	0.0459*** (0.0137)	0.000244 (0.00496)	0.110*** (0.0145)	0.0247*** (0.00723)	0.000490 (0.00304)	-0.207*** (0.00798)	0.0205*** (0.00494)	0.00852*** (0.00276)	0.0767*** (0.0105)	0.0424*** (0.00787)	0.0672*** (0.0109)
(12) MTD	0.438*** (0.0422)	0.197 (0.143)	0.0522 (0.0620)	0.401*** (0.108)	0.0484 (0.0858)	-0.0135 (0.0443)	0.0120 (0.00907)	-0.020 (0.0148)	0.0451 (0.0432)	-0.0902 (0.00962)	0.680*** (0.0791)	0.744*** (0.0715)	0.561*** (0.0432)
(13) MSJ	0.125*** (0.0267)	0.0673 (0.0466)	0.0984*** (0.0381)	-0.0190 (0.0294)	0.0108 (0.0294)	-0.0190 (0.0158)	-0.00770 (0.00580)	0.0872** (0.0404)	0.0325 (0.0169)	-0.0126** (0.00498)	0.00881 (0.0315)	0.0590** (0.0274)	0.0526 (0.0329)
(14) Case consolidated	0.0441 (0.0584)	-0.103** (0.0504)	0.290*** (0.0495)	-0.0203 (0.0179)	0.189*** (0.0396)	-0.0349* (0.0189)	-0.0213*** (0.00725)	-0.0298 (0.0182)	0.0211* (0.0154)	-0.0425 (0.0109)	-0.0425 (0.0263)	-0.0231 (0.0223)	-0.0597** (0.0271)
<i>Patent characteristics</i>													
(15) SEP in pool	-0.0317 (0.0352)	-0.192*** (0.0374)	-0.0278 (0.0322)	0.0832*** (0.0180)	-0.0636** (0.0305)	0.0977*** (0.0250)	0.00306 (0.0101)	-0.00646 (0.0154)	0.000817 (0.00634)	0.000563 (0.00420)	-0.000178 (0.0312)	0.0309** (0.0145)	0.0609** (0.0254)
(16) Patent reassigned	-0.0151 (0.0447)	-0.0864** (0.0393)	-0.0118 (0.0389)	-0.0348** (0.0144)	0.0771** (0.0300)	-0.0947*** (0.0201)	0.0196** (0.00857)	-0.0937*** (0.0253)	0.00812 (0.00851)	-0.00710 (0.00432)	0.121*** (0.0315)	0.0884*** (0.0224)	0.0481* (0.0288)
Case filing year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.286	0.580	0.302	0.540	0.271	0.377	0.105	0.314	0.093	0.124	0.338	0.375	0.471
Observations	1,781	1,781	1,781	1,781	1,781	1,781	1,781	1,781	1,781	1,781	1,781	1,781	1,781

**Notes:** Unit of observation at the patent-party-case level; OLS coefficients shown; robust standard errors clustered at the patent-level; \* significant at 10%, \*\* at 5%, \*\*\* at 1%; **Col. (1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **Col. (2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **Col. (3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **Col. (4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **Col. (5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **Col. (6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licenses? **Col. (7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **Col. (8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **Col. (9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **Col. (10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **Col. (11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPPU). **Col. (12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **Col. (13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

the while, these results suggest that our findings are driven by within-case variation, not unaccounted unobservables.

To provide a further check, we also present results in Table A-12 that rely exclusively on within-case variation. Since our data includes many instances in which an SEP enforcer filed a single complaint enforcing the same SEPs against multiple, independent defendants, we can examine variation in our measures of opportunistic behavior within the same case. While this approach has the advantage of eliminating case-level unobservables, it also presents a number of complexities. In addition to further reducing the sample size (so much so that we can no longer estimate the model for some measures of opportunistic behavior) and list of determinants, our focus is now also limited to a potentially unrepresentative subset of cases in which the SEP enforcer chose to pursue multiple parties at once. Moreover, patentees' ability to join multiple defendants in a single lawsuit was restricted by the America Invents Act which took effect in 2012. Consequently, this sample consists disproportionately of cases filed in 2010 through September 2012. All that said, and despite the fact that most coefficients have now lost their statistical significance, we note that the results shown in Table A-12 do not contradict and, in fact, generally agree with the results shown in Table 4.

Finally, in Tables A-13 and A-14 in the appendix, we report the results of a dif-in-dif approach that estimates the effect of three events that may have impacted opportunistic behavior. Our approach focuses on just two measures of opportunism: requests for injunctive relief in district court pleadings and the initiation of parallel ITC investigations. We limit our analysis to these two measures because they are both objective in nature (i.e., neither rely on allegations) and, more importantly, because both can be tied to a particular date. By contrast, all other measures are typically alleged to have taken place (or begun) at some indeterminate or unspecified time in the past.<sup>52</sup> Studying these measures also allows us to take advantage of the fact that, under U.S. law, operating technology companies (i.e., PEs) are far more likely than NPEs to obtain both injunctions (Seaman, 2016) and ITC exclusion orders<sup>53</sup> and, thus, are likely relatively more sensitive to events that impact the availability of these remedies. Accordingly, we rely on the PE/NPE distinction to establish our treatment (PE) and comparison (NPE) groups.

We estimate both groups' reaction to three events that may have impacted incentives to seek injunctive relief in U.S. SEP cases. In chronological order, we first examine (in column (1)) the impact of a [joint policy statement](#) released by the U.S. DOJ and USPTO in January 2013.<sup>54</sup> This statement (while vague) suggested that SEP enforcers should typically be denied injunctive relief because “[s]uch an order may harm competition and consumers by degrading one of the tools SDOs employ to mitigate the threat of such opportunistic actions by the holders of F/RAND-encumbered patents.”

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ciated in Table 3

<sup>52</sup>Consider the allegations quoted above in Section 4.4. While all provide specific details about the SEP enforcer's alleged behavior, none provide a specific date on which that behavior took place.

<sup>53</sup>See U.S. International Trade Commission, [Facts and Trends Regarding USITC Section 337 Investigations](#) (June 10, 2014).

<sup>54</sup>In December 2019, the DoJ and USPTO withdrew the 2013 policy statement. Unfortunately, because this event occurred at the very end of our sample period, we cannot include it in our analysis.



Table 4: Determinants of opportunistic behavior by SEP enforcer: comparison for same SEP enforcer across cases (2010-2019)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Any	Injunction	Untimely decl.	Overdecl.	Exhaust.	Discrim. lic.	Sue custom.	Lit. ITC	Lit. abroad	No discl.	EMVR/SSPPU	Comparable lic.	Other
<i>P/D characteristics</i>													
(1) D is both P and D	-0.0448 (0.0429)	0.00342 (0.0276)	-0.109*** (0.0381)	-0.0207 (0.0159)	-0.0163 (0.0609)	-0.00787 (0.0132)	0.000176 (0.0132)	0.0460*** (0.0152)	0.0251 (0.0203)	0.00824 (0.00663)	0.0441 (0.0317)	0.0312 (0.0247)	0.0176 (0.0296)
(2) P upstream of D	-0.130 (0.149)	-0.104 (0.193)	0.261 (0.255)	0.250*** (0.106)	0.439*** (0.137)	0.137 (0.0998)	0.0440 (0.0454)	0.0112 (0.117)	-0.112 (0.128)	0.0924 (0.0618)	0.338 (0.243)	0.0507 (0.230)	-0.293 (0.266)
(3) P and D competitors	-0.179 (0.143)	-0.322** (0.149)	-0.0737 (0.197)	0.196* (0.103)	0.0376 (0.124)	0.181* (0.104)	0.0529 (0.0464)	-0.148 (0.105)	0.00552 (0.0232)	0.103* (0.0619)	0.0927 (0.106)	-0.0908 (0.0699)	-0.122 (0.163)
(4) D prior licensee of P	0.0881 (0.0786)	0.217*** (0.0834)	-0.220*** (0.0843)	-0.0201 (0.0526)	0.319*** (0.106)	-0.0908 (0.0598)	-0.0153 (0.0493)	0.0630 (0.0495)	-0.00821 (0.0705)	-0.0557** (0.0255)	-0.303*** (0.0721)	-0.312*** (0.0703)	0.0175 (0.0887)
(5) D technology user	-0.0390 (0.0869)	0.000202 (0.0723)	0.0259 (0.0758)	-0.0109 (0.0235)	0.0641 (0.0679)	-0.0327 (0.0245)	-0.0143 (0.0255)	0.0340* (0.0195)	0.00665 (0.0126)	0.00665 (0.00665)	-0.0466 (0.0532)	-0.0315 (0.0469)	-0.0348 (0.0307)
(6) Technology in component	-0.126* (0.0733)	-0.106** (0.0478)	-0.105* (0.0589)	-0.0173 (0.0354)	-0.0341 (0.0605)	-0.00204 (0.0339)	-0.0445 (0.0351)	0.0465 (0.0311)	-0.0364 (0.0298)	0.00771 (0.00777)	-0.0293 (0.0683)	-0.0532* (0.0309)	-0.0254 (0.0431)
(7) Log P's SEP portfolio size	0.112** (0.0502)	0.0483 (0.0377)	0.0588* (0.0350)	-0.00177 (0.0184)	0.0481 (0.0405)	-0.0147 (0.0141)	0.0333** (0.0169)	-0.0437** (0.0171)	-0.00338 (0.0424)	0.0171 (0.0160)	0.110*** (0.0345)	0.0375 (0.0285)	0.103** (0.0432)
<i>Case characteristics</i>													
(8) Declaratory action	-0.168 (0.122)	-0.568*** (0.102)	-0.110 (0.0763)	0.166** (0.0728)	-0.161 (0.114)	0.0375 (0.0584)	0.168** (0.0853)	-0.102** (0.0489)	0.0853 (0.0733)	0.108* (0.0632)	0.131* (0.0752)	0.0700 (0.0610)	0.103 (0.0837)
(9) D answer count	0.0848** (0.0221)	0.00161 (0.0152)	0.0701*** (0.0201)	-0.00200 (0.00831)	0.104*** (0.0213)	0.0233** (0.0133)	0.000651 (0.00725)	-0.0102 (0.00862)	0.0242** (0.0118)	0.00689* (0.00499)	0.0361** (0.0141)	0.0303** (0.0118)	0.0582*** (0.0182)
(10) MTD	0.315*** (0.107)	-0.198** (0.0982)	0.190 (0.112)	0.342*** (0.124)	0.162 (0.145)	-0.00650 (0.0680)	0.0136 (0.0251)	1.63e-07 (0.0181)	0.124* (0.0702)	-0.00470 (0.0121)	0.453*** (0.123)	0.465*** (0.114)	0.480*** (0.104)
(11) MSJ	0.0506* (0.0260)	0.00560 (0.0156)	0.403 (0.255)	0.00335 (0.0160)	-0.0356 (0.0306)	-0.0111 (0.0203)	0.00187 (0.00801)	0.0593** (0.0295)	-3.89e-05 (0.0144)	-0.0115 (0.00588)	0.0638** (0.0324)	0.0997*** (0.0316)	0.0896*** (0.0305)
(12) Case consolidated	0.0147 (0.0648)	-0.0428 (0.0415)	0.168*** (0.0482)	0.000866 (0.0297)	0.142** (0.0562)	0.0207 (0.0311)	-0.0823 (0.0249)	-0.0208 (0.0197)	-0.00665 (0.0261)	0.00575 (0.0118)	-0.00440 (0.0313)	-0.0194 (0.0227)	-0.0262 (0.0372)
<i>Patent characteristics</i>													
(13) SEP in pool	0.0418 (0.0665)	0.0478 (0.0404)	-0.0374 (0.0566)	0.0249 (0.0243)	-0.0838* (0.0447)	-0.00370 (0.0295)	-0.00815 (0.0128)	-0.0218 (0.0216)	0.0313 (0.0288)	0.00793 (0.0274)	0.0896* (0.0509)	0.121** (0.0535)	0.0529 (0.0594)
(14) Patent reassigned	0.0547 (0.0499)	0.0281 (0.0305)	-0.000802 (0.0333)	-0.0520 (0.0376)	0.0427 (0.0431)	0.0120 (0.0251)	-0.0172 (0.0175)	-0.0270 (0.0373)	0.00410 (0.0149)	-0.00823 (0.00626)	0.133*** (0.0408)	0.121*** (0.0423)	-0.00575 (0.0382)
Case filing year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SEP enforcer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technology FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.487	0.855	0.593	0.475	0.430	0.427	0.235	0.525	0.314	0.199	0.515	0.553	0.581
Observations	828	828	828	828	828	828	828	828	828	828	828	828	828

**Notes:** Unit of observation at the patent-party-case level; OLS coefficients shown; robust standard errors clustered at the case-level, \* significant at 10%, \*\* at 5%, \*\*\* at 1%; **Col. (1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **Col. (2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **Col. (3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **Col. (4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **Col. (5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **Col. (6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licenses? **Col. (7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **Col. (8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **Col. (9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **Col. (10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **Col. (11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPPU). **Col. (12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **Col. (13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Thus, this statement can be expected to have reduced the frequency with which injunctions were requested in U.S. SEP cases. Next, we analyze the effect of two important decisions released by U.S. Courts of Appeal in columns (2) and (3). In April 2014 in *Apple v. Motorola*, the U.S. Court of Appeals for the Federal Circuit held that SEP-holder Motorola was not entitled to an injunction because “Motorola’s FRAND commitments, which have yielded many license agreements . . . strongly suggest that money damages are adequate to fully compensate Motorola for any infringement.”<sup>55</sup> Similarly, in July 2015 in *Microsoft v. Motorola*, the U.S. Court of Appeals for the Ninth Circuit affirmed a jury verdict finding that Motorola breached its FRAND commitments by seeking an injunction against SEP infringement in the case.<sup>56</sup> Both decisions were highly anticipated by the patent community and can also be expected to reduce injunction requests in SEP cases.

As shown in Table A-13, our results show large and highly statistically significant level-differences in the likelihood that NPEs and PEs request injunctive relief (between 26% and 32%), which supports the motivation underlying our definition of treatment and comparison groups. Moreover, as expected, we see a negative interaction term for the 2013 policy statement and both court decisions. However, only the negative effect of *Apple v. Motorola* is statistically significant. Table A-14 presents results for parallel ITC investigation. To the contrary, we see here a positive interaction term for two of the three events, and a statistically significant increase following the *Microsoft v. Motorola* decision. This suggests an increase in parallel ITC litigation by PE SEP owners relative to NPE SEP owners following the *Microsoft v. Motorola* decision. Because ITC investigations tend to serve as substitutes, rather than complements, for obtaining injunctive relief in court (Chien and Lemley, 2012), the positive effects that we observe here are consistent with the negative effects shown in Table A-13.

## 5.4 Opportunistic conduct and case outcomes

Finally, we conclude our analysis by considering the impact of opportunistic behaviors on case outcomes. We focus primarily on the relationship between our measures and settlement, both because settlement is by far the most common outcome that we observe and because the intended goal of most forms of opportunism that we study is arguably to induce accused infringers to accept the SEP enforcer’s royalty demands.

### 5.4.1 Empirical results

Table 5 cross-tabulates our measures of opportunistic behavior with overall case outcomes. In addition to presenting results for our entire sample of cases (in the five leftmost columns), we also present results for the subset of cases that were litigated to at least one responsive pleading by the accused infringer (the middle five columns), as well as results for the (even smaller) subset of cases that were litigated to a ruling on at least one substantive motion (the five rightmost columns).

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<sup>55</sup>757 F.3d 1286, 1332 (Fed. Cir. 2014).

<sup>56</sup>795 F.3d. 1024, 1045-47 (9th Cir. 2015).

First, comparing across these three sets of results, we see that cases resolved by a substantive ruling or trial (column (1)) exhibit a higher rate of opportunistic behavior than cases terminated on other grounds. To some extent this finding is driven by the fact that, as cases progress toward a substantive ruling, more information becomes available in the docket and, therefore, certain types of opportunistic behavior are more likely to be revealed (see discussion in Section 5.2 above). However, even when we condition on at least one substantive motion ruling (in the five rightmost columns), we see that cases terminated on the merits still exhibit the highest rate of aggressive behavior. Because settlement terms are almost always confidential, we cannot judge whether individual settlements were favorable to the SEP enforcer or the accused infringer and, thus, we cannot determine the extent to which settlements are driven by the strength of the SEP enforcer’s infringement allegations. Nonetheless, our findings raise the possibility that particularly aggressive behavior by SEP enforcers can induce accused infringers to respond with particularly aggressive defenses, which ultimately decrease the likelihood of settlement.

In Table 6, we report the share of decided NPE and PE cases that include each measure of opportunism. While it is prudent to interpret the statistics with caution due to the relatively small number of cases that did not settle, we observe here that decided cases reveal plenty of opportunistic behavior, especially by operating technology companies and regardless of whether the case is ultimately decided for or against the SEP enforcer. This suggests that, conditional on a case not settling, opportunistic behaviors have little effect on the SEP enforcer’s likelihood of winning the case, which again suggests that the principal objective of these behaviors is to influence settlement terms rather than the merits of the case.

We take a closer look at the connect between opportunistic behavior and settlement in Table 7. Here, we compare settled and decided cases, and drop all cases that were terminated on “other” grounds or remain ongoing. Table 7 presents the results from a linear probability model where the outcome is equal to one if the case settled (measured at the patent-party-case level). We present results for both the summary measure *any opportunistic behavior* (columns (1), (3), and (5)) and for the full set of remaining measures (columns (2), (4), and (6)). We also run the analysis with three different samples. First (in columns (1) and (2)), we restrict the sample to cases that were litigated for at least one year (measured as the difference between filing and termination date). Second (in columns (3) and (4)), we condition on the accused infringer filing at least one answer to the SEP enforcer’s infringement allegations. And third (in columns (5) and (6)), we condition on the defendant filing a second, amended answer to the infringement allegations. We use these three samples to ensure that our results are derived from cases in which the accused infringer mounted a meaningful defense, as well as to mitigate the fact that information on opportunistic behavior is often revealed as a case progresses.

Results for our summary measure are only statistically significant in the sample of cases in which the accused infringer filed an amended answer (column (5)), and in that sample, the measure is positively associated with settlement. Our results for the full set of measures (columns (2), (4), and (6)) show that they are jointly significant in all three samples, meaning that these measures affect the decision to settle in combi-

Table 5: Opportunistic behavior by SEP enforcer by case outcome (2010-2019)

	All														
	D Response					MSJ/MTD									
	Substantive Ruling (1)	Non-substantive Ruling (2)	Settled (3)	Other (4)	Ongoing (5)	Substantive Ruling	Non-substantive Ruling	Settled	Other	Ongoing	Substantive Ruling	Non-substantive Ruling	Settled	Other	Ongoing
1	100	84.31	74.66	29.41	68.78	100	84.31	80.83	35.71	75.73	100	54.54	93.92	0	100
2	72.82	17.64	48.15	29.41	24.33	72.52	17.64	48.75	35.71	26.03	66.66	18.18	43.92	0	52.94
3	19.56	10.45	20.91	0	19.04	19.78	10.45	25.31	0	21.30	22.91	36.36	47.66	0	11.76
4	9.78	51.63	5.59	0	2.64	9.89	51.63	6.77	0	2.95	12.50	0	8.41	0	0
5	21.73	26.79	23.85	0	3.70	21.97	26.79	28.87	0	4.14	20.83	9.09	34.11	0	23.52
6	3.26	49.67	4.93	0	4.76	3.29	49.67	5.97	0	5.32	0	9.09	5.60	0	0
7	0	3.26	1.54	0	0	0	3.26	1.87	0	0	0	0	0.46	0	0
8	3.26	0	5.74	0	6.87	3.29	0	5.43	0	7.69	6.25	0	3.27	0	52.94
9	2.17	0.65	1.32	0	3.17	2.19	0.65	1.60	0	3.55	0	0	2.33	0	23.52
10	0	0	1.25	0	0	0	0	1.51	0	0	0	0	0	0	0
11	58.69	7.84	10.38	0	30.68	59.34	7.84	12.56	0	34.31	45.83	9.09	20.56	0	11.76
12	57.60	2.61	5.96	0	5.82	58.24	2.61	7.21	0	6.50	47.91	18.18	17.75	0	23.52
13	41.30	51.63	14.94	5.88	21.69	41.75	51.63	18.09	7.14	24.26	39.58	0	19.62	0	82.35
Total cases	92	153	1,358	17	189	91	153	1,122	14	169	48	11	214	8	17

**Notes:** Unit of observation at the patent-party-case level; *D response*: only cases where the defendant filed at least one response to the complaint; *MSJ/MTD*: only cases where at least one motion, a motion to dismiss and/or a motion for summary judgment was filed; **1**) In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2**) In the complaint (or counterclaim) did the patent enforcer request an injunction? **3**) Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4**) Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5**) Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6**) Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7**) Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8**) Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **9**) Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10**) Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11**) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPU). **12**) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13**) Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table 6: Opportunistic behavior by SEP enforcer by overall win/loss outcome (2010-2019)

	P win		D win	
	PE	NPE	PE	NPE
	(1)	(2)	(3)	(4)
1 Any opportunistic behavior	100	100	100	66.32
2 Injunction	100	45.83	100	35.71
3 Untimely declaration	0	12.50	12.90	27.55
4 Overdeclaration	0	0	9.67	6.12
5 Exhaustion	12.50	4.16	70.96	21.42
6 Discriminatory license	0	0	9.67	6.12
7 Threats to sue customers	0	0	0	0
8 Parallel ITC litigation	0	8.33	0	1.02
9 Relevant litigation abroad	0	0	0	0
10 No disclosure	0	0	0	0
11 EMVR vs. SSPUU	100	45.83	48.38	13.26
12 Prior licenses not comparable	87.50	70.83	48.38	9.18
13 Other	100	8.33	29.03	10.20
Total cases	16	24	31	98

**Notes:** PE: practicing entity; NPE: non-practicing entity. Unit of observation at the patent-party-case level; **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation?; **9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

nation. Looking across all three samples, we see that while requesting an *injunction* in pleadings does not appear to have a statistically significant effect on settlement, pursuit of an importation ban in *parallel ITC litigation* and injunctive relief in *relevant litigation abroad* both have a significant positive effect on settlement. This may indicate that accused infringers view the ITC and foreign patent litigation, but not U.S. district courts, as posing a credible threat of an eventual disruption to sales.<sup>57</sup> Untimely declaration, discriminatory license, threats to sue customers, and no disclosure are all positively associated with settlement as well. At the same time, *overdeclaration*, *exhaustion*, *EMVR vs. SSPUU*, and *prior licenses not comparable* are negatively associated with settlement. These results may indicate that, while some behaviors are successful at inducing settlement, others tend to impede settlement. We also note that all four variables with a negative effect on settlement — *overdeclaration*, *exhaustion*, *EMVR vs. SSPUU*, and *prior licenses not comparable* — are intended to have a direct effect on the royalty base and rate used to calculate how much the accused infringer owes.

Here, as in Section 5.3, we can additionally rely on within technology and SEP enforcer variation to mitigate concerns over unobservables. These results, shown in Table 8, do differ somewhat from the results in Table 7. Namely, our summary measure is no longer statistically significant in column (5) and, moreover, its coefficient is close to zero. That said, our remaining measures remain jointly significant in columns (2), (4), and (6). Among individual measures, the main difference we see is that alleged entitlement to an *injunction* and *threats to sue customers* are now significantly, and negatively, associated with settlement. However, *discriminatory license*, *parallel ITC litigation*, and *no disclosure* all continue to have a statistically significant, positive association with settlement, and *EMVR vs. SSPUU* continues to have a significant, negative association. All other measures lose their statistical significance. Despite this and the differences identified above, our results still suggest that opportunistic conduct affects settlement and also that different types of opportunistic behavior can have opposing effects on settlement.

#### 5.4.2 Theoretical model

To gain more insight into the effect of opportunism on settlement and explain why different opportunistic behaviors can have different effects on settlement, we construct a simple model of SEP litigation. In this model, an SEP enforcer making a settlement demand to an accused infringer faces a tradeoff between a high settlement amount and a high probability that the demand be accepted. Our main result is that opportunistic behavior by the SEP enforcer may tilt this tradeoff in one direction or the other. Specifically, and consistently with our empirical results, we find that behaviors that primarily increase the accused infringer’s litigation costs tend to increase the settlement rate, while behaviors that primarily increase the accused infringer’s loss in case settlement fails and the SEP enforcer prevails in court tend to decrease the settlement rate. We first describe our setting and compute the relevant equilibrium variables and then analyze the impact of opportunistic conduct on the settlement rate.

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<sup>57</sup>Indeed, we observed only a single case in which an SEP enforcer even filed a motion for a preliminary injunction and zero cases in which a permanent injunction was awarded after trial.

Table 7: Opportunistic behavior by SEP enforcer (at the patent-party-level) and case outcomes (2010-2019)

		Settlement (0/1)					
		Litigation $\geq$ 1 year		$\geq$ 1 answer by D		$\geq$ 2 answer by D	
		(1)	(2)	(3)	(4)	(5)	(6)
1	Any opportunistic behavior	-0.0598 (0.0434)		-0.0315 (0.0310)		0.228*** (0.0767)	
2	Injunction		-0.0390 (0.0544)		-0.00125 (0.0386)		0.0941 (0.0630)
3	Untimely declaration		0.0563* (0.0341)		0.0488* (0.0254)		0.179*** (0.0453)
4	Overdeclaration		-0.319*** (0.123)		-0.152** (0.0695)		-0.0830 (0.0852)
5	Exhaustion		-0.00745 (0.0357)		-0.0464* (0.0265)		-0.117** (0.0463)
6	Discriminatory license		0.0129 (0.0909)		-0.0468 (0.0607)		0.395*** (0.0597)
7	Threats to sue customers		-0.0733 (0.160)		0.158** (0.0706)		0.0179 (0.0984)
8	Parallel ITC litigation		0.325*** (0.0815)		0.163*** (0.0512)		0.190** (0.0952)
9	Relevant litigation abroad		0.224* (0.120)		0.267*** (0.0990)		0.144 (0.119)
10	No disclosure		0.296** (0.132)		0.0634 (0.0741)		-0.0947 (0.123)
11	EMVR vs. SSPUU		0.143 (0.110)		0.0538 (0.0701)		-0.261** (0.115)
12	Prior licenses not comparable		-0.490*** (0.0926)		-0.491*** (0.0832)		-0.114 (0.109)
13	Other		0.0245 (0.0654)		0.0256 (0.0485)		-0.0131 (0.0684)
	Covariates	Yes	Yes	Yes	Yes	Yes	Yes
	Case filing year	Yes	Yes	Yes	Yes	Yes	Yes
	F-test		11.90		9.25		9.68
	R <sup>2</sup>	0.308	0.408	0.292	0.384	0.263	0.378
	Observations	1,027	1,027	1,345	1,345	583	583

**Notes:** Unit of observation at the patent-party-case level; OLS coefficients shown; robust standard errors clustered at the patent-level; \* significant at 10%, \*\* at 5%, \*\*\* at 1%; **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **9)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **10)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **12)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table 8: Opportunistic behavior by SEP enforcer (at the patent-party-level) and case outcomes: comparison for same SEP enforcer across cases (2010-2019)

		Settlement (0/1)					
		Litigation $\geq 1$ year		$\geq 1$ answer by D		$\geq 2$ answer by D	
		(1)	(2)	(3)	(4)	(5)	(6)
1	Any opportunistic behavior	-0.0770 (0.0590)		-0.0539 (0.0456)		-0.00141 (0.175)	
2	Injunction		-0.305** (0.147)		-0.0952 (0.0851)		-0.0783 (0.198)
3	Untimely declaration		0.0132 (0.0687)		0.0307 (0.0655)		-0.0496 (0.140)
4	Overdeclaration		-0.118 (0.177)		-0.0858 (0.124)		0.366 (0.238)
5	Exhaustion		-0.00525 (0.0347)		-0.0401 (0.0342)		-0.131 (0.0812)
6	Discriminatory license		0.534** (0.207)		0.217 (0.140)		0.714*** (0.201)
7	Threats to sue customers		-0.503 (0.352)		-0.130 (0.143)		-0.340* (0.180)
8	Parallel ITC litigation		0.387*** (0.104)		0.271*** (0.0959)		0.0986 (0.147)
9	Relevant litigation abroad		-0.0516 (0.189)		0.144 (0.189)		-0.315 (0.278)
10	No disclosure		0.408 (0.275)		0.193* (0.117)		-0.0361 (0.245)
11	EMVR vs. SSPUU		-0.252 (0.267)		-0.192 (0.218)		-0.459* (0.259)
12	Prior licenses not comparable		-0.0266 (0.219)		-0.171 (0.192)		0.0619 (0.243)
13	Other		0.000656 (0.133)		0.0301 (0.0930)		0.136 (0.122)
	Covariates	Yes	Yes	Yes	Yes	Yes	Yes
	Case filing year	Yes	Yes	Yes	Yes	Yes	Yes
	SEP enforcer FE	Yes	Yes	Yes	Yes	Yes	Yes
	Technology FE	Yes	Yes	Yes	Yes	Yes	Yes
	F-test		5.29		4.24		3.75
	R <sup>2</sup>	0.404	0.486	0.346	0.405	0.372	0.504
	Observations	491	491	668	668	248	248

**Notes:** Unit of observation at the patent-party-case level; OLS coefficients shown; robust standard errors clustered at the case-level; \* significant at 10%, \*\* at 5%, \*\*\* at 1%; **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **9)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **10)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **12)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?



**Setting.** Consider an SEP enforcer (plaintiff)  $P$  and an accused infringer (defendant)  $D$ . Denote  $c_P$  and  $c_D$  the litigation costs of the SEP enforcer and the accused infringer, respectively,  $\theta$  the probability that the court finds that the patent is infringed, and  $\alpha$  the probability that the patent's validity is upheld by the court. If the court finds that the patent is invalid, the SEP enforcer incurs a loss  $l_P$ .<sup>58</sup> If the court finds that the patent is valid and infringed, the accused infringer incurs a loss  $l_D$ . For the sake of simplicity, let us assume that the SEP enforcer's gain if the patent is found valid and infringed is also equal to  $l_D$ . This is for instance the case if  $l_D$  is the amount of damages paid by the accused infringer to the SEP enforcer. If the court finds that the patent is valid but not infringed, we assume that neither the accused infringer nor the SEP enforcer are affected by this decision. The probability of infringement  $\theta \in (\underline{\theta}, \bar{\theta}]$  is known to the accused infringer while the SEP enforcer only knows that it is drawn from a uniform distribution over an interval  $[\underline{\theta}, \bar{\theta}]$ .

Consider the following game:

**Stage 1:**  $P$  makes a take-it-or-leave-it settlement demand to  $D$ .

**Stage 2:**  $D$  decides whether to accept the demand. If it is accepted, the game ends; otherwise  $P$  and  $D$  incur litigation costs  $c_P$  and  $c_D$ , and court decisions regarding infringement, and validity are handed down.<sup>59</sup>

Note that we implicitly assume that the SEP enforcer's litigation threat is always credible,<sup>60</sup> which is standard in the economic literature on settlement.<sup>61</sup>

**Accused infringer's decision.** The accused infringer accepts to pay a settlement amount  $S$  if and only if

$$S \leq \alpha\theta l_D + c_D$$

or, equivalently, if and only if

$$\theta \geq \tilde{\theta}(S) \equiv \frac{S - c_D}{\alpha l_D}.$$

As expected, the higher the settlement amount, the lower the probability that the settlement demand is accepted by the accused infringer.

**SEP enforcer's decision.** The SEP enforcer knows that a demand  $S$  will be accepted by the accused infringer with probability  $\frac{\bar{\theta} - \tilde{\theta}(S)}{\bar{\theta} - \underline{\theta}}$  and turned down with probability  $\frac{\tilde{\theta}(S) - \underline{\theta}}{\bar{\theta} - \underline{\theta}}$ . In the latter scenario, the SEP enforcer's probability of winning (i.e., the probability that

<sup>58</sup>For instance, the SEP enforcer may incur losses because the current licensees may stop paying license fees.

<sup>59</sup>We assume that the accused infringer challenges the patent's validity, which is typically the case in practice.

<sup>60</sup>This holds if  $\underline{\theta} \geq \frac{c_P + (1-\alpha)l_D}{\alpha l_D}$ .

<sup>61</sup>For a survey see for example Spier (2007). A notable exception is Nalebuff (1987).

the patent is found valid and infringed) is  $\alpha \frac{\tilde{\theta}(S) + \underline{\theta}}{2}$ . Thus, the SEP enforcer's expected payoff is given by

$$G(S) = \frac{\bar{\theta} - \tilde{\theta}(S)}{\bar{\theta} - \underline{\theta}} S + \frac{\tilde{\theta}(S) - \underline{\theta}}{\bar{\theta} - \underline{\theta}} \left[ -c_p + \alpha l_D \frac{\tilde{\theta}(S) + \underline{\theta}}{2} - (1 - \alpha) l_p \right].$$

The first-order condition with respect to  $S$  gives the equilibrium settlement amount:

$$S^* = \alpha l_D \bar{\theta} - c_p - (1 - \alpha) l_p, \quad (1)$$

assuming that the parameters are such that this amount is positive. We find that  $S^*$  increases with  $l_D$  and  $\alpha$  and decreases with  $c_p$  and  $l_p$ , which is consistent with the intuition that the settlement amount should increase if the SEP enforcer's (resp., accused infringer's) payoff absent settlement increases (resp., decreases).

**Settlement rate.** Denoting  $\theta^* = \tilde{\theta}(S^*)$ , we have

$$\theta^* = \bar{\theta} - \frac{c_p + c_D + (1 - \alpha) l_p}{\alpha l_D}, \quad (2)$$

assuming that the parameters are such that  $\theta^* \in (\underline{\theta}, \bar{\theta}]$ . We can now compute the equilibrium settlement rate, i.e., the probability that the equilibrium settlement demand is accepted:

$$r^* = \frac{\bar{\theta} - \theta^*}{\bar{\theta} - \underline{\theta}} = \frac{1}{\bar{\theta} - \underline{\theta}} \frac{c_p + c_D + (1 - \alpha) l_p}{\alpha l_D} = \frac{1}{\bar{\theta} - \underline{\theta}} \frac{\Delta}{A}$$

where  $\Delta \equiv c_p + c_D + (1 - \alpha) l_p$  is the joint surplus generated by settlement, and  $A \equiv \alpha l_D$  is a measure of the extent of adverse selection: It becomes more costly for the SEP enforcer to separate defendant types when  $A$  increases.<sup>62</sup> The equilibrium settlement rate is higher when the joint surplus from settlement is higher and is lower when the adverse selection problem faced by the SEP enforcer is more severe.

**Impact of opportunistic conduct on the settlement rate.** An SEP enforcer can rely on a variety of opportunistic conduct to place pressure on an accused infringer in order to increase the expected monetary transfer from the latter to the former. In our simple framework, such a conduct would lead to an increase in the accused infringer's litigation costs  $c_D$  and/or an increase in her loss  $l_D$  in case settlement fails and the SEP enforcer prevails in court (i.e. the patent is found valid and infringed). Therefore, it could yield an increase in the joint surplus from settlement  $\Delta$  and/or an increase in the extent of adverse selection  $A$ . Since  $\Delta$  and  $A$  have opposite effects on the settlement rate, the net impact of a given opportunistic behavior is ambiguous in general. Specifically, it depends on the effect of the behavior on the ratio  $\Delta/A$ .

In particular, our model shows that opportunistic behaviors that primarily affect the accused infringer's litigation costs tend to have a positive effect on the settlement rate.

<sup>62</sup>To see why, notice that the informational rent that an SEP enforcer leaves to defendants that have a type above the borderline type  $\tilde{\theta}(S)$  is  $\alpha \theta l_D + c_D - S = \theta A + c_D - S$ , which is increasing in  $A$ .

This may explain why behaviors such as *threats to sue customers*, *parallel ITC litigation*, and *relevant litigation abroad* are positively associated with settlement. In contrast, opportunistic behaviors that primarily affect the accused infringer’s loss if settlement fails and the SEP enforcer prevails in court tend to have a negative effect on the settlement rate. This is in-line with our empirical finding that behaviors that directly affect the royalty base and rate are negatively associated with settlement, notably *overdeclaration*, *exhaustion*, *EMVR vs. SSPUU*, and *prior licenses not comparable*.

## 6 Conclusion

We contribute to the literature on SEP licensing by quantifying the prevalence of opportunistic behaviors (or allegations thereof) revealed in the dockets of all U.S. district court cases filed 2010-2019 to enforce declared SEPs. Despite well recognized deficiencies in the empirical literature surrounding SEP holdup, scholars have to date failed to take full advantage of information available in public filings. We aim to fill this gap in our understanding of SEP licensing.

Overall, we find evidence of opportunistic behavior by the SEP enforcer in approximately 75% of patent-party level SEP assertions. In addition, across almost all measures of opportunism that we explore, we find that such behavior is revealed more often in cases brought by operating technology companies than cases brought by NPEs.

While it is true that many of our measures of opportunistic behavior are based on allegations by accused infringers, we strictly limit our data to allegations of strategic behavior that are supported by specific factual statements. Moreover, by combining our measures with detailed information on litigants and case outcomes, we make a number of additional findings that support the general veracity of accused infringers’ pleadings. In addition, while we do not claim that the presence of any behavior that we observe constitutes *per se* empirical proof of holdup, our examination of factors that correlate with the different opportunistic behaviors links our analysis to the theoretical literature on patent holdup, and we note that opportunistic behaviors are likely to be particularly effective in the SEP licensing context due to a general lack of adequate substitutes to standardized technology.

Finally, we explore whether our measures of strategic behavior affect case outcomes. Interestingly, our empirical findings show that opportunistic behaviors have mixed effects on settlement. We provide a theoretical explanation for these results based on the distinction between behaviors that mainly aim at increasing the accused infringer’s litigation costs and those that primarily increase the accused infringer’s loss in case settlement fails and the SEP owner prevails in court. While we cannot make claims about the welfare effects of opportunistic behaviors by SEP holders based on our analysis, we believe that the distinction above may also matter for those effects.

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# Online Appendix

## A Appendix: Technology and Product Classifications

Each patent-party-level infringement claim in our data is classified according to:

- (i) The type of standardized technology or technologies that are allegedly covered by the patent enforcer's rights;
- (ii) The specific product(s) or service(s) in which the accused infringer has allegedly incorporated those technologies.

In this Appendix, we explain our classification methodology in greater detail.

### Technology Classifications

To classify the standardized technology at issue in each case, we adopted the two-level taxonomy shown below. By far, the two most common classifications in our data are “compression/encoding” and “wireless communication.” The “compression/encoding” category includes standardized technologies for coding (and decoding) data, generally in a compressed form, for storage or transmission over a network. At the second level of categorization, we distinguish among standards for encoding/compressing images (e.g., JPEG), videos (e.g., MPEG-4), voice (e.g., Enhanced Voice Services), other audio (e.g., MP3), text messages (e.g., Multimedia Messaging Service), and data for storage on discs (e.g., Blu-ray). “Wireless communication” comprises standards for the transmission of data on a wireless network. Given the composition of cases in our data, we further distinguish among standards for transmission over a cellular network (e.g., CDMA, GSM, and LTE), over a Wi-Fi network (i.e., the IEEE 802.11 family of standards), or using another technology such as Bluetooth.

A majority of the remaining categories also relate directly to data transmission over a network. Our “media broadcast” category covers standards for the broadcast of audio and/or video data, including both digital television (e.g., ATSC standards) and digital radio (e.g., satellite radio) transmission. Next, our “wired communication” category includes standards for data transmission over physical connections like wires or cables. In our data this category is limited to cases involving digital subscriber line (DSL) technology and fiber optics. Finally, our “virtual private network” category, which covers technology for extending a private network across a public network, is composed solely of cases filed by VirnetX.

Our remaining two categories have a much more indirect link to networking. We define “near field communication” standards as those governing the exchange of data over very short distances when a “tag” is exposed to an electromagnetic field. In our data, all such cases involve radio-frequency identification (RFID) technology. Similarly, our “mobile code” classification is composed entirely of cases involving a single technology: Quick Response (QR) codes.

Finally, we note that individual patents are commonly declared essential to multiple standards, and sometimes those standards span our classifications. For all “multiply-declared” patents, we consulted the pleadings filed in each case, and the allegations pled against each accused infringer, and classified each patent-party-level assertion according to the specific technology identified in the case. Only very rarely did an individual patent-party-level assertion concern more than one standardized technology.

Our technology classification:

- Compression/encoding:
  - image
  - video
  - voice
  - audio
  - text
  - disc
- Media broadcast:
  - digital television
  - digital radio
- Mobile code
- Near field communication
- Virtual private network
- Wired communication:
  - digital subscriber line
  - fiber optic
- Wireless communication:
  - cellular
  - WiFi
  - other

## Product and Service Classifications

For each patent-party-level assertion we classified the specific product(s) or service(s) in which each standardized technology was allegedly incorporated. We categorized products and services using the taxonomy shown below.

Though the categories are largely self-explanatory, we provide a few additional notes here. First, the category “mobile device” includes smartphones and tablet computers, as well as (in a small number of cases) smartwatches and MP3 players (such as the Apple iPod). By contrast, our definition of “computer” is limited to laptop and desktop computers, our definition of “telephone” is limited to desktop phones with a wired (landline or VoIP connection) connection, and our definition of “camera” is limited to standalone still and/or video cameras. Our definition of “network hardware” includes (standalone) modems, routers, and gateways (most commonly), as well as base stations, access points, nodes, and session border controllers. In addition to chips, chipsets, and wireless modules, our definition of “component chip/module/card” includes a few additional items, including server blades and modem “sticks,” that were designed to be incorporated into a larger end product. Our “Internet of things” category includes both one case involving automotive technology and two cases involving “smart home” products. Finally, a single accused infringer was commonly alleged to sell more than one product or service, in which case we include the relevant patent-party-level infringement allegations in both categories with two exceptions: (i) when infringement was alleged in both a computing device and software that can only run on that computer device (such as Apple devices and Apple software), we classified the case according to the computer device and did not additionally classify it as a “software product” case, and (ii) when a wireless service provider that sells mobile devices was sued alongside mobile device manufacturers, we did not classify allegations against the wireless service provider in the “network/internet/wireless service provider” category, and not additionally in the “mobile device” category.

The resulting product categories are:

- Mobile device
- Network/internet/wireless service provider
- Network hardware
- Computer
- Component chip/module/card
- Software product
- Media service provider
- Set-top box/DVR/video disc player
- Television
- Telephone



- Camera
- Copier/scanner/printer
- Game console
- Internet of things
- Video disc
- Website/advertisement
- Other

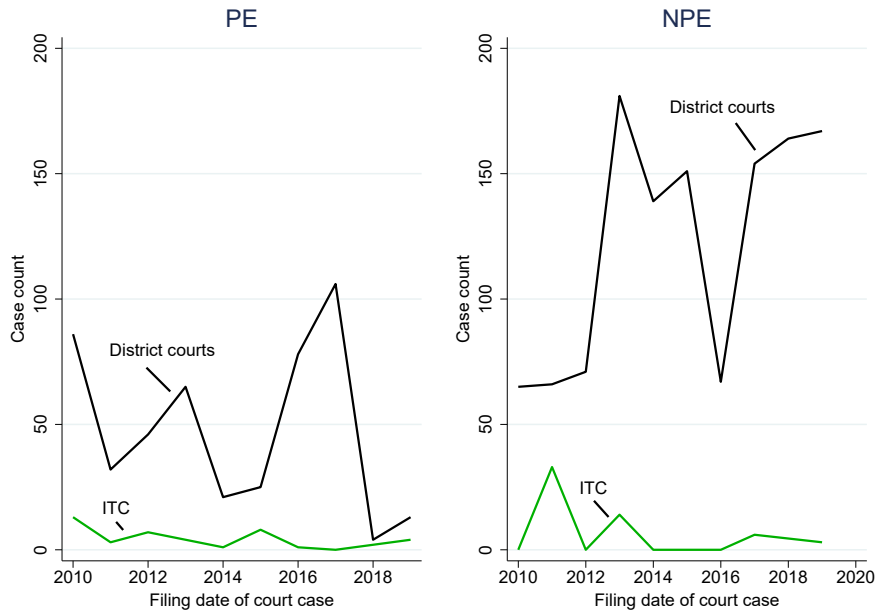
## B Appendix: Variables

In this Appendix we provide an overview of the variables used in the regression analysis:

- **P is NPE:** = 1 if the plaintiff is an NPE.
- **P is both P and D:** = 1 if the plaintiff appears as both plaintiff and defendant in our dataset of SEP court cases between 2010 and 2019.
- **D is both P and D:** = 1 if the defendant appears as both plaintiff and defendant in our dataset of SEP court cases between 2010 and 2019.
- **P upstream of D:** = 1 if the plaintiff is upstream of the defendant.
- **P and D competitors:** = 1 if the plaintiff and defendant are product market competitors.
- **D prior licensee of P:** = 1 if the plaintiff and defendant had a prior licensing agreement.
- **D technology user:** = 1 if the defendant use the infringing technology to sell something (significantly) unrelated, = 0 if the defendant sell the infringing technology.
- **Technology in component:** = 1 if the infringement substantially occurs in a component of the accused product, or the infringement occurs in some product/service that the defendant buys from an upstream vendor; = 0 if the accused product is, itself, a component.
- **Log P's SEP portfolio size:** log of plaintiff's SEP portfolio size. The portfolio size takes into account all declared SEPs assigned to the plaintiff at the time of the filing date of the court case, i.e. the portfolio size measure varies over time as SEP owners buy and sell SEPs.
- **Declaratory action:** = 1 if the case is a declaratory action as opposed to an infringement action.
- **D answer count:** count of answers filed by the defendant.
- **MTD:** = 1 if a motion to dismiss was filed.
- **MSJ:** = 1 if a motion for summary judgment was filed.
- **Case consolidated:** = 1 is several separate court cases were consolidated by the court into a single case.
- **SEP in pool:** = 1 is SEP is part of a patent pool.
- **Patent reassigned:** = 1 if the patent has been re-assigned at least once at any point between independent entities.

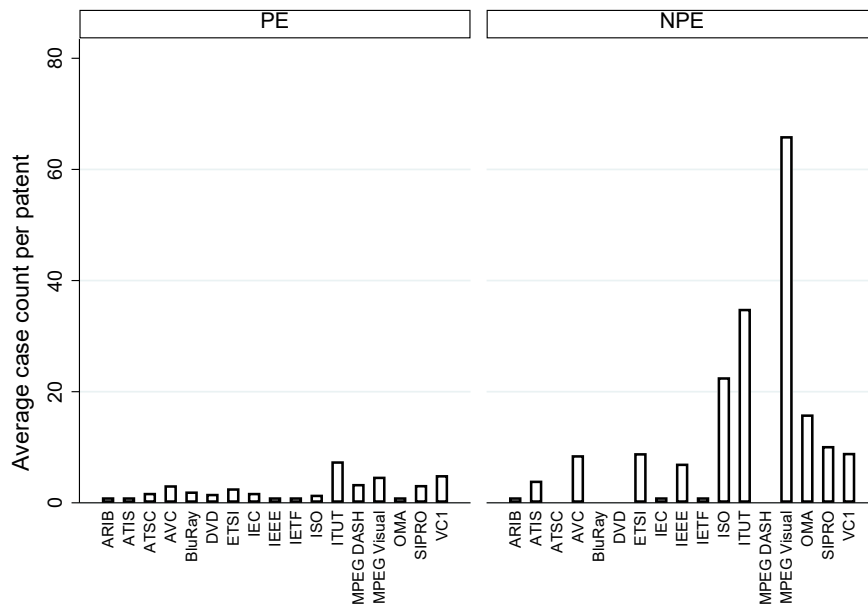
## C Appendix: Figures

Figure A-1: Number of court and ITC cases of SEPs and other patents by NPE status (2010-2019)



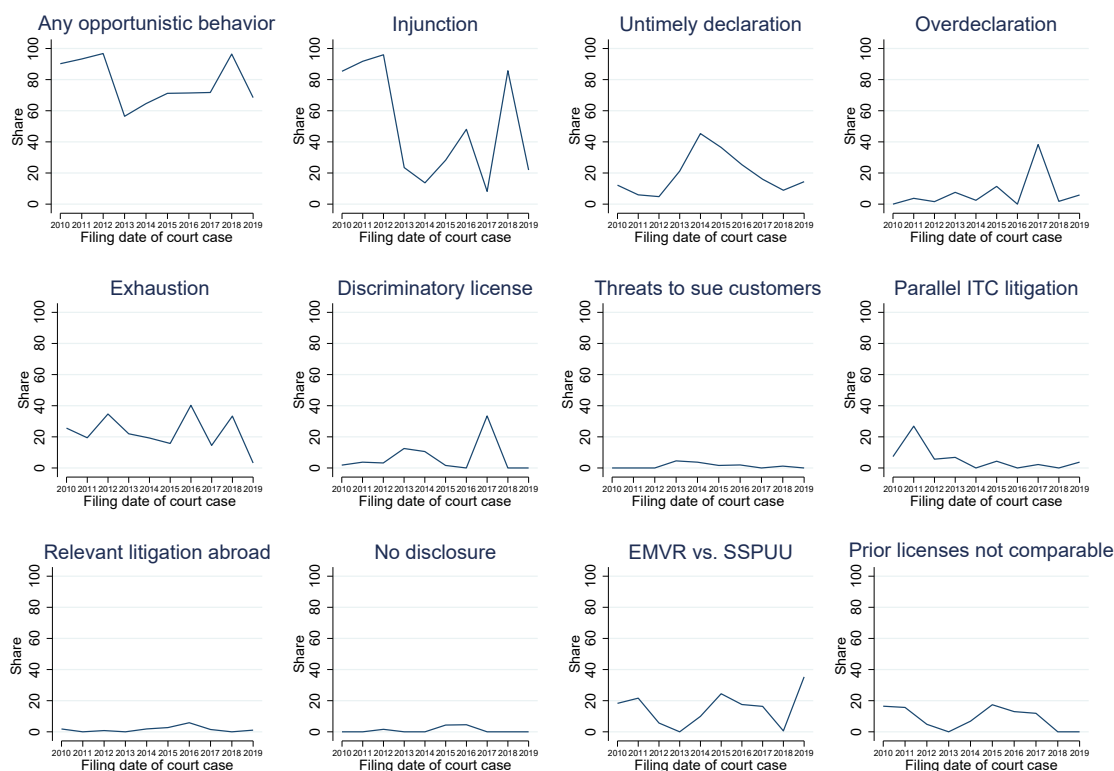
**Note:** PE: practicing entity; NPE: non-practicing entity. The graph shows the number of cases (at the patent-party-level) that involve SEPs between 2010 and 2019.

Figure A-2: Average number of court cases (at the patent-party-level) per SEP by SSO and NPE status (2010-2019)



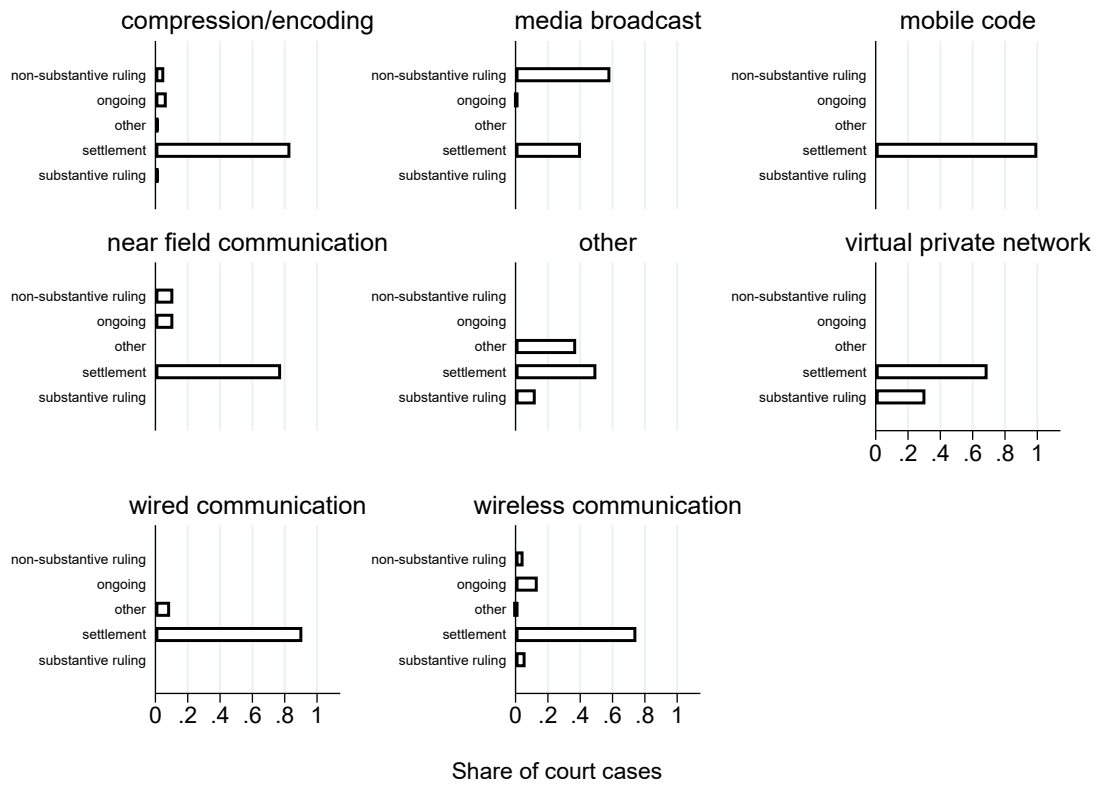
**Note:** PE: practicing entity; NPE: non-practicing entity. The graph shows the number of cases that involve SEPs per SSO to which the patents were declared standard-essential and NPE status of the enforcing entity between 2010 and 2019.

Figure A-3: Opportunistic behavior by SEP enforcers over time (2010-2019)



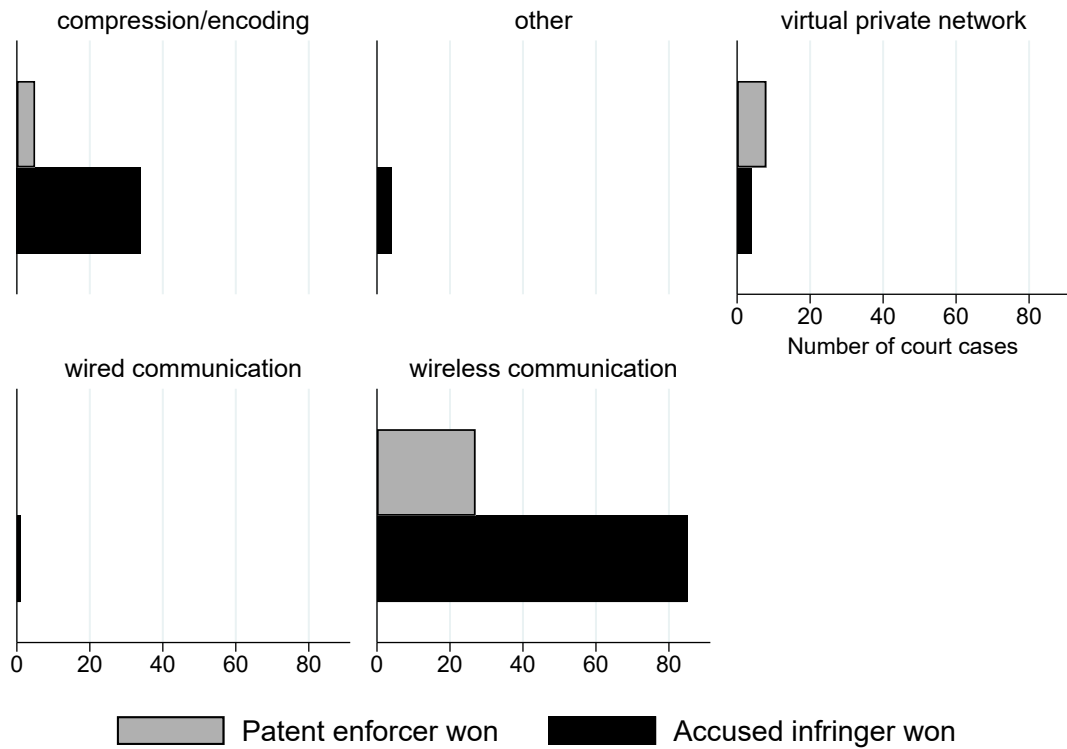
**Notes:** Share: share of all cases (at the patent-party-case level) that allege opportunistic conduct; **Any opportunistic behavior:** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **Injunction:** In the complaint (or counterclaim) did the patent enforcer request an injunction? **Untimely declaration:** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **Overdeclaration:** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **Exhaustion:** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **Discriminatory license:** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **Threats to sue customers:** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **Parallel ITC litigation:** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **Relevant litigation abroad:** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **No disclosure:** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **EMVR vs. SSPUU:** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **Prior licenses not comparable:** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc).

Figure A-4: Case outcomes of SEPs and by allegedly infringing technology (2010-2019)



**Note:** The graph shows outcomes at the patent-party-case level for cases that involve SEPs by allegedly infringing technology between 2010 and 2019.

Figure A-5: Overall win/loss case outcomes (at the patent-party-level) of SEPs by allegedly infringing technology (2010-2019)



**Note:** The graph shows overall win/loss outcomes at the patent-party-case level for cases that involve SEPs by allegedly infringing technology between 2010 and 2019.

## D Appendix: Tables

Table A-1: Top-20 SEP asserting entities by NPE status (2010-2019)

Rank	Name	NPE	# Cases	Share
1	Acacia	1	286	15.80
2	Fineur International	1	179	9.89
3	Sol IP	1	135	7.46
4	Ericsson	0	75	4.14
5	SPH America	1	69	3.81
6	WiLan Quarterhill	1	68	3.75
7	Princeton Digital	1	66	3.64
8	Interdigital	1	60	3.31
8	LG Electronics	1	60	3.31
9	Multimedia Patent Trust	0	54	2.98
10	FastVDO	1	50	2.76
11	Huawei	0	46	2.54
12	Intellectual Ventures	1	45	2.48
13	Evolved Wireless	1	43	2.37
14	Samsung	0	41	2.26
15	Virnetx	1	39	2.15
16	Neomedia	1	37	2.04
16	Helferich Patent Licensing	1	37	2.04
17	Brevet Capital	1	32	1.76
18	Philips	0	29	1.60
19	Nokia	0	28	1.54
20	EVS Codec	1	25	1.38
20	AIM IP	1	25	1.38
Total			1,529	84.52
		1	1,196	66.11
		0	333	18.40

**Notes:** NPE: non-practicing entity. The table shows the number of court cases (at the patent-party-case level) and the corresponding share of total assertions between 2010-2019 by asserting party and NPE status.



Table A-2: Top-20 defendants (2010-2019)

Rank	Name	# Cases	% Share
1	Apple	127	7.02
2	AT&T	80	4.42
2	ZTE	80	4.42
3	Ericsson	78	4.43
4	Samsung	77	4.25
5	Haier	70	3.86
6	Verizon	69	3.81
6	Nokia	69	3.81
7	Sprint	68	3.75
8	T-Mobile	67	3.70
9	LG Electronics	57	3.15
10	Huawei	56	3.09
11	HTC	38	2.10
12	Lenovo	36	1.99
13	Microsoft	29	1.60
14	Motorola	28	1.54
14	Blackberry	28	1.54
15	Dell	27	1.49
16	Sony	26	1.43
17	Blu Products	24	1.32
18	Amazon	21	1.16
19	Toshiba	16	0.88
20	Netgear	15	0.83
20	Belkin	15	0.83
20	Honeywell	15	0.83
Total		1,216	67.21

**Notes:** The table shows the number of court cases (at the patent-party-case level) and the corresponding share of total assertions between 2010-2019 by defending party.

Table A-3: Court cases by SSO and NPE status (2010-2019)

SSO/Pool	Company	NPE	# Cases	Share
ARIB	2	1	3	0.12
ATIS	12	4	16	0.67
ATSC	108	0	108	4.55
AVC	24	19	43	1.81
BluRay	19	0	19	0.80
DVD	16	0	16	0.67
ETSI	261	928	1,189	50.18
IEC	5	1	6	0.25
IEEE	3	128	131	5.52
IETF	1	1	2	0.08
ISO	17	122	139	5.86
ITU	134	228	362	15.28
MPEG DASH	5	0	5	0.21
MPEG Visual	14	66	80	3.37
OMA	1	37	38	1.60
SIPRO	9	175	184	7.76
VC1	10	18	28	1.18
Total	641	1,728	2,369	100.00

**Notes:** NPE: non-practicing entity. The table shows the number of court cases (at the patent-party-case level) and the corresponding share of total assertions between 2010-2019 by SSO.

Table A-4: Opportunistic behavior by SEP enforcer for all court cases involving SEPs (2010-2019)

Opportunistic behavior	All		D Response		MSJ/MTD	
	# Cases	%	# Cases	%	# Cases	%
	(1)	(2)	(3)	(4)	(5)	(6)
1 Any opportunistic behavior	1,370	75.73	1,260	81.34	272	91.27
2 Injunction	799	44.16	689	44.48	137	45.97
3 Untimely declaration	354	19.56	354	22.85	119	39.93
4 Overdeclaration	169	9.34	169	10.91	24	8.05
5 Exhaustion	392	21.66	392	25.30	88	29.53
6 Discriminatory license	155	8.56	155	10.00	13	4.36
7 Threats to sue customers	26	1.43	26	1.67	1	0.33
8 Parallel ITC litigation	94	5.19	77	4.97	19	6.37
9 Relevant litigation abroad	27	1.49	27	1.74	9	3.02
10 No disclosure	17	0.93	17	1.09	0	0
11 EMVR vs. SSPUU	265	14.64	265	17.10	69	23.15
12 Prior licenses not comparable	149	8.23	149	9.61	67	22.48
13 Other	362	20.01	362	23.36	75	25.16

**Notes:** *D response*: only cases where the defendant filed at least one response to the complaint; *MSJ/MTD*: only cases where at least one motion, a motion to dismiss and/or a motion for summary judgment was filed; unit of observation at the patent-party-case level; **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-5: Opportunistic behavior by SEP enforcer by district court (2010-2019)

Court	TX E.	Delaware	CA S.	CA C.	Florida S.	NY N.	CA N.	Illinois N.	Colorado	TX N.	Georgia N.	N. Carolina E.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Opportunistic behavior												
1 Any opportunistic behavior	82.21	66.59	77.48	86.84	50	100	70	92.85	13.79	96.42	30	100
2 Injunction	48.38	44.39	39.73	75	22.36	0	36.66	92.85	13.79	3.57	0	100
3 Untimely declaration	29.51	7.91	31.12	5.26	6.57	0	20	0	0	60.71	0	0
4 Overdeclaration	3.09	3.07	13.90	5.26	22.36	100	23.33	0	0	0	0	0
5 Exhaustion	30.32	7.25	35.76	14.47	14.47	0	15	45.23	0	10.71	30	0
6 Discriminatory license	0	4.83	17.88	5.26	25	100	11.66	0	0	0	0	0
7 Threats to sue customers	0.13	0	1.32	0	21.05	0	6.66	0	0	0	0	0
8 Parallel ITC litigation	3.09	11.64	0	5.26	0	0	0	4.76	0	0	0	40
9 Relevant litigation abroad	0.26	0.87	0.66	6.57	0	0	16.66	0	0	0	0	0
10 No disclosure	0.94	0	0	6.57	0	0	8.33	0	0	0	0	0
11 EMVR vs. SSPUU	14.42	18.68	18.54	0	0	0	41.66	0	0	39.28	0	0
12 Prior licenses not comparable	12.26	5.71	4.63	0	0	0	21.66	4.76	0	0	0	0
13 Other	17.25	16.92	15.89	5.26	25	100	43.33	4.76	0	0	0	0
Total cases	742	455	151	76	76	70	60	42	29	28	20	10

**Notes:** District courts with less than 10 cases omitted—this includes Arizona, Virginia Eastern, New Jersey, Wisconsin Western, TX Western, NY Southern, NY Eastern, Nevada, Washington Western, Oregon, Maryland, and Massachusetts; E.: Eastern; S.: Southern; C: Central; N.: Northern; unit of observation at the patent-party-case level; **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently then similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-6: Opportunistic behavior by SEP enforcer by accused infringer type and NPE status (2010-2019)

Accused infringer type	Use/Sell		Product/Component		D prior licensee	
	Use	Sell	Product	Component	Yes	No
Opportunistic behavior	(1)	(2)	(3)	(4)	(5)	(6)
1 Any opportunistic behavior	49.70	78.44	79.28	75.17	95.39	72.73
2 Injunction	41.91	44.56	62.72	42.79	45.60	43.94
3 Untimely declaration	9.58	20.52	5.32	20.49	2.92	22.10
4 Overdeclaration	0	10.26	1.77	9.71	43.93	4.07
5 Exhaustion	32.93	20.46	11.83	21.95	46.44	17.89
6 Discriminatory license	0	9.41	1.77	8.89	30.12	5.28
7 Threats to sue customers	0	1.57	3.55	1.17	3.76	1.08
8 Parallel ITC litigation	0	5.70	14.20	5.50	14.22	3.82
9 Relevant litigation abroad	0	1.63	2.36	1.34	3.34	1.21
10 No disclosure	0	1.03	0	0.99	0	1.08
11 EMVR vs. SSPUU	0	16.08	14.20	14.28	15.48	14.52
12 Prior licenses not comparable	0	9.04	7.10	8.19	0.83	9.36
13 Other	0	21.97	11.24	20.37	70.71	12.29
Total cases	167	1,647	169	1,708	239	1,570

**Notes:** Unit of observation at the patent-party-case level; **Use/sell:** Does the accused infringer sell the technology, or use it to sell something (significantly) unrelated? **Product/Component:** Component is = 1 if the alleged infringement substantially occurs (i) in a component of the accused product, or (ii) the infringement occurs in some product/service that the accused infringer buys from an upstream vendor. Product = 1 if the accused product is, itself, a component; **D prior licensee:** = 1 is there was a prior license between P and D. **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPPU). **12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-7: Opportunistic behavior by SEP enforcer by product market relationship between SEP enforcer and accused infringer (2010-2019)

P-D relation	Licensor					
	Competitor	Diff. market	NPE	Upstream	Downstream	Gov/univ
	(1)	(2)	(3)	(4)	(5)	(6)
1 Any opportunistic behavior	75.98	77.77	72.52	92.30	100	92.85
2 Injunction	41.57	72.22	39.11	74.87	81.81	35.71
3 Untimely declaration	7.52	55.55	22.40	17.94	0	7.14
4 Overdeclaration	29.74	5.55	2.88	21.02	0	50.00
5 Exhaustion	20.78	0	17.01	49.23	81.81	14.28
6 Discriminatory license	30.46	5.55	4.21	4.10	0	50.00
7 Threats to sue customers	2.86	5.55	0.93	1.53	0	14.28
8 Parallel ITC litigation	4.30	22.22	4.37	9.23	18.18	0
9 Relevant litigation abroad	4.65	0	0.85	1.02	0	7.14
10 No disclosure	3.22	0	0.62	0	0	0
11 EMVR vs. SSPUU	14.69	0	11.55	37.43	0	21.42
12 Prior licenses not comparable	10.75	0	6.08	21.02	0	0
13 Other	45.16	81.81	9.36	44.61	81.81	71.42
Total cases	279	22	1,281	195	22	14

**Notes:** Unit of observation at the patent-party-case level; **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPPU). **12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-8: Opportunistic behavior by SEP enforcer by licensor/licensee relation (2010-2019)

	P is both		only P		P is NPE	
	D both	only D	D both	only D	D both	only D
	(1)	(2)	(3)	(4)	(5)	(6)
1 Any opportunistic behavior	82.35	80.88	93.48	86.11	75.85	71.11
2 Injunction	68.24	41.67	52.17	67.59	47.51	35.56
3 Untimely declaration	7.06	14.71	0	23.15	20.47	23.22
4 Overdeclaration	12.94	35.29	39.13	18.52	1.31	3.56
5 Exhaustion	47.65	17.16	54.35	30.56	14.17	18.22
6 Discriminatory license	5.88	34.80	0	18.52	3.94	4.33
7 Threats to sue customers	0	3.92	2.17	4.63	2.62	0.22
8 Parallel ITC litigation	18.24	1.96	6.52	0	10.50	1.78
9 Relevant litigation abroad	7.65	0.98	2.17	0	1.57	0.56
10 No disclosure	5.29	0	0	0	0.79	0.56
11 EMVR vs. SSPUU	22.94	24.51	47.83	5.56	12.07	11.33
12 Prior licenses not comparable	8.24	24.02	8.70	3.70	12.34	3.44
13 Other	48.82	55.39	39.13	25.93	13.91	7.44
Total cases	170	204	46	108	381	900

**Notes:** NPE: non-practicing entity. Unit of observation at the patent-party-case level; **1)** In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2)** In the complaint (or counterclaim) did the patent enforcer request an injunction? **3)** Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4)** Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5)** Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6)** Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7)** Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8)** Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **9)** Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10)** Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **12)** Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13)** Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-9: Opportunistic behavior by SEP enforcer by technology (2010-2019)

Opportunistic behavior	C/E	Media broadcast	Mobile code	NF Com.	VP network	Wired Com.	Wireless Com.	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 Any opportunistic behavior	68.57	90.90	5.40	100	100	45.45	79.00	12.50
2 Injunction	49.23	20.66	5.40	88.88	100	45.45	43.84	12.50
3 Untimely declaration	16.26	7.43	0	0	0	0	24.00	0
4 Overdeclaration	2.85	69.42	0	0	0	0	6.37	0
5 Exhaustion	24.61	9.09	0	0	15.38	0	23.29	0
6 Discriminatory license	2.85	69.42	0	0	0	0	5.13	0
7 Threats to sue customers	3.07	4.13	0	11.11	0	0	0.53	0
8 Parallel ITC litigation	1.75	2.47	0	0	2.56	0	7.26	0
9 Relevant litigation abroad	0.65	0	0	11.11	0	0	2.03	0
10 No disclosure	2.19	0	0	0	0	0	0.62	0
11 EMVR vs. SSPUU	5.71	0	0	0	35.89	0	19.92	0
12 Prior licenses not comparable	4.83	0	0	0	15.38	0	10.71	0
13 Other	10.10	69.42	0	0	0	18.18	20.37	0
<b>Total cases</b>	<b>455</b>	<b>121</b>	<b>37</b>	<b>9</b>	<b>39</b>	<b>11</b>	<b>1,129</b>	<b>8</b>

**Notes:** C/E: compression/encoding; NF Com.: near field communication; VP network: virtual private network; Wired Com.: wired communication; Wireless Com.: wireless communication; unit of observation at the patent-party-case level; unit of observation at the patent-party-case level; 1) In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? 2) In the complaint (or counterclaim) did the patent enforcer request an injunction? 3) Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? 4) Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? 5) Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? 6) Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? 7) Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? 8) Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation?; 9) Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? 10) Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? 11) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). 12) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). 13) Did the accused infringer make some other specific allegation that something might be a FRAND violation?



Table A-10: Opportunistic behavior by SEP enforcer by product/service (2010-2019)

Opportunistic behavior	IoT	Camera	C/M/C	Computer	C/S/P	Game console	Mobile device	Network hardware	ISP	Player	Software	TV	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1 Any opportunistic behavior	55.00	100	65.55	100	100	100	78.20	81.56	88.76	100	100	47.05	50.00
2 Injunction	0	100	44.44	69.23	100	100	46.31	57.67	46.06	100	100	47.05	50.00
3 Unimely declaration	10.00	0	5.55	5.12	0	0	22.75	2.73	46.06	0	0	0	0
4 Overdeclaration	55.00	0	3.33	0	0	0	6.41	1.70	4.86	0	0	0	0
5 Exhaustion	0	100	1.11	7.69	100	0	27.88	23.20	35.58	27.27	0	17.64	0
6 Discriminatory license	0	0	0	0	0	0	5.28	6.48	2.24	0	0	0	0
7 Threats to sue customers	0	0	2.22	0	0	0	0	1.36	0	0	0	0	0
8 Parallel ITC litigation	0	20.00	26.66	5.12	0	100	12.33	8.19	0	18.18	0	11.76	0
9 Relevant litigation abroad	0	0	0	2.56	0	0	3.68	0	0	0	0	0	0
10 No disclosure	0	0	0	0	0	0	1.12	0	0	0	0	0	0
11 EMVR vs. SSPUU	55.00	0	18.88	41.02	100	0	19.07	22.86	7.86	45.45	0	29.41	0
12 Prior licenses not comparable	0	0	6.66	12.82	100	0	9.45	11.60	7.86	45.45	0	29.41	0
13 Other	0	100	10.00	20.51	100	0	22.75	29.01	4.86	72.72	0	47.05	0
Total cases	20	5	90	39	5	1	624	293	267	11	1	17	2

**Notes:** C/M/C: component chip/module/card; C/S/P: copier/scanner/printer; ISP: network/Internet/wireless service provider; Player: set-top box/dvr/video disc player; Software: Software product; unit of observation at the patent-party-case level; 1) In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? 2) In the complaint (or counterclaim) did the patent enforcer request an injunction? 3) Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? 4) Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? 5) Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? 6) Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? 7) Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? 8) Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? 9) Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? 10) Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? 11) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPU). 12) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). 13) Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-11: Opportunistic behavior by SEP enforcer by SSO/Pool (2010-2019)

Opportunistic behavior	ARIB	ATIS	ATSC	AVC	Blu Ray	DVD	ETSI	IEC	IEEE	IETF	ISO	ITUT	MPEG Dash	MPEG Visual	OMA	SIPRO	VC.1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1 Any opportunistic behavior	66.66	100	95.37	48.83	94.73	93.75	81.49	83.33	51.90	100	85.61	68.78	80.00	26.50	7.89	80.43	28.57
2 Injunction	0	25.00	17.59	11.62	57.89	93.75	46.42	83.33	32.06	100	46.04	45.30	0	3.75	7.89	31.52	0
3 Untimely declaration	0	0	8.33	2.32	5.26	0	25.23	50.00	4.58	50.00	32.37	20.99	20.00	0	0	26.08	0
4 Overdeclaration	66.66	75.00	77.77	20.93	36.84	0	5.97	0	0	0	4.31	3.86	80.00	3.75	0	2.71	7.14
5 Exhaustion	66.66	81.25	10.18	16.27	26.31	31.25	24.64	0	12.97	0	10.07	15.19	20.00	18.75	0	13.58	21.42
6 Discriminatory license	0	0	77.77	27.90	36.84	0	2.85	0	18.32	0	2.15	4.69	80.00	3.75	0	0	7.14
7 Threats to sue customers	0	0	4.62	6.97	5.26	0	0.84	0	0	0	2.15	2.48	20.00	3.75	0	0	7.14
8 Parallel ITC litigation	0	0	2.77	4.65	0	0	7.14	16.66	0	0	2.15	1.65	0	0	0	0	0
9 Relevant litigation abroad	0	0	0	6.97	0	0	2.01	0	0	0	2.87	2.20	0	0	0	2.71	0
10 No disclosure	0	0	0	0	0	0	0.84	33.33	0	0	5.03	3.31	0	0	0	2.71	0
11 EMVR vs. SSPUU	66.66	87.50	0	6.97	0	0	19.51	33.33	0	0	10.79	8.56	0	0	0	19.02	0
12 Prior licenses not comparable	0	6.25	0	9.30	0	0	10.17	0	0.76	0	8.63	6.35	0	0	0	5.43	0
13 Other	66.66	75.00	77.77	27.90	36.84	0	18.67	33.33	14.50	0	15.82	13.25	80.00	3.75	0	10.86	7.14
Total cases	3	16	108	43	19	16	1,189	6	131	2	139	362	5	80	38	184	28

**Notes:** Unit of observation at the patent-party-case level; **1**) In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? **2**) In the complaint (or counterclaim) did the patent enforcer request an injunction? **3**) Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? **4**) Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? **5**) Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? **6**) Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? **7**) Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? **8**) Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? **9**) Did the patent enforcer initiate litigation against the accused infringer in another country - e.g., in an attempt to get an injunction in Germany when it couldn't get an injunction in the US? **10**) Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? **11**) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPUU). **12**) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). **13**) Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-12: Determinants of opportunistic behavior by SEP enforcer: comparison for same SEP enforcer and same court case (2010-2019)

	(a) Any	(b) Injunction	(c) Untimely decl.	(d) Overdecl.	(e) Exhaust.	(f) EMVR/SSPUU	(g) Comparable lic.	(h) Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>P/D characteristics</i>								
D is both P and D	-0.0349 (0.0404)	-0.000836 (0.00118)	-0.0477 (0.0414)	-0.00236 (0.0140)	-0.0571 (0.131)	0.0545 (0.0647)	-0.00293 (0.0206)	0.0156 (0.0243)
P upstream of D	-0.249* (0.134)	0.00408 (0.00648)	0.730 (0.972)	1.337 (1.053)	0.380 (1.318)	0.314** (0.137)	0.774*** (0.0370)	1.041 (1.087)
P and D competitors	-0.261* (0.137)	0.00501 (0.00726)	0.712 (0.969)	1.335 (1.051)	0.144 (1.318)	0.294** (0.132)	0.769*** (0.0350)	1.039 (1.085)
D prior licensee of P	0.0486 (0.0479)	-0.000221 (0.000780)	-0.945*** (0.0436)	-0.00876 (0.0136)	0.305** (0.140)	-1.034*** (0.0582)	-0.992*** (0.0270)	-0.0267 (0.0244)
D technology user	-0.0384 (0.0261)	0.00339 (0.00407)	0.396*** (0.0367)	-0.000850 (0.00297)	0.0950*** (0.0270)	0.00369 (0.0110)	-0.00543 (0.00514)	0.00200 (0.00442)
Technology in component	0.0683 (0.0894)	0.00109 (0.00186)	-0.0121 (0.0303)	0.000237 (0.00184)	0.0966 (0.0909)	0.0615 (0.101)	0.0724 (0.0942)	-0.00186 (0.00364)
Log P's SEP portfolio size	-0.112 (0.0930)	0.00733 (0.00889)	0.610 (0.572)	0.800 (0.626)	-0.695 (0.804)	-0.0112 (0.0707)	-0.0137 (0.0151)	0.816 (0.646)
<i>Case characteristics</i>								
D answer count	0.0471 (0.0324)	-0.00533 (0.00639)	0.0913* (0.0523)	0.000565 (0.00223)	0.240*** (0.0420)	0.0108 (0.0119)	0.00727 (0.0110)	0.00168 (0.00283)
Case filing year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SEP enforcer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technology FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Court case FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.682 290	0.993 290	0.881 290	0.673 290	0.550 290	0.849 290	0.950 290	0.896 290
Observations								

**Notes:** Unit of observation at the patent-party-case level; OLS coefficients shown; robust standard errors clustered at the case-level; \* significant at 10%, \*\* at 5%, \*\*\* at 1%; (a) In the answer (and/or other, later filings) did the accused infringer (specifically) allege that the patent enforcer (or its predecessor) engaged in some kind of opportunistic behavior or something that might constitute a FRAND violation? (b) In the complaint (or counterclaim) did the patent enforcer request an injunction? (c) Did the accused infringer argue that the patent enforcer (or its predecessor) did not disclose the SEP to the SSO until after the technology was adopted? (d) Did the accused infringer argue that the patent enforcer was trying to force the accused infringer to license (along with SEPs) additional patents that were not actually essential to the standard? (e) Did the accused infringer (specifically) allege that the patent was already licensed (often by an upstream component supplier)? (f) Did the accused infringer make a specific allegation that the patent enforcer was treating it differently than similarly situated companies/licensees? (g) Did the patent enforcer bring the accused infringer's customers in the licensing dispute, either by contacting them or threatening to sue them or actually suing them? (h) Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation? (i) Did the accused infringer make a specific allegation that the patent enforcer simply refused to disclose the terms of prior licenses with similarly situated companies? (j) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on the price of the end product (using the EMVR), rather than the price of a component/module (the SSPU). (k) Did the accused infringer argue that the patent enforcer was improperly trying to base the royalty owed on prior licenses that were not really comparable (due to differences in patents, duration, geographic scope, licensee type, etc). (l) Did the accused infringer make some other specific allegation that something might be a FRAND violation?

Table A-13: Effect of events on opportunistic behavior by SEP enforcer: injunctive relief (2010-2019)

	Injunction <sup>†</sup>		
	DoJ 2013 policy statement 8 Jan 2013	Apple v. Motorola 25 Apr 2014	Microsoft v. Motorola 30 Jul 2015
	(1)	(2)	(3)
<i>P/D characteristics</i>			
Event	-0.593*** (0.103)	0.164* (0.0964)	-0.0773 (0.125)
P is NPE	-0.321*** (0.0912)	-0.259*** (0.0784)	-0.277*** (0.0785)
Event × NPE	-0.0127 (0.0797)	-0.130* (0.0776)	-0.105 (0.0792)
<i>P/D characteristics</i>			
P is both P and D	0.00938 (0.0602)	-0.0272 (0.0590)	-0.0202 (0.0594)
D is both P and D	0.0288 (0.0224)	0.0304 (0.0222)	0.0280 (0.0222)
P upstream of D	-0.184** (0.0725)	-0.169** (0.0679)	-0.160** (0.0691)
P and D competitors	-0.286*** (0.0741)	-0.283*** (0.0722)	-0.274*** (0.0721)
D prior licensee of P	0.261*** (0.0440)	0.291*** (0.0438)	0.294*** (0.0435)
D technology user	-0.0042 (0.0603)	-0.0119 (0.0624)	-0.0064 (0.0637)
Technology in component	-0.0977** (0.0449)	-0.101** (0.0432)	-0.102** (0.0434)
Log P's SEP portfolio size	-0.0081 (0.0165)	0.0022 (0.0160)	0.0007 (0.0161)
<i>Case characteristics</i>			
Declaratory action	-0.372*** (0.0628)	-0.423*** (0.0625)	-0.424*** (0.0648)
D answer count	0.0213 (0.0140)	0.0271** (0.0137)	0.0275** (0.0138)
MTD	0.196 (0.142)	0.204 (0.143)	0.203 (0.137)
MSJ	0.0533 (0.0459)	0.0645 (0.0475)	0.0608 (0.0486)
Case consolidated	-0.0846 (0.0525)	-0.103** (0.0520)	-0.0999** (0.0506)
<i>Patent characteristics</i>			
SEP in pool	-0.188*** (0.0384)	-0.188*** (0.0396)	-0.190*** (0.0388)
Patent reassigned	-0.0764* (0.0396)	-0.0732* (0.0403)	-0.0742* (0.0407)
Case filing year	Yes	Yes	Yes
R <sup>2</sup>	0.590	0.582	0.582
Observations	1,781	1,781	1,781

**Notes:** Unit of observation at the patent-party-case level; OLS coefficients shown; robust standard errors clustered at the case-level; \* significant at 10%, \*\* at 5%, \*\*\* at 1%; † In the complaint (or counterclaim) did the patent enforcer request an injunction?

Table A-14: Effect of events on opportunistic behavior by SEP enforcer: Parallel ITC investigation (2010-2019)

	Parallel ITC litigation <sup>†</sup>		
	DoJ 2013 policy statement 8 Jan 2013	Apple v. Motorola 25 Apr 2014	Microsoft v. Motorola 30 Jul 2015
	(1)	(2)	(3)
<i>P/D characteristics</i>			
Event	-0.671*** (0.0906)	0.0163 (0.0388)	0.0406 (0.0522)
P is NPE	-0.00217 (0.0560)	0.0433 (0.0527)	0.0157 (0.0497)
Event × NPE	0.00433 (0.0416)	-0.0322 (0.0388)	0.0732* (0.0387)
<i>P/D characteristics</i>			
P is both P and D	0.0380 (0.0370)	0.00693 (0.0387)	0.0148 (0.0387)
D is both P and D	0.0436*** (0.00963)	0.0452*** (0.00985)	0.0462*** (0.00996)
P upstream of D	-0.0411 (0.0522)	-0.0207 (0.0539)	-0.0307 (0.0541)
P and D competitors	-0.145*** (0.0493)	-0.127** (0.0520)	-0.121** (0.0537)
D prior licensee of P	0.0922*** (0.0307)	0.127*** (0.0331)	0.127*** (0.0332)
D technology user	0.0528** (0.0219)	0.0587*** (0.0226)	0.0681*** (0.0227)
Technology in component	0.0573*** (0.0182)	0.0589*** (0.0191)	0.0671*** (0.0198)
Log P's SEP portfolio size	0.0354*** (0.00992)	0.0465*** (0.0108)	0.0462*** (0.0107)
<i>Case characteristics</i>			
Declaratory action	-0.0888*** (0.0275)	-0.115*** (0.0302)	-0.0784*** (0.0281)
D answer count	-0.0251*** (0.00742)	-0.0203** (0.00806)	-0.0223*** (0.00802)
MTD	-0.0232* (0.0134)	-0.0200 (0.0148)	-0.0260 (0.0168)
MSJ	0.0710* (0.0396)	0.0866** (0.0407)	0.0916** (0.0404)
Case consolidated	-0.00886 (0.0167)	-0.0285 (0.0181)	-0.0316* (0.0181)
<i>Patent characteristics</i>			
SEP in pool	-0.00182 (0.0139)	-0.00529 (0.0155)	-0.00865 (0.0164)
Patent reassigned	-0.0847*** (0.0233)	-0.0894*** (0.0251)	-0.102*** (0.0254)
Case filing year	Yes	Yes	Yes
R <sup>2</sup>	0.375	0.315	0.319
Observations	1,781	1,781	1,781

**Notes:** Unit of observation at the patent-party-case level; OLS coefficients shown; robust standard errors clustered at the case-level; \* significant at 10%, \*\* at 5%, \*\*\* at 1%; † Did the patent enforcer initiate litigation against the accused infringer at the ITC in parallel to the district court litigation?