

Solving the Patent Settlement Puzzle

Einer Elhauge* & Alex Krueger**

Courts and commentators are sharply divided about how to assess “reverse payment” patent settlements under antitrust law. The essential problem is that a PTO-issued patent provides only a probabilistic indication that courts would hold that the patent is actually valid and infringed, and parties have incentives to structure reverse payment settlements to exclude entry for longer than this patent probability would merit. Some favor comparing the settlement exclusion period to the expected litigation exclusion period, but this requires difficult case-by-case assessments of the probabilities of patent victory. Others instead favor a formal “scope of the patent” test that allows such settlements for nonsham patents if the settlement does not delay entry beyond the patent term, preclude noninfringing products, or delay nonsettling entrants. However, the formal scope of the patent test excludes entry for longer than merited by the patent strength, and it provides no solution when there is either a significant dispute about infringement or a bottleneck issue delaying other entrants.

This Article provides a way out of this dilemma. It proves that when the reverse payment amount exceeds the patent holder’s anticipated litigation costs, then under standard conditions the settlement will, according to the patent holder’s own probability estimate, exclude entry for longer than both the expected litigation exclusion period and the optimal patent exclusion period, and thus will both harm consumer welfare and undermine optimal innovation incentives. Further, whenever a reverse payment is necessary for settlement, it will also have those same anticompetitive effects according to the entrant’s probability estimate. This proof thus provides an easily administrable way to determine when a reverse payment settlement is necessarily anticompetitive, without requiring any probabilistic inquiry into the patent merits. We also show that, contrary to conventional wisdom, patent settlements without any reverse payment usually (but not always) exceed both the expected litigation exclusion period and the optimal patent exclusion period, and we suggest a procedural solution to resolve such cases.

* Petrie Professor of Law, Harvard Law School. Professor Elhauge has been an expert witness on both the plaintiff and defense side in antitrust challenges to reverse payment patent settlements.

** Executive Director, Legal Economics. Alex Krueger has consulted for the plaintiff side in an antitrust challenge to reverse payment patent settlements. For their helpful comments, we would like to thank Richard Brunell, Terry Fisher, Scott Hemphill, Al Klevorick, David Opderbeck, and the participants in the Harvard Health Law Policy workshop.

Introduction.....	284
I. The Two Relevant Benchmarks: <i>Ex Post</i> Consumer Welfare and the Optimal Patent Reward.....	293
II. Reverse Payments That Exceed the Patent Holder’s Anticipated Litigation Costs.....	297
A. The Proof.....	297
1. <i>Strong Patent</i>	299
2. <i>Weak Patent</i>	301
3. <i>Implications</i>	303
B. Presumption and Limited Grounds for Rebuttal.....	304
1. <i>Establishing Presumption by Comparing Reverse Payment to Anticipated Litigation Costs</i>	305
2. <i>Rebuttal by Showing At-Risk Entrant Is Sufficiently Judgment Proof</i>	307
3. <i>Rebuttal by Proving Other Procompetitive Justifications</i>	309
4. <i>No Rebuttal by Showing Lack of Market Power</i>	310
5. <i>No Rebuttal by Showing Risk Aversion</i>	311
III. Settlements Without Reverse Payments That Exceed Litigation Costs.....	312
A. Proof That Even Settlements with Zero Reverse Payment Are Usually Anticompetitive.....	313
1. <i>Strong Patent</i>	314
2. <i>Weak Patent</i>	317
3. <i>Summary</i>	319
B. Grounds for Rebuttal and Possible Procedural Solution.....	323
IV. Relationship to Prior Scholarship.....	325
Conclusion.....	328
Appendix.....	330

Introduction

Reverse payment patent settlements have led to widespread legal controversy. In such settlements, the patent holder agrees to make a payment to an allegedly infringing potential entrant (called a “reverse” payment because traditionally settlement-payment flow was from alleged infringer to patent holder) and the potential entrant agrees to stay out of the market until a later date.¹ Such settlements have anticompetitive potential because they can exclude entry for longer than the expected litigation exclusion period,

1. These are sometimes called “pay-for-delay” settlements, but we avoid that terminology because it presupposes that the settlement entry date does “delay” entry compared to the expected entry date, which is generally the disputed issue.

which would have reflected the often significant likelihood that the patent holder would have lost.² Indeed, unless constrained by the risk of antitrust liability, settling parties would (no matter how weak the patent) always have incentives to set the settlement entry date at the end of the patent term because that maximizes joint profits (by precluding competition for as long as possible), and they can use the reverse payment to split those joint profits in a way that leaves both better off. However, if antitrust liability could be designed to prevent settlements that exclude entry for more than the expected litigation exclusion period, then reverse payment settlements could theoretically avoid litigation costs without causing any anticompetitive effect.

Such reverse payment settlements have been a huge issue in the multitrillion dollar pharmaceutical industry. But the issue is even bigger than that because reverse payment settlements can occur in *any* market where the patent holder would have greater market power if the entrant were excluded.³

The federal courts of appeals are in utter conflict on when reverse payment settlements violate antitrust law. The Sixth Circuit has held that reverse payment settlements are *per se* illegal.⁴ This is the *categorical illegality* position. Two Eleventh Circuit cases rejected this position, holding that reverse payment settlements violate antitrust law only if the settlement exceeds the exclusionary “scope of the patent,” which means the “settlement cannot be more anticompetitive than litigation” and thus “underscores the need to evaluate the strength of the patent.”⁵ The test in these Eleventh

2. The literature often instead compares the settlement entry date to the “expected entry date” from litigation, but the latter term is imprecise in cases where, absent settlement, the entrant would have entered at risk and thus could have been excluded well after entry if it had later lost the patent litigation. So we use the more precise term “expected litigation exclusion period.” For example, suppose the entrant would enter at risk, the remaining patent term is 10 years, the patent litigation will last two years, and the entrant has a 20% chance of losing and being excluded. The expected entry date is immediate and thus would be exceeded by any settlement that excludes entry for any period at all. But this does not accurately determine whether the settlement harms consumer welfare because the expected litigation exclusion period is 20% of 8 years or 1.6 years. Thus, a settlement that excludes entry for less than 1.6 years does not harm consumer welfare.

3. Delaying entry through a reverse patent settlement is profit maximizing whenever entry reduces the joint profits of the patent holder and entrant, which is true whenever the patent holder has market power that the entrant would constrain to some degree. Further, we show below that if the reverse payment amount exceeds the patent holder’s anticipated litigation costs, then the patent holder must have believed it had market power that the settling entrant would uniquely constrain.

4. *In re Cardizem CD Antitrust Litig.*, 332 F.3d 896, 907–08 (6th Cir. 2003). In this case, Professor Elhauge filed an expert declaration for a generic defendant in which he opposed application of the *per se* rule.

5. *Schering-Plough Corp. v. FTC*, 402 F.3d 1056, 1065–66, 1075–76 (11th Cir. 2005); *id.* at 1071 (finding the evidence un rebutted that the settlement “entry date reasonably reflected the strength of [the patent holder’s] case”); *Valley Drug Co. v. Geneva Pharm., Inc.*, 344 F.3d 1294, 1312 (11th Cir. 2003) (requiring inquiry into whether the settlement terms exceeded patent protections, “considered in light of the likelihood of [the patent holder] obtaining such protections”).

Circuit cases thus turns on a case-by-case assessment of the objective probability that the patent holder would have won, which the court stressed should be determined at the time of settlement rather than by some later discrete outcome.⁶ Call this the *objective probabilistic* scope of the patent test.

The Second Circuit rejected an approach that required case-by-case assessments of patent probabilities as inadministrable.⁷ Instead, it concluded that, unless the patent was a sham or procured by fraud, reverse patent settlements were illegal only if the settlement exceeded the *formal* scope of the patent by delaying entry after the patent expires, precluding noninfringing products, or delaying the entry of nonsettling potential entrants.⁸ This *formal* scope of the patent test was then adopted by the Federal Circuit and another panel of the Eleventh Circuit.⁹

Finally, the Third Circuit has just rejected the formal scope of the patent test, adopting a presumption that reverse payment settlements are illegal unless the defendant shows that “the payment (1) was for a purpose other than delayed entry or (2) offers some pro-competitive benefit.”¹⁰ The Third Circuit held that this presumption could not be rebutted by proof about the merits of the patent suit because the reverse payment itself indicated that the purpose was to delay entry.¹¹ Instead, the Third Circuit indicated that the first rebuttal required proving that the patent holder received sufficient separate consideration to negate the existence of reverse payment and that the

6. *Valley Drug*, 344 F.3d at 1306–07 (holding that such a settlement could thus be proper even if the patent were later held invalid).

7. *In re Tamoxifen Citrate Antitrust Litig.*, 466 F.3d 187, 203–04 (2d Cir. 2006).

8. *Id.* at 212–13; *id.* at 213–16 (holding that the settlement did not exceed the scope of the patent because it did not preclude “non-infringing products,” did not delay other potential entrants, and allowed entry before the patent term expired); *Ark. Carpenters Health & Welfare Fund v. Bayer AG*, 604 F.3d 98, 106 (2d Cir. 2010) (stressing that a “settlement agreement did not exceed the scope of the patent where (1) there was no restriction on marketing non-infringing products; (2) a generic version of the branded drug would necessarily infringe the branded firm’s patent; and (3) the agreement did not bar other generic manufacturers from challenging the patent”).

9. *In re Ciprofloxacin Hydrochloride Antitrust Litig.*, 544 F.3d 1323, 1336–37 (Fed. Cir. 2008); *id.* at 1335 (indicating that if a reverse payment settlement created a bottleneck effect “delaying the entry of other generic manufacturers” or covered “non-infringing” products, then it would clearly lie “outside the exclusion zone of the patent”); *FTC v. Watson Pharm., Inc.*, 677 F.3d 1298, 1312 (11th Cir. 2012). The Eleventh Circuit panel in *Watson* claimed its conclusion was consistent with prior Eleventh Circuit panels, but it never addressed the language in *Valley Drug* saying that the exclusionary scope of a patent turned on “the likelihood of [the patent holder] obtaining [patent] protections.” *Valley Drug*, 344 F.3d at 1312. The *Watson* panel’s effort to reconcile *Schering-Plough* relied on the dubious assertion that *Schering-Plough*’s references to evaluating the “strength of the patent” merely meant the temporal length of the patent. *Watson*, 677 F.3d at 1311 n.8. But the *Watson* panel was reasonably concerned that the FTC’s proposed standard in that case (whether patent victory was unlikely) failed to reliably identify whether the settlement was anticompetitive and required difficult inquiries into the probability that the patent holder would have won. *Id.* at 1312–15.

10. *In re K-Dur Antitrust Litig.*, 686 F.3d 197, 218 (3d Cir. 2012).

11. *Id.*

second condition required proving some unrelated procompetitive benefit.¹² Call this the *presumptive condemnation* approach.

The antitrust enforcement agencies have advocated a similar presumption, but have suggested a broader range of rebuttal. The Department of Justice (DOJ) Antitrust Division has concluded that reverse payment settlements should be presumed unlawful, allowing defendants to rebut that presumption by showing either that (1) the reverse payment amount was “not greatly in excess of avoided litigation costs” or (2) the settlement exclusion period did not exceed the expected litigation exclusion period, given the settlors’ contemporaneous estimates of the likelihood that the patent holder would have won the patent litigation.¹³ The Federal Trade Commission (FTC) has advocated the Third Circuit approach of presuming that reverse payment settlements are illegal unless defendants demonstrate offsetting procompetitive effects.¹⁴ The FTC (like the Third Circuit) has also concluded that this presumption cannot be rebutted by proof of the actual *objective* likelihood that the patent holder would have prevailed.¹⁵ However, the FTC has suggested that maybe this presumption could be rebutted by evidence of the *perceived* probability at the time of settlement.¹⁶ Thus, at least for large reverse payment settlements, the Antitrust Division approach would require (and the FTC approach might permit) case-by-case assessments of the perceived probability of patent victory. Call this the *perceived probabilistic* scope of the patent test.

This split in authority does not simply reflect stubbornness or ideological conflict. There seems to be a real dilemma. The underlying problem is that the mere issuance of a patent by the Patent and Trademark Office (PTO) does not mean a court will hold that the patent is actually valid, let alone hold that another firm’s product infringes it. Indeed, even though patent holders get a presumption of patent validity, they lose 48%–73% of patent cases.¹⁷ On average, then, even without any at-risk entry during

12. *Id.*

13. Brief for the United States in Response to the Court’s Invitation at 10, 22, 28–32, *Ark. Carpenters Health & Welfare Fund*, 604 F.3d 98 (Nos. 05-2851-cv(L), 05-2852-cv (CON), 05-2863-cv (CON)), 2009 WL 8385027, at *10, *22, *28–32. The Antitrust Division used to favor a case-by-case inquiry into whether the patent holder actually would likely have won, but now rejects that sort of objective probabilistic approach in favor of the perceived probabilistic approach described in the text above. *Id.* at 24–27, 26 n.9.

14. Schering-Plough Corp., 136 F.T.C. 956, 987–91, 1000–03 (2003), *vacated*, 402 F.3d 1056 (11th Cir. 2005).

15. *Id.* at 992–98.

16. *Id.*

17. See FED. TRADE COMM’N, GENERIC DRUG ENTRY PRIOR TO PATENT EXPIRATION: AN FTC STUDY vi (2002) (“Generic applicants have prevailed in 73 percent of the cases in which a court has resolved the patent dispute.”); ADAM GREENE & D. DEWEY STEADMAN, RBC CAPITAL MKTS., PHARMACEUTICALS: ANALYZING LITIGATION SUCCESS RATES I (2010) (noting that patent holders lose 48% of the cases with generic entrants); Paul M. Janicke & LiLan Ren, *Who Wins Patent*

litigation, the expected litigation exclusion period across all cases is only 27%–52% of the patent term that remains after litigation. And this is the average; weaker patents would lose even more often and thus result in even shorter expected litigation exclusion periods, especially because they might provoke at-risk entry during litigation. Any settlement exclusion period that exceeds the expected litigation exclusion period has anticompetitive effects on consumer welfare because it increases the amount of time consumers must pay supracompetitive prices. Further, if we assume (for the purpose of antitrust analysis) that patent law has been optimally designed, then the odds of patent victory in litigation reflect the extent to which the patent holder should be rewarded with supracompetitive profits. Therefore, a settlement also exceeds the optimal patent exclusion period, and thus undermines optimal innovation incentives, if it excludes rivals for a percentage of the remaining patent period that exceeds the percentage chance of a patent victory.

The *objective probabilistic* scope of the patent test provides a straightforward solution: compare the settlement exclusion period to the expected litigation exclusion period by directly adjudicating the likelihood of patent victory. But that approach requires the very sort of inquiry into the patent merits that settlement is supposed to avoid, thus defeating the point of settlement. Moreover, once the court does investigate the patent merits, it will conclude that the patent holder should either have won or lost, and it may have difficulty calculating the perhaps imponderable probability that another court would have been (in its judgment) wrong.¹⁸ Further, this approach subjects settling parties who honestly believe that their settlement excludes entry for less than the expected litigation exclusion period to the threat of trebled antitrust damages if a court later decides the probability of patent victory was different, which may be affected by hindsight bias if other cases later adjudicate the same patent.

The *perceived probabilistic* scope of the patent test nicely avoids these problems when those perceived probabilities can reliably be ascertained. This may be possible when the parties carelessly record their probability judgments in contemporaneous documents. But if courts regularly depended on the parties' contemporaneous documents, then settling parties would likely stop documenting the true probabilities, and instead document inflated

Infringement Cases?, 34 AIPLA Q.J. 1, 20 (2006) (providing data that demonstrates that patent holders lose approximately 70% of the time).

18. This difficulty might be particularly acute because the Federal Circuit has exclusive jurisdiction over patent cases, while antitrust cases can go to any appellate panel. Thus, the appellate panel hearing the antitrust case might worry it lacks the expertise to predict how the Federal Circuit would decide any patent issues. See *FTC v. Watson Pharm., Inc.*, 677 F.3d 1298, 1314–15 (11th Cir. 2012) (expressing concern that “[t]his Court and the other non-specialized circuit courts have no expertise or experience in the area” of patent law and thus “are ill-equipped to make a judgment about the merits of a patent infringement claim”).

probabilities in order to protect their profitable settlements. Settling parties might also or instead simply offer self-serving testimony about those perceived probabilities. To avoid those problems, courts could critically examine such self-serving assessments, but to do so they would have to rely on an objective probability that would bring us back to the *objective probabilistic* scope of the patent test and all its problems.

One can thus understand the attraction of categorical approaches, but both categorical possibilities have serious problems. The problem with categorical *illegality* is that sometimes a positive reverse payment could be consistent with a socially desirable settlement.¹⁹ The problem with categorical *legality* for reverse payment settlements within the *formal* scope of a nonsham patent is that, if it were the accepted rule, settlements would always exclude entry until the patent expiration date, no matter how weak the patent was, because that would maximize firm profits. Indeed, the Second Circuit has indicated considerable ambivalence about its formal scope of the patent test, acknowledging that it produces the perverse result that the weaker a patent, the more such a rule would produce settlements that benefit the patent holder more than it deserves,²⁰ and in its most recent decision, the Second Circuit suggested that the policy problems were great enough that en banc review was merited to reconsider this rule.²¹ Moreover, the formal scope of the patent test by its own terms provides no guidance about how to assess settlements either when there is a serious dispute about whether the entrant product infringes the patent or when the settlement does create bottleneck effects that delay other entrants. Therefore, the one seeming virtue of the formal scope of the patent test, its apparent certainty, is illusory in most cases, where either infringement or bottleneck issues are seriously disputed.

Further, if the formal scope of the patent test prevails, its anticompetitive potential can be multiplied. In some cases, the parties to a patent dispute could *each* have some nonsham patent that applies to the relevant market. The formal scope of the patent test means such parties would maximize joint profits with settlements that declare the validity of whichever patent ends last, even if the other patent is actually more likely to be valid. They can then split those maximized joint profits with reverse payments to make both settling parties better off, while harming consumer welfare and providing rewards that bear no relation to any innovation. Firms would have incentives to further exacerbate the problem by creating a stream of weak (but nonsham) patents precisely for the purpose of enabling these

19. However, our proof below shows this possibility exists only when the reverse payment amount is lower than the patent holder's anticipated litigation costs, absent a judgment-proof entrant or a separate procompetitive justification.

20. *In re Tamoxifen Citrate Antitrust Litig.*, 466 F.3d 187, 211 (2d Cir. 2006).

21. *Ark. Carpenters Health & Welfare Fund v. Bayer AG*, 604 F.3d 98, 108–10 (2d Cir. 2010).

last-to-expire settlements that preclude competition as long as possible. Such a stream could even allow horizontal competitors to create a chain of reverse payment settlements that span multiple patent periods, trading the monopoly power back and forth between each other and splitting the profits with their counterpart throughout.

Clearly then, adopting the formal scope of the patent test can have disastrous consequences. But how can courts prevent anticompetitive settlements without either using a categorical condemnation approach that deters some socially beneficial settlements, engaging in a direct inquiry into the probability of patent victory that may be imponderable and effectively precludes real settlement of the patent issues, or relying on perceptions of patent strength that the settling parties will predictably exaggerate?

In this Article, we present a proof that solves this puzzle for the lion's share of cases. We begin in Part I by separating out two relevant benchmarks: (1) the expected litigation exclusion period and (2) the optimal patent exclusion period. References to the "probabilistic scope" of a patent could mean either one of these benchmarks, which have generally been conflated in prior work and cases, but in fact the benchmarks differ from each other. The expected litigation exclusion period is the expected time that the rival would be excluded with litigation, accounting for the reality of litigation delays and the fact that at-risk entry during litigation might occur or be deterred. Any settlement that excludes the entrant for more than the expected litigation exclusion period thus harms *ex post* consumer welfare because it subjects consumers to supracompetitive prices for longer than litigation would have. The optimal patent exclusion period, in contrast, equals the probability of patent-holder victory times the remaining patent term (ignoring litigation delays and the issue of at-risk entry), and thus is the exclusion period that the patent holder deserves on the merits according to substantive patent law. Assuming that substantive patent law is optimal, any settlement that excludes the entrant for more than the optimal patent exclusion period undermines optimal innovation incentives. Both benchmarks are thus relevant to policy, but the two can differ from each other. A strong patent deters at-risk entry with certainty during litigation, even though there is a probability of patent loss. Therefore, for strong patents, the expected litigation exclusion period always exceeds the optimal patent exclusion period. In contrast, a weak patent produces at-risk entry with certainty during litigation, even though there is a probability of patent victory. Therefore, for weak patents, the optimal patent exclusion period always exceeds the expected litigation exclusion period.

We then prove in Part II that whenever a reverse payment exceeds the patent holder's anticipated litigation costs, the settlement exclusion period will always exceed *both* the expected litigation exclusion period *and* the optimal patent exclusion period, according to the patent holder's *own* probability estimate. Further, whenever such a reverse payment is necessary for settlement, the settlement will also have both those anticompetitive

effects according to the probability estimates of *both* the patent holder and the entrant. Nor is there any reason to tolerate any reverse payment that is not necessary for settlement because without it the settlement would have provided an earlier entry date less harmful to consumer welfare, while still exceeding the optimal patent exclusion period according to the patent holder's own estimate. This proof thus provides an easily administrable way to determine when a reverse payment settlement is anticompetitive, without requiring any probabilistic inquiry into the patent merits. Unlike prior analyses, this proof does not depend at all on actually knowing what the patent holder or entrant perceive the patent strength to be, and it applies even if patent holders and entrants disagree about the patent strength or the future profitability of the patented product.

Although we formally illustrate our proof using a mathematical model below, the basic logic is as follows. If the reverse payment amount exceeds the patent holder's anticipated litigation costs, then we show that the settlement exclusion period necessarily exceeds the expected litigation exclusion period and the optimal patent exclusion period according to the patent holder's own estimate of the patent strength because otherwise the patent holder would be better off litigating. If the entrant's estimate of patent strength is below the patent holder's, then this settlement exclusion period must also exceed the entrant's estimate of the expected litigation exclusion period and optimal patent exclusion period. If the entrant's estimate of patent strength exceeds the patent holder's, then no reverse payment is necessary for settlement because without any reverse payment the parties could have agreed to a settlement exclusion period that is greater than the litigation exclusion period that the patent holder expects but less than what the entrant expects, which would make both better off than they have would be if they litigated.

Our proof assumes that at-risk entrants are not judgment proof and that the reverse payment does not have some other procompetitive justification. Courts therefore should presumptively condemn reverse payments that exceed the patent holder's anticipated litigation costs, but allow defendants to rebut that presumption by proving either: (a) the entrant would have entered at risk and is judgment proof to a sufficient extent to indicate the settlement exclusion period could or would be within the optimal patent exclusion period or (b) that some other procompetitive justification exists that offsets the anticompetitive effects. Absent one of those rebuttals, the proof holds. One important implication is that, contrary to the recommendations by the DOJ (and perhaps the FTC), defendants should *not* be able to rebut this presumption by arguing that the settlement exclusion period did not exceed the expected litigation exclusion period or the optimal patent exclusion period because our proof precludes that possibility for reverse payments that exceed the patent holder's anticipated litigation costs. Nor should the defendants be able to rebut the presumption by arguing that the patent holder lacks market power because our proof also shows that the patent holder

would never make a reverse payment of that size unless it had the requisite market power.

In Part III, we address patent settlements that set entry dates without using reverse payments that exceed the patent holder's anticipated litigation costs. Many, including the FTC and DOJ, have assumed that settlements with no reverse payments will likely set exclusion periods that equal the expected litigation exclusion period.²² However, we prove that this conventional wisdom is untrue. Although patent settlements without any reverse payment will not *necessarily* exceed the expected litigation exclusion period and optimal patent exclusion period, it turns out that they *usually* will exceed both benchmarks. The magnitude of anticompetitive harm is certainly much smaller without the reverse payments, but that does not alter the fact that those harms are undesirable.

One approach to deal with this problem would be to extend presumptive condemnation to settlements that exclude entry without any reverse payment, but to allow parties to rebut this presumption by showing that their settlement exclusion period did not exceed the expected litigation exclusion period or the optimal patent exclusion period. Sometimes this inquiry can be limited with a market power screen or by bounding the possible probabilities that could satisfy the relevant benchmarks. However, in other cases, this approach would require courts to directly adjudicate the patent strength, which is what courts are generally trying to avoid. If direct inquiry into probabilistic patent strength is too unreliable, then the best substantive solution would be categorical condemnation because the proof shows that most such settlements are anticompetitive. However, the better solution in such cases may be procedural rather than substantive. Because the underlying problem that allows anticompetitive settlements is that patent law does not ordinarily give buyers standing to challenge dubious patents, a possible procedural solution would provide that when such settlements are reached buyers should have standing to challenge the patent's validity.

Finally, in Part IV, we relate our analysis to prior scholarship. Although some prior commentators have conjectured that reverse payments that exceed litigation costs are usually anticompetitive, this conjecture has not previously been proven. Our proof establishes the validity of this conjecture under two benchmarks that prior work had generally conflated. Our analysis also proves that other commentators are mistaken in instead claiming that we can tell when settlements are anticompetitive by determining whether the odds of patent victory exceed some general threshold or by comparing the reverse payment to entrant profits. Further, our proof allows us to more accurately determine the conditions under which reverse payments should be

22. Schering-Plough Corp., 136 F.T.C. 956, 987 (2003), *vacated*, 402 F.3d 1056 (11th Cir. 2005); Brief for the United States, *supra* note 13, at 21–22.

presumptively condemned and the proper grounds for rebuttal. We show that the right benchmark is not all litigation costs, as prior proponents of this conjecture have assumed, but only the patent holder's future anticipated litigation costs at the time of settlement. More important, we disprove the claim by prior proponents of this conjecture that courts should allow rebuttal based on alleged direct proof regarding the likelihood of patent victory, the expected litigation exclusion period, risk aversion, or varying party estimates of patent strength. We also prove that courts need to allow a limited rebuttal for judgment-proof entrants that prior proponents of this conjecture have missed. Finally, we disprove the conventional wisdom in prior scholarship that settlements without reverse payments generally do not cause anticompetitive effects.

I. The Two Relevant Benchmarks: *Ex Post* Consumer Welfare and the Optimal Patent Reward

To determine whether a given patent settlement is anticompetitive, one must focus on two benchmarks: (1) but-for *ex post* consumer welfare and (2) optimal patent rewards for *ex ante* innovation. But-for *ex post* consumer welfare reflects the level of expected consumer welfare that would have resulted had the relevant patent disputes been litigated rather than settled. It is called "*ex post*" consumer welfare because it is calculated assuming that the innovation has already occurred. Because the patent holder can charge a significantly higher price while the potential entrant is excluded from the market, a settlement reduces *ex post* consumer welfare below but-for levels if the settlement excludes the entrant from the market for a larger portion of the patent's remaining life than one would have expected to result from litigation. Thus, any settlement exclusion period that exceeds the expected litigation exclusion period necessarily harms *ex post* consumer welfare.

However, not all things that increase *ex post* consumer welfare above but-for levels are desirable or increase *overall* consumer welfare. For example, refusing to enforce any patent (no matter how valid) would increase *ex post* consumer welfare above but-for levels. But that is only because the *ex post* perspective assumes the innovation has already occurred, when in reality patent protection is often necessary to encourage the innovation *ex ante*.²³ If designed optimally, the patent system will maximize overall consumer welfare by giving patent holders the optimal fraction of *ex post*

23. See John H. Barton, *Patents and Antitrust: A Rethinking in Light of Patent Breadth and Sequential Innovation*, 65 ANTITRUST L.J. 449, 450 (1997) ("The patent-antitrust analysis has always had to take into account and balance benefit to consumers by maintaining the competitive structure of existing markets against benefit to consumers by permitting the intellectual property rights system to provide an incentive for research toward new and improved products.").

total surplus created by their innovations.²⁴ Reducing the patent exclusion period below the optimal level will thus result in an inefficiently low amount of innovation.

Exceeding the optimal patent exclusion period is likewise inefficient for several reasons. First, the economic literature shows that patent profits that exceed the optimal level result in excessive investments in innovation that reduce social welfare compared to the optimal investments in innovation.²⁵ Second, excessive patent protection can produce a net reduction in innovation by precluding subsequent innovations by others.²⁶

Third, settlements that overreward the patent holder with a longer exclusion period than it deserves reduce the *net* reward for true innovation by increasing the reward *more* for less-deserving patents than for more-deserving patents. As the proof below shows and the Second Circuit has already pointed out,²⁷ settlements that exclude entry increase patent-holder profits more for weaker patents than for stronger patents. For example, the holder of a weak patent that is only 5% likely to be deemed a valid innovation could use such a settlement to secure exclusion throughout the entire patent term, even though its patent is 95% likely to be deemed a non-innovation, while the holder of an ironclad patent that is 100% likely to be deemed a true innovation could not increase its exclusion period through settlement because it would already expect 100% exclusion from litigation. Thus, settlements with an excessive exclusion period reduce the net reward for investing in a true innovation that leads to a stronger patent rather than in a pseudo-innovation that leads to a weaker patent. When a firm faces a choice between investing in true innovation or pseudo-innovation, this artificially reduced net reward for true innovation will distort its choice, and can reduce the rate of true innovation because it is generally harder, more costly, or less certain than pseudo-innovation.

24. See SUZANNE SCOTCHMER, INNOVATION AND INCENTIVES 100–03 (2004); Partha Dasgupta & Joseph Stiglitz, *Uncertainty, Industrial Structure, and the Speed of R&D*, 11 BELL J. ECON. 1, 18 (1980); Pankaj Tandon, *Rivalry and the Excessive Allocation of Resources to Research*, 14 BELL J. ECON. 152, 152, 156–57 (1983). Such a system will also maximize overall *total* welfare because competing innovators will keep spending on *ex ante* investments until their investment costs equal their expected *ex post* profits, so that the profits to patent holders wash out *ex ante*.

25. See *supra* note 24.

26. For a theoretical model proving that this is possible, see generally Michele Boldrin & David K. Levine, *A Model of Discovery*, 99 AM. ECON. REV. 337 (2009). For empirical work showing that expanding patent protections have had net negative effects on patent filings and suppressed later innovations, see generally Josh Lerner, *The Empirical Impact of Intellectual Property Rights on Innovation: Puzzles and Clues*, 99 AM. ECON. REV. 343 (2009); Fiona Murray et al., *Of Mice and Academics: Examining the Effect of Openness on Innovation* (Nat'l Bureau of Econ. Research, Working Paper No. 14819, 2009); Heidi L. Williams, *Intellectual Property Rights and Innovation: Evidence from the Human Genome* (Nat'l Bureau of Econ. Research, Working Paper No. 16213, 2010).

27. *In re Tamoxifen Citrate Antitrust Litig.*, 466 F.3d 187, 211 (2d Cir. 2006).

For example suppose that a true innovation will produce a gross patent reward of \$1 billion, but that the *net* reward for this true innovation is only \$400 million because the firm can instead get \$600 million in the same market by creating a pseudo-innovation that it can convert into a long exclusion period using a reverse payment settlement. Suppose further that the true innovation requires a \$500 million investment, but the pseudo-innovation requires no investment. Then the true innovation will be deterred because the excessive reward for the pseudo-innovation reduces the net reward for true innovation below the investment required for it. Therefore, settlements that overreward patent holders with longer exclusion periods than they deserve can actually *decrease* incentives to invest in true innovation.

More generally, by reducing the net reward for investing in stronger patents rather than weaker patents, settlements that provide excessive exclusion periods distort investment choices away from the stronger patents that are more likely to reflect real innovation. In all three ways summarized above, settlements that exceed the optimal patent exclusion period will undermine optimal innovation incentives.

For the purpose of antitrust analysis of these settlements, it is best to assume that substantive patent law is optimal. Although scholars sometimes argue that current patent law upholds too many patents,²⁸ or too few,²⁹ some balance must be struck. Even if one believes that current patent law does not strike the correct balance, the correct solution is to reform patent law, not to allow courts in antitrust cases to second-guess patent law doctrine and try to offset it imperfectly for the limited set of cases that produce patent settlements that raise antitrust issues. This second-guessing approach would not work both because it would require litigating the optimality of the patent system in *every* antitrust case that involved patent rights (not just reverse payment settlement cases), and because it would alter the innovation reward in the odd subset of cases that lead to such antitrust suits, which would distort firm incentives in choosing among possible innovations. Therefore, antitrust analysis of patent settlements should assume the optimality of patent law.

Given that Congress and the courts have crafted the substantive doctrines that determine the probability that a patent would be found valid and infringed, the amount of exclusion that the patent holder deserves on the merits is equal to the probability that the patent would be found valid and infringed times the remaining patent term.³⁰ To formalize this, call the

28. See, e.g., Ian Ayres & Gideon Parchomovsky, *Tradable Patent Rights*, 60 STAN. L. REV. 863, 864 (2007) (arguing that issuance of too many patents chills innovation).

29. See, e.g., Joshua L. Sohn, *Can't the PTO Get a Little Respect?*, 26 BERKLEY TECH. L.J. 1603, 1605 (2011) (arguing that federal courts do not give PTO decisions enough deference during invalidity contests).

30. For the same reasons, we think antitrust law should assume the optimality of the Hatch-Waxman Act, which gives pharmaceutical patent holders the additional exclusion right of an automatic 30-month stay on generic entry, which helps incentivize patent holders to incur the costs

probability that the patent will be found valid and infringed θ , and normalize the remaining patent term so that it spans from 0 to 1. For example, if 100 months remained on the patent term, then 100 months would be 1.0 on the normalized scale, 50 months would be 0.5, 10 months would be 0.1, and so forth. According to patent law, the patent holder deserves exclusivity for θ of the remaining patent period because θ percent of the time it deserves exclusivity for the entire period and $1 - \theta$ percent of the time it deserves no exclusivity. This means that if a settlement exclusion period T (again on the normalized 0 to 1 timeline) is greater than θ , then T exceeds the optimal patent exclusion period, and thus gives the patent holder more exclusivity and patent reward than it deserves. For example, if the remaining patent term is 100 months, and the probability of patent victory is 0.5, then the settlement exclusion period exceeds the optimal patent exclusion period only if $T > 0.5$; in other words, if the settlement excludes entry for more than 50 months. This measure entitles the patent holder to all the expected profits it would get if patent litigation were instant and costless, and thus enables patent holders to reap any legitimate settlement benefits that come from avoiding the delay and cost of litigation.

Whether a settlement is anticompetitive or procompetitive therefore depends both on whether: (a) the settlement harms or benefits *ex post* consumer welfare, which turns on whether the settlement exclusion period is greater or less than the expected litigation exclusion period; and (b) the patent holder receives more or less than the optimal patent reward, which turns on whether the settlement exclusion period is greater or less than the optimal patent exclusion period. The net effect could be murky if these tests pushed in opposite directions because that would require us to weigh the *ex post* effect on consumer welfare against the *ex ante* effect on innovation (which also affects consumer welfare). We avoid this difficulty by proving that both tests point in the same direction for settlements with reverse payments that exceed the patent holder's anticipated litigation costs.

The reason that these tests could in theory point in opposite directions is that the optimal patent exclusion period might be less or more than the expected litigation exclusion period. If the patent is strong enough to deter at-risk entry during litigation, then the optimal patent exclusion period would be smaller than the expected litigation exclusion period. The reason is that entry would be deterred during litigation with 100% probability, even though such entry would be legal and outside the scope of the patent with a

of new drug applications that can secure FDA approval. 21 U.S.C. § 355(j)(5)(D)(i)-(ii) (2006). Thus, in a Hatch-Waxman case, we would treat the residual patent period as starting once that 30-month stay expires because monopoly profits before the stay expires are part of the special intellectual property reward for investing in new drug applications, which are valuable even if the patent proves invalid. Although the Hatch-Waxman Act provides this limited exclusion right, it nowhere approves anticompetitive settlements that extend beyond that 30-month exclusion right.

probability of $1 - \theta$. If the patent is too weak to deter at-risk entry during litigation, then the optimal patent exclusion period would exceed the expected litigation exclusion period. The reason is that entry would occur during litigation with 100% probability, even though such entry would be illegal and within the scope of the patent with a probability of θ . In either case, the theoretical concern is that if the settlement exclusion period was between the optimal patent exclusion period and the expected litigation exclusion period, then the two tests would produce conflicting conclusions.

However, we prove that when a settlement has a reverse payment that exceeds the patent holder's anticipated litigation costs, the settlement exclusion period will exceed *both* (1) the expected litigation exclusion period and thus harm *ex post* consumer welfare *and* (2) the optimal patent exclusion period and thus exceed the optimal patent reward for innovation *ex ante*. Such a settlement is thus unambiguously anticompetitive.

II. Reverse Payments That Exceed the Patent Holder's Anticipated Litigation Costs

A. *The Proof*

To begin, we must define some variables. Call θ_P and θ_E the respective estimates by the patent holder and entrant of the probability that the patent will be found valid and infringed. Call P_N the supracompetitive profits that the patent holder would earn with *no* entry by the entrant for the remainder of the patent term. This would equal monopoly profits in the case where the patent holder is a monopolist, but could reflect a lesser degree of market power if other rivals exist that constrain the patent holder from charging the full monopoly price but do not fully constrain the patent holder to price at cost. Call P_Y the more competitive profits that the patent holder would earn over that period if the entrant enters as soon as it can. We normalize the remaining patent term to extend from time 0 (when the entrant is first capable of entering the market) to time 1 (the patent expiration date), with no discount rate and the assumption that each time slice reflects an equal share of the total profits that could be earned during that period.³¹ Call E the profits the entrant would earn if it were in the market for the remainder of the patent term (from time 0 to time 1), and call C_P and C_E the expected cost of litigation for the patent holder and entrant, respectively.

31. Altering the model to include discount rates, make profitability differ over time, or both would not change any of the conclusions in the proof but would significantly complicate the mathematical formulas. In fact, adding either of these complications would only strengthen our proof. Adding discount rates would reduce the net present value of the patent holder's anticipated litigation costs but would not reduce the net present value of any reverse payment made at time 0. Discounting future profit streams would only increase the extent to which an entrant would be willing to delay entry in exchange for an upfront settlement payment and reduce the extent to which a patent holder is willing to speed up entry.

The proof below does not require one to know P_N , P_Y , or E . Instead, the proof holds so long as the patent holder has enough market power that the joint profits of the patent holder and entrant are lower with entry by the potential entrant than without it, which is what standard economic models and common observation predict. For example, standard economic models indicate that monopoly profits exceed duopoly profits, and empirical evidence indicates that each entrant added to a market generally reduces profit margins until one gets to the point where market power is fully constrained.³² Moreover, one need not even assume this because in the Appendix we prove in the alternative that if joint profits were *not lower* with entry, then a reverse payment would be completely unnecessary for settlement. For now, let's focus on the more realistic case where $P_N > P_Y + E$.

Absent settlement, the entrant must decide whether to enter before resolution of the patent litigation or instead wait and enter only if it wins that patent litigation. Entry before resolution of the patent litigation is often called "at-risk" entry because the entrant risks having to pay infringement damages to the patent holder if it loses the litigation. Call L the expected duration of the patent litigation, again on the normalized 0 to 1 timeline.³³ The entrant will enter at risk if its expected profits during at-risk entry, LE , exceed its expected infringement liability, which is equal to θ_E (its expected probability of losing) times the patent holder's lost profits during at-risk entry $L(P_N - P_Y)$.³⁴ This means the entrant will enter at risk only if $\theta_E < E/(P_N - P_Y)$. As shorthand, define $\theta^* = E/(P_N - P_Y)$, and call a patent "strong" if it deters at-risk entry ($\theta_E > \theta^*$) and "weak" if it does not ($\theta_E < \theta^*$).³⁵

We model settlements that do two things: set a settlement exclusion period (of T , on the normalized 0 to 1 time scale) and give the entrant a reverse payment (in amount R). Thus, the entrant's settlement payoff is

32. See, e.g., Timothy F. Bresnahan & Peter C. Reiss, *Entry and Competition in Concentrated Markets*, 99 J. POL. ECON. 977, 984 (1991); Richard G. Frank & David S. Salkever, *Generic Entry and the Pricing of Pharmaceuticals*, 6 J. ECON. & MGMT. STRATEGY 75, 84 (1997); David Reiffen & Michael R. Ward, *Generic Drug Industry Dynamics*, 87 REV. ECON. & STAT. 37, 43 (2005).

33. For example, if the remaining patent term is 100 months, and the parties expect the patent litigation to last 10 months, then $L = 0.1$. We assume both parties share the same expected litigation duration L because it makes the mathematical model easier to understand but does not change any of the relevant conclusions. If we instead assumed that the entrant was relatively pessimistic about litigation length (so that $L_E > L_P$), that would only widen the range of possible settlement entry dates that (without any reverse payment) can provide settlement payoffs to both the entrant and patent holder that exceed their litigation payoffs. If we instead assumed the entrant was relatively optimistic about litigation length (so that $L_E < L_P$), that would only increase the extent to which a settlement exclusion period that exceeds the patent holder's estimate of the expected litigation exclusion period will exceed the entrant's estimate of that expected litigation exclusion period.

34. This formula assumes that the entrant has sufficient assets to pay damages, i.e., that it is not judgment proof. We discuss below the case of a judgment-proof entrant. See *infra* section II(B)(2).

35. Our model assumes firms are risk neutral, but as we show below, our conclusions do not depend on this assumption.

$(1 - T)E + R$ because the entrant earns nothing during T , when the settlement excludes it from the market, earns profits at a rate of E during the remaining patent term (i.e., during $1 - T$), and gets the reverse payment R . Conversely, the patent holder's settlement payoff is $TP_N + (1 - T)P_Y - R$ because it earns supracompetitive profits at a rate of P_N during T , when the settlement excludes the entrant, earns more competitive profits at a rate of P_Y for the remaining patent term $(1 - T)$, and pays R to the entrant.

The parties' joint payoff from settlement is thus $TP_N + (1 - T)P_Y - R + (1 - T)E + R$, which simplifies to $P_Y + E + T(P_N - P_Y - E)$. Because the patent holder's profits without entry exceed joint profits with entry, $P_N - P_Y - E$ is positive. The parties' joint payoff is thus clearly maximized by choosing the maximum T of 1, that is, by setting the settlement exclusion period equal to the entire remaining patent term. At this $T = 1$, the joint settlement payoff is P_N , which in the case where the patent holder was a monopolist would mean monopoly profits throughout the patent period. This is the settlement we can expect if the *formal* scope of the patent test were adopted and the settling parties were free to choose any settlement exclusion period as long as it did not exceed the patent expiration date because such a settlement maximizes their joint profits. Because θ_P and θ_E are both less than 1, a settlement exclusion period of $T = 1$ means that the settlement exclusion period necessarily exceeds both the optimal patent exclusion period and the expected litigation exclusion period.

However, if the formal scope of the patent test were *not* adopted, we might hope that the threat of antitrust liability would cause the parties to choose a settlement exclusion period of $T < 1$. Even then, however, neither party would ever enter into a patent settlement that leaves it worse off than it would be if it litigated. We prove next that the unwillingness of either party to approve a settlement that leaves it worse off suffices to assure that a settlement must be anticompetitive if the reverse payment exceeds the patent holder's anticipated litigation costs.

1. Strong Patent.—With a strong patent, the entrant would not enter at risk during the litigation. Thus, expected entry would be delayed by at least the length of litigation L , and also delayed with probability θ for the remainder of the patent term, $1 - L$. Accordingly, the expected litigation exclusion period is $L + \theta(1 - L)$, which can be rearranged as $\theta + (1 - \theta)L$.

The patent holder's expected litigation payoff is $LP_N + (1 - L)[\theta_P P_N + (1 - \theta_P)P_Y] - C_P$. The first term reflects the fact that the patent holder earns profits at a rate of P_N during the patent litigation, no matter how that litigation turns out. The next two terms reflect the fact that, after the patent litigation ends, it earns profits at a rate of P_N if it wins that litigation and P_Y if it loses. The last term reflects its anticipated litigation costs. Given a reverse payment that exceeds the patent holder's anticipated litigation costs by some additional amount A , the patent holder's settlement payoff is $TP_N + (1 - T)P_Y - A - C_P$. Thus, the patent holder will accept the settlement only if $TP_N +$

$(1 - T)P_Y - A - C_P > LP_N + (1 - L)[\theta_P P_N + (1 - \theta_P)P_Y] - C_P$. Rearranging, this is true only when $T > \theta_P + (1 - \theta_P)L + A/(P_N - P_Y)$.

Therefore, the minimum settlement exclusion period that the patent holder will demand is $\theta_P + (1 - \theta_P)L + A/(P_N - P_Y)$. According to the patent holder's own probability estimate, the optimal patent exclusion period is θ_P and the expected litigation exclusion period is $\theta_P + (1 - \theta_P)L$. Thus, the minimum settlement exclusion period will, by its own estimate, always exceed the optimal patent exclusion period by $(1 - \theta_P)L + A/(P_N - P_Y)$ and the expected litigation exclusion period by $A/(P_N - P_Y)$. These terms are all positive because by definition $A > 0$, $P_N > P_Y$, $L > 0$, and $\theta_P \leq 1$. Moreover, the more the reverse payment exceeds the patent holder's anticipated litigation costs, the more the minimum settlement exclusion period will exceed both benchmarks.

In short, according to the patent holder's own probability estimate, a settlement with a reverse payment that exceeds its anticipated litigation costs will always exclude the entrant for greater than the expected litigation exclusion period and the optimal patent exclusion period, even though the patent is strong enough to deter at-risk entry. This is true no matter what the entrant estimates the patent strength to be.

If the patent holder and the entrant disagree about the patent strength θ , there are two possibilities. One possibility is that $\theta_P > \theta_E$, meaning that the patent holder's estimate of patent strength exceeds the entrant's, so that we can say the entrant is relatively optimistic. If so, then all the above propositions will also be true according to the entrant's probability estimate. Indeed, according to the entrant's lower probability estimate, the settlement exclusion period will even more greatly exceed the expected litigation exclusion period and the optimal patent exclusion period.

The other possibility is that $\theta_E > \theta_P$, meaning that the entrant's estimate of patent strength exceeds the patent holder's, so that we can say the entrant is relatively pessimistic. If so, then the parties will always be able to reach a settlement without any reverse payment. Without any reverse payment, $A = -C_P$, so the above analysis shows that the patent holder will agree to such a settlement if $T > \theta_P + (1 - \theta_P)L - C_P/(P_N - P_Y)$, which can be rearranged as $L + \theta_P(1 - L) - C_P/(P_N - P_Y)$. The entrant will agree as long as its settlement payoff exceeds its expected litigation payoff. Without a reverse payment, the entrant's settlement payoff is $(1 - T)E$. The entrant's expected litigation payoff, given litigation delays and no at-risk entry, is $(1 - L)(1 - \theta_E)E - C_E$ because the entrant earns nothing during the litigation period, earns profits at a rate of E after the litigation period if it wins, and must pay litigation costs of C_E . Thus, the entrant will agree to such a settlement if $(1 - T)E > (1 - L)(1 - \theta_E)E - C_E$. Rearranging, this is true if $T < L + \theta_E(1 - L) + C_E/E$. Thus, a settlement without any reverse payment will be possible for a strong patent as long as the maximum exclusion period T that the entrant would agree to, $L + \theta_E(1 - L) + C_E/E$, is greater than the minimum T that the patent holder would demand, $L + \theta_P(1 - L) - C_P/(P_N - P_Y)$. This can be rearranged as $(\theta_E -$

$\theta_P(1 - L) + C_E/E + C_P/(P_N - P_Y) > 0$. This inequality is always satisfied because $\theta_E > \theta_P$, given that the entrant is relatively pessimistic, and all the other terms are positive.

Therefore, when the entrant is relatively pessimistic, a reverse payment is never necessary to reach settlement, even if the patent is strong. Further, because adding a reverse payment can only increase the entrant's willingness to agree to a larger settlement exclusion period, the settlement they would have reached without the reverse payment would provide a shorter exclusion period less harmful to consumer welfare, while still exceeding the optimal patent exclusion period according to the patent holder's own estimate.

2. *Weak Patent.*—With a weak patent, the entrant would enter at risk immediately because the entrant thinks that its expected profits during entry exceed its expected infringement liability. The patent holder's expected litigation payoff would thus be $P_N\theta_P + P_Y(1 - \theta_P) - C_P$. The first term reflects the fact that, if the patent holder wins the patent litigation, the patent holder receives supracompetitive profits P_N throughout the patent term because the patent victory means it will recover damages for any reduction in profits below that level during the litigation and it can exclude its rival after the litigation ends.³⁶ The second term reflects the fact that, if the patent holder loses the patent litigation, it will receive the more competitive profits P_Y throughout the patent term because the lost litigation means it gets no damages for the entry during litigation and cannot exclude the entrant after the litigation ends. The last term reflects its anticipated litigation costs. Given a reverse payment that exceeds the patent holder's expected litigation costs by A , its settlement payoff is $P_NT + P_Y(1 - T) - A - C_P$. Thus, the patent holder will agree to a settlement if $P_NT + P_Y(1 - T) - A - C_P > P_N\theta_P + P_Y(1 - \theta_P) - C_P$, which simplifies to $T > \theta_P + A/(P_N - P_Y)$.

Therefore, the minimum settlement exclusion period that the patent holder will demand is $\theta_P + A/(P_N - P_Y)$. Accordingly, the shortest possible settlement exclusion period will exceed the optimal patent exclusion period, θ_P , by $A/(P_N - P_Y)$. Given at-risk entry, the entrant would have entered at time 0, but would remain in the market after the patent litigation ends only if

36. The formula in the above text assumes the entrant has sufficient assets to pay any patent damages. If the entrant does not, then it is judgment proof to some extent, which does provide a possible ground for rebuttal that we discuss below in section II(B)(2). The formula in the text also assumes that damages are not trebled for willful infringement. Because we are talking here about a weak patent, where by definition the odds are relatively low that a court would sustain the patent claims, it is very unlikely willful infringement would ever be found, especially because willful infringement is found in only 2.1% of all patent disputes. Kimberly A. Moore, *Empirical Statistics on Willful Patent Infringement*, 14 FED. CIR. B.J. 227, 234 (2005). In any event, the prospect that damages might be trebled would either: (1) raise damages high enough to deter entry, in which case the strong patent proof would apply; or (2) raise the patent-holder returns from litigation if the patent remained too weak to deter entry, which would make the patent holder demand an even larger settlement exclusion period, worsening all the effects predicted by the model.

it won. Thus, the expected litigation exclusion period is $\theta_P(1 - L)$, or $\theta_P - \theta_P L$. The minimum settlement exclusion period of $\theta_P + A/(P_N - P_Y)$ will thus exceed the expected litigation exclusion period by $\theta_P L + A/(P_N - P_Y)$.

In short, according to the patent holder's own probability estimate, a settlement with a reverse payment that exceeds its anticipated litigation costs will always exclude entry for longer than both the expected litigation exclusion period and the optimal patent exclusion period. Again, the more the reverse payment exceeds the patent holder's anticipated litigation costs, the more the minimum settlement exclusion period will exceed both benchmarks.

If the entrant is relatively optimistic, then we can also say that the patent holder's probability estimate θ_P exceeds the entrant's probability estimate θ_E , and therefore all the above propositions will also be true according to the entrant's probability estimate. Indeed, according to the entrant's lower probability estimate, the settlement exclusion period will even more greatly exceed the expected litigation exclusion period and the optimal patent exclusion period.

If the entrant is relatively pessimistic, then the parties will be able to reach a settlement without any reverse payment. Without any reverse payment, $A = -C_P$, and thus the above analysis shows that the patent holder will agree if $T > \theta_P - C_P/(P_N - P_Y)$. The entrant will agree as long as its settlement payoff exceeds its litigation payoff. Without any reverse payment, the entrant's settlement payoff is $(1 - T)E$. The entrant's litigation payoff with at-risk entry is $L[E - \theta_E(P_N - P_Y)] + (1 - L)(1 - \theta_E)E - C_E$ because during the litigation period it earns profits at a rate of E but must pay infringement damages at a rate of $P_N - P_Y$ if it loses; after the litigation period, it earns profits at a rate of E if it wins and nothing if it loses, and it must pay litigation costs of C_E either way. Therefore, with a weak patent, the entrant will agree to a settlement without any reverse payment as long as $(1 - T)E > L[E - \theta_E(P_N - P_Y)] + (1 - L)(1 - \theta_E)E - C_E$. Rearranging, this is true if $T < \theta_E + (1/E)[\theta_E L(P_N - P_Y - E) + C_E]$. Thus, a settlement without any reverse payment will be possible for any weak patent as long as the maximum exclusion period T that the entrant would agree to, $\theta_E + (1/E)[\theta_E L(P_N - P_Y - E) + C_E]$, is greater than the minimum T that the patent holder would demand, $\theta_P - C_P/(P_N - P_Y)$, which can be rearranged as $\theta_E - \theta_P + (1/E)[\theta_E L(P_N - P_Y - E) + C_E] + C_P/(P_N - P_Y) > 0$. This inequality is always true because $\theta_E > \theta_P$, given that the entrant is relatively pessimistic, and the other terms are all positive, given that the patent holder's profits without entry exceed joint profits with entry.

Therefore, when the entrant is relatively pessimistic, a reverse payment is never necessary to reach settlement. Further, because increasing the reverse payment amount beyond the patent holder's anticipated litigation costs can only increase the entrant's willingness to agree to a longer settlement exclusion period, the settlement they would have reached without a reverse payment above this level would provide a shorter exclusion period

less harmful to consumer welfare, while still exceeding the optimal patent exclusion period according to the patent holder's own estimate.

3. *Implications.*—In sum, if the reverse payment amount exceeds the patent holder's anticipated litigation costs, the following propositions hold true, whether the patent is weak or strong. *First*, the settlement exclusion period must exceed the expected litigation exclusion period and the optimal patent exclusion period according to the patent holder's own estimate of the patent strength. This is true whether the entrant is relatively optimistic or pessimistic. Further, the higher the reverse payment, the worse these effects are.

Second, if the entrant is relatively optimistic, then both benchmarks are exceeded even further according to the entrant's own estimate of the patent strength. Such a settlement thus anticompetitively excludes the entrant for longer than the expected litigation exclusion period and the optimal patent exclusion period according to *both* the patent holder's *and* the entrant's estimates of the patent strength. This means that both the entrant and patent holder knew the settlement was anticompetitive.

Third, if the entrant is relatively pessimistic, the parties could always settle without any reverse payment at all. In this case, a reverse payment that exceeds the patent holder's anticipated litigation costs is not only *unnecessary* to reach settlement, but this also means that the settlement exclusion period *must* exceed the expected litigation exclusion period and the optimal patent exclusion period, according to the patent holder's *own* probability estimate. There is thus no reason to tolerate a reverse payment of this size because without it the alternative settlement the parties could have reached would have provided a shorter exclusion period less harmful to consumer welfare, while still exceeding the optimal patent exclusion period according to the patent holder's own estimate. Because the patent holder's own estimate is the only estimate that can affect *its* incentives to invest in innovation, it is the key estimate to consider in determining whether the settlement exceeds the optimal patent exclusion period.

Defenders of reverse payments often stress that they may sometimes be necessary to reach settlement.³⁷ But the above analysis proves that a reverse payment that exceeds the patent holder's anticipated litigation costs is never necessary to secure a *desirable* settlement. Instead, a reverse payment of this size can be necessary to reach settlement only when both the patent holder and entrant know the settlement is anticompetitive. Therefore, courts can safely condemn settlements with reverse payments of this size because doing so can deter only anticompetitive settlements.

37. See, e.g., Robert D. Willig & John P. Bigelow, *Antitrust Policy Toward Agreements That Settle Patent Litigation*, 49 ANTITRUST BULL. 655, 659–62, 667–77 (2004).

To put it another way, when a reverse payment exceeds the patent holder's anticipated litigation costs, a court can be confident that the settlement exclusion period will exceed the optimal patent reward, while anticompetitively reducing consumer welfare as compared either to litigation or to an alternative settlement without a reverse payment of that size. This conclusion does not rely on any particular level of patent strength θ or any assumption that the parties agreed on that level. Nor does it require knowledge of the parties' varying estimates of patent strength or even knowing which side's estimate is greater. It does not even require us to assume that the parties picked the settlement that maximized profits or to make any particular assumption about the extent to which the parties considered the risk of antitrust liability. It simply requires us to assume that neither party to the patent dispute would agree to a settlement that made it worse off.

The proof above nowhere needed to assume the existence of anything like the Hatch-Waxman Act's 180-day generic exclusivity period, during which only the first-filing generic entrant is permitted to enter.³⁸ That generic exclusivity period is often cited as the main problem with reverse payment settlements because it means that a settlement between the patent holder and first-filing generic that delays the entry of that generic will also create a bottleneck effect that delays the entry of other nonsettling generic entrants.³⁹ When settlements have this bottleneck effect, that certainly exacerbates their anticompetitive consequences. Because our proof does not rely on this bottleneck effect, it not only provides a conservative estimate of the anticompetitive consequences of reverse payment settlements under the Hatch-Waxman Act, but also shows that the problem with reverse payment settlements extends well beyond the Hatch-Waxman Act and the pharmaceutical industry regulated by it.

B. Presumption and Limited Grounds for Rebuttal

The above proof assumes that at-risk entrants are not judgment proof and that the reverse payment does not have some other procompetitive justification. The proof thus suggests that courts should presumptively condemn settlements when the reverse payment exceeds the patent holder's litigation costs, unless the defendants can rebut this presumption by showing either: (1) that the entrant would have entered at risk and is judgment proof to a sufficient effect to change the results or (2) that some other procompetitive justification exists and offsets the anticompetitive effect. Absent either of those rebuttals, the proof shows that a settlement with a

38. 21 U.S.C. § 355(j) (2006).

39. See, e.g., Michael A. Carrier, *Unsettling Drug Patent Settlements: A Framework for Presumptive Illegality*, 108 MICH. L. REV. 37, 71 (2009).

reverse payment of this size always has anticompetitive effects. In particular, absent such rebuttals, a reverse payment of this size precludes the possibilities: (1) that the settlement exclusion period is actually shorter than the expected litigation exclusion period or the optimal patent exclusion period and (2) that the patent holder lacks market power. Defendants thus should not be permitted to rebut the presumption by trying to prove that either of those possibilities is true.

1. Establishing Presumption by Comparing Reverse Payment to Anticipated Litigation Costs.—To apply the presumption indicated by our proof, a court need only determine whether the reverse payment amount exceeds the patent holder’s anticipated litigation costs. The amount of the reverse payment is easy to ascertain if the settlement specifies just a monetary payment to the entrant. Sometimes, however, a payment to the entrant consists of consideration other than money, such as a business license, in which case the reverse payment amount equals the expected value (at the time of settlement) of that consideration. Other times there is also some return consideration, in which case the reverse payment amount is the difference between the expected value of the consideration flowing to and from the entrant, leaving aside the value of setting the entry date and avoiding litigation costs.

One must also estimate anticipated litigation costs. For the purpose of applying this proof, only the *forward-looking* anticipated litigation costs are relevant; past litigation expenses are sunk costs and thus should not affect the patent holder’s willingness to settle. This means that the patent holder’s anticipated litigation costs will be relatively small in cases where the parties settle after discovery or trial, which are by far the most expensive aspects of litigation.⁴⁰ However, when parties settle before discovery or trial, those potentially expensive litigation costs have not yet occurred. Thankfully, there are three easily administrable ways that a court can determine whether the reverse payment amount exceeded the patent holder’s anticipated litigation costs. We present them in order from easiest to hardest.

First, the reverse payment amount may sometimes exceed the patent holder’s own estimate of litigation costs in its documents. This is a sufficient

40. See AIPLA, REPORT OF THE ECONOMIC SURVEY 2011, at 35 (2011) [hereinafter 2011 AIPLA REPORT] (stating that, as of 2011, median litigation costs for a patent infringement suit with more than \$25 million at stake were \$3 million through the end of discovery and \$5 million in total); Meredith Addy, *Appellate Strategy Before the U.S. Court of Appeals for the Federal Circuit*, in PATENT LITIGATION, NEGOTIATION, AND SETTLEMENT: LEADING LAWYERS ON STRATEGIES FOR EFFECTIVELY RESOLVING PATENT DISPUTES 7, 8 (2006), available at <http://www.brinkshofer.com/files/201.pdf> (“Generally, once a patent case has gone through a district court trial, it has already cost, on average, \$3 to \$5 million, or more. Comparatively, the cost of appeal is far less: perhaps a few hundred thousand dollars for an easy case, a few million for a complicated one, but almost always exponentially less than the initial litigation.”).

but not necessary condition for finding that the reverse payment exceeded its anticipated litigation costs because, if this presumption were adopted, patent holders would predictably start to inflate their recorded estimates of litigation costs in order to evade antitrust liability. Thus, courts should move onto the next method if this first method does not indicate that the reverse payment exceeded the patent holder's anticipated litigation costs.

Second, a court could compare the reverse payment amount to the upper bound of litigation costs from similar cases. The largest publicly documented amount spent on patent litigation that we could find was \$32 million, spent by Apple in a suit against Google's Motorola Mobility unit.⁴¹ Empirical literature confirms that \$32 million is an upper bound. Surveys of intellectual property lawyers indicate that the 75th percentile for patent litigation costs through trial, for cases with more than \$25 million in controversy, was around \$7.5 million in 2011.⁴² This 75th percentile is \$10 million for cases in New York,⁴³ but even that figure is only one-third of the \$32 million upper bound. A court could, therefore, be confident that any reverse payment settlement in excess of the \$32 million upper bound exceeds the patent holder's anticipated litigation costs.

The reverse payments in past cases have often far exceeded \$32 million, including \$66.4 million in *Tamoxifen*,⁴⁴ \$151.5 million in *Valley Drug*,⁴⁵ \$264–\$382.5 million in *Watson*,⁴⁶ and \$398.1 million in *Arkansas Carpenters*.⁴⁷ These past cases show that in many situations, including those arising in the past key appellate cases, applying this test should not require significant fact-finding. Further, in most cases the relevant upper bound will

41. See Susan Decker, *Apple Patent Battles Create Lawyer Boon at \$1,200 an Hour*, BLOOMBERG (Aug. 23, 2012, 3:00 PM), <http://www.bloomberg.com/news/2012-08-23/apple-patent-battles-create-lawyer-boon-at-1-200-an-hour.html>.

42. 2011 AIPLA REPORT, *supra* note 40, at 35–36, I-154.

43. *Id.* at I-154. The reports from previous years have similar figures, with the highest 75th percentile reported in any year being \$11.5 million for cases in the Los Angeles region in 2009. See AIPLA, REPORT OF THE ECONOMIC SURVEY 2009, at I-129 (2009) [hereinafter 2009 AIPLA REPORT].

44. *In re Tamoxifen Citrate Antitrust Litig.*, 466 F.3d 187, 190, 194 (2d Cir. 2006) (noting the \$66.4 million total given to two generics).

45. The patent holder agreed to pay one generic \$6 million every three months and the other generic \$4.5 million per month for the period from March 31, 1998 to March 1, 2000. *Valley Drug Co. v. Geneva Pharm., Inc.*, 344 F.3d 1294, 1300–01 (11th Cir. 2003). Because of an FTC investigation, the parties terminated this settlement agreement early on August 13, 1999, so \$39 million of this was not actually paid out, but that was not part of the original settlement agreement and thus not relevant to the inference at issue here. *Id.*

46. The patent holder agreed to pay \$60 million to one generic and \$19–\$30 million annually to another generic for the 10.75 years from January 2006 to September 2015. *FTC v. Watson Pharm., Inc.*, 677 F.3d 1298, 1304–05 (11th Cir. 2012). The patent holder also agreed to pay one generic \$12 million for backup manufacturing assistance, but if we assume that this \$12 million constituted fair consideration for that assistance, then it should be excluded from the calculation of the reverse payment amount. *Id.*

47. *Ark. Carpenters Health & Welfare v. Bayer AG*, 604 F.3d 98, 102 n.8 (2d Cir. 2010).

be much smaller than \$32 million. Reverse payment settlements have most often arisen in the pharmaceutical industry, where patent litigation usually involves one or a few patents and the largest publicly documented amount spent on litigation that we could find was \$15 million, for a drug that had over \$1 billion in annual sales.⁴⁸ In contrast, the \$32 million litigation cost mentioned above involved many patents relevant to Apple's iPhone, on which it earned annual revenue of \$47 billion, which likely explains Apple's willingness to spend so much on that patent litigation.⁴⁹ Thus, \$15 million is likely a safe upper bound for pharmaceutical cases.

If neither of the above tests is dispositive, then the parties could call patent lawyers as experts to estimate the patent holder's anticipated litigation costs. For several reasons, this method of objectively measuring the patent holder's anticipated litigation costs is significantly more administrable than trying to objectively measure the patent strength, as courts would have to endeavor to do under an objective probabilistic scope of the patent test. First, because law firms that try large patent cases almost exclusively bill by the hour, one need only know the average amount of time that was expected to be necessary for patent litigation in order to estimate the patent holder's anticipated litigation costs; one need not estimate the probability that the patent holder would win or lose, which is conceptually far more difficult, if not imponderable. Second, hindsight bias is not a concern because most firms' hourly billing structures mean that patent litigation costs do not depend on whether the patent holder wins or loses. Third, firms that honestly are trying to keep their settlement payments below the patent holder's anticipated litigation costs could easily insulate themselves from being second-guessed by a court by soliciting arm's-length estimates of their litigation costs from law firms prior to the settlement.

2. Rebuttal by Showing At-Risk Entrant Is Sufficiently Judgment Proof.—Whether an entrant is judgment proof can affect whether or not the patent holder expects it to enter at risk, although the effects are mixed. On the one hand, if the entrant is judgment proof, then it pays only a fraction of damages if it loses, which makes it more likely to enter at risk. On the other hand, being judgment proof also means that if it loses, the entrant will go bankrupt and the managers may lose their jobs, which will make the corporation more likely to behave in a risk-averse fashion due to managerial risk aversion.

If the patent holder concludes that the net effect is that the entrant will not enter at risk, then our proof for strong patents continues to apply without any modification. The reason is that if the patent holder does not expect at-

48. See Richard D. Margiano, *Cost and Duration of Patent Litigation*, MANAGING INTELL. PROP., Feb. 2009, at 150, 150.

49. See Decker, *supra* note 41.

risk entry, then whether the entrant is judgment proof is irrelevant to assessing the patent holder's litigation payoff because it does not expect to sue for damages anyway. However, if the patent holder concludes that the net effect is that the entrant will enter at risk, then it becomes relevant that our model for weak patents assumes that the entrant is not judgment proof, that is, that it has sufficient assets to fully pay any patent damages. If we instead assume that an at-risk entrant would be judgment proof, then a patent holder could suffer an uncompensated loss of patent profits from such at-risk entry. This would reduce the expected litigation payoff to the patent holder, and thus would make it willing to accept a settlement with a smaller exclusion period than our proof predicted with at-risk entry.

This effect could mean that, even with a reverse payment that exceeds litigation costs, the patent holder might accept a settlement exclusion period that is less than the optimal patent exclusion period. To see why, call J the share of damages (between 0 and 1) that a judgment-proof entrant will be unable to pay. To simplify, assume here that both the patent holder and entrant perceive the same patent strength of θ . Then, assuming at-risk entry, we must subtract $JL\theta(P_N - P_Y)$ from the previously predicted litigation payoff because the patent holder no longer expects to collect that share of its lost-profits damages during litigation if it wins. Thus, its litigation payoff is now $P_N\theta + P_Y(1 - \theta) - C_P - JL\theta(P_N - P_Y)$. If this litigation payoff is exceeded by its settlement payoff, $P_N T + P_Y(1 - T) - A - C_P$, the patent holder will agree to settlement. This simplifies to saying the patent holder will agree to a settlement exclusion period of $T > \theta + A/(P_N - P_Y) - JL\theta$. The minimum settlement exclusion period of T that the patent holder would accept could thus be less than the optimal patent exclusion period if $JL\theta > A/(P_N - P_Y)$, which we can rearrange as when $JL\theta(P_N - P_Y) > A$. That is, the minimum settlement exclusion period might be less than the optimal patent exclusion period if the expected amount of uncollectable lost profits exceeds the difference between the reverse payment and the patent holder's anticipated litigation costs.

However, this is just the minimum settlement exclusion period. The actual settlement exclusion period could also be larger. The at-risk entrant's litigation payoff would be $L[E - \theta(P_N - P_Y)] + (1 - L)(1 - \theta)E - C_E$ plus the $JL\theta(P_N - P_Y)$ in damages it expects to avoid because it is judgment proof. If this is exceeded by its settlement payoff, $(1 - T)E + R$, it will accept settlement. This can be rearranged to conclude that the at-risk entrant will accept settlement if $T < \theta + (1/E)[R + C_E + L\theta(P_N - P_Y - E) - JL\theta(P_N - P_Y)]$. The maximum settlement exclusion period that the at-risk entrant would accept can thus exceed the optimal patent exclusion period when the expected amount of uncollectable lost profits is less than the sum of the reverse payment, avoided entrant litigation costs, and joint profits from excluding at-risk entry for a valid patent. Because the settlement could be reached anywhere between the minimum T the patent holder would accept and the maximum T the entrant would accept, one cannot know in such a

case whether the settlement exclusion period will or will not exceed the optimal patent exclusion period. On the other hand, where the defendants can show that the expected amount of uncollectable lost profits does exceed the sum of the reverse payment, avoided entrant litigation costs, and joint profits from excluding at-risk entry for a valid patent, then we do know that the settlement exclusion period must have been less than the optimal patent exclusion period.

However, even in such a case, the settlement exclusion period will still exceed the expected litigation exclusion period if the reverse payment exceeds litigation costs. As shown above, the expected litigation exclusion period without litigation is $\theta(1 - L)$. The settlement exclusion period will always exceed this if $\theta + A/(P_N - P_Y) - JL\theta > \theta(1 - L)$, which rearranges to $(1 - J)L\theta + A/(P_N - P_Y) > 0$. This is always true because $J \leq 1$, A is positive, and $P_N > P_Y + E$. The extent to which the minimum settlement exclusion period will exceed the expected litigation exclusion period will thus increase the higher the reverse payment and the higher the length of litigation, odds of patent victory, or share of damages the judgment-proof entrant will pay.

In sum, even if the defendants can show that at-risk entry would have occurred by a judgment-proof entrant, that showing will mean only that the settlement exclusion period *could* be less than the optimal patent exclusion period *only* if they also show that the expected amount of uncollectable lost profits exceeds the difference between the reverse payment and the patent holder's anticipated litigation costs. It will mean the settlement exclusion period necessarily *will* be less than the optimal patent exclusion period *only* if the defendants can also show that the expected amount of uncollectable lost profits exceeds the sum of the reverse payment, avoided entrant litigation costs, and joint profits from excluding at-risk entry for a valid patent. Further, even in such a case, the settlement will clearly increase the exclusion period relative to litigation, thus creating at most a murky tradeoff between harming *ex post* consumer welfare through that increased exclusion of entry and benefiting *ex ante* consumer welfare by increasing the patent reward to a level still within the optimal patent exclusion period.

3. *Rebuttal by Proving Other Procompetitive Justifications.*—Leaving aside cases of judgment-proof entrants, the proof above shows that when a settlement does nothing else other than set an entry date and provide reverse payments that exceed the patent holder's anticipated litigation costs, then the settlement cannot be justified as necessary to reach a settlement that: (a) shortens the expected exclusion period (which would increase *ex post* consumer welfare); or (b) increases the patent reward to a level still within the optimal patent exclusion period (which would increase *ex ante* consumer welfare). The reason is that our proof precludes those procompetitive justifications.

However, in some cases, settlements might have unique features that create *other* procompetitive justifications that can offset any anticompetitive

effects.⁵⁰ For example, one of us was a defense expert in the *In re Cardizem* case and found that the settlement there had the unique feature that it allowed the generic to bring a reformulation of its generic drug onto the market more quickly than otherwise possible. The entry in that case was governed by the Hatch-Waxman Act, which allows a patent holder to automatically delay entry by a reformulated generic by an additional 30 months.⁵¹ The settlement prevented this additional delay by providing that the reformulated generic would be treated like the original generic. The reverse payment was then used to fund the reformulation, which the patent holder ultimately conceded was outside the patent. It thus resulted in earlier generic entry. Further, in that case, the evidence indicated that the generic was judgment proof to a significant extent. It was thus a particularly strong case to rebut a presumption that reverse payment settlements have anticompetitive effects.⁵²

4. *No Rebuttal by Showing Lack of Market Power.*—The model above assumed only that the joint profits of the patent holder and entrant would be higher without entry than with it. This condition will hold as long as the patent holder has any degree of market power that the entrant would constrain, even if it falls well short of monopoly power.

Further, the fact that the reverse payment exceeds litigation costs itself proves that the patent holder has market power that the settling entrant would constrain. If the patent holder lacked this market power, then by definition its business profits would be identical no matter when the entrant entered the market because other firms would constrain the patent holder to price at cost regardless of when this entrant entered. If so, the patent holder would earn the same business profits whether it won the patent litigation, lost the patent litigation, or settled and excluded the entrant for some period. The only effect of settlement would thus be that the patent holder would save its anticipated litigation costs and incur the cost of making the reverse payment.

50. The Third Circuit has recognized the need to allow this sort of rebuttal for other procompetitive justifications. *In re K-Dur Antitrust Litig.*, 686 F.3d 197, 218 (3d Cir. 2012).

51. 21 U.S.C. § 355(j)(5)(D)(i)–(ii) (2006).

52. Aiding this sort of rebuttal evidence was other evidence in that case that minimized the possible anticompetitive effects that needed to be rebutted. The *Cardizem* settlement differed from the sort we model in this Article because it did not end the patent litigation and set a fixed settlement entry date. Rather, it was an interim settlement that required the parties to continue the patent litigation, precluded entry only during the litigation and only if the litigation did not last too long, and allowed the generic to keep the reverse payment only if it won the litigation. Further, in that case anticompetitive effects were undermined by strong evidence that: (1) the entrant would not have entered at risk anyway, so that such a purely interim settlement did not preclude any entry by the settling generic; and (2) no other generic entry was delayed because (a) under the rules that then prevailed, the settling generic had to win the patent litigation to preclude other generics and (b) no other generic received FDA approval in time to enter any earlier anyway. Given this evidence, the FTC concluded that the settlement had not actually delayed any generic entry. FED. TRADE COMM'N, DOCKET NO. 9293, ANALYSIS TO AID PUBLIC COMMENT 4 (2001), available at <http://www.ftc.gov/os/2001/04/hoechstanalysis.pdf>.

Therefore, if the reverse payment amount exceeds the litigation costs, the settlement would always make the patent holder worse off if it lacked market power. Accordingly, the patent holder's willingness to make a reverse payment that exceeds its anticipated litigation costs necessarily means that it believes it has market power.

Given this, if the reverse payment exceeds litigation costs, courts should not allow defendants to rebut the presumption by arguing that the patent holder lacked market power. Instead, a reverse payment of that size itself proves market power, and obviates any need to establish market definition or other methods of showing market power.⁵³

This same analysis also rebuts the claim that anticompetitive effects could be eliminated because nonsettling entrants can still challenge the patent.⁵⁴ Even though that possibility generally exists, our analysis proves that the patent holder would never make a reverse payment of this size if nonsettling entrants could—through entry or patent litigation—create the same constraint on its market power. The patent holder would make a reverse payment that exceeds its anticipated litigation costs only if excluding the settling entrant confers an enhanced market power on the patent holder that it otherwise would not enjoy.

5. No Rebuttal by Showing Risk Aversion.—Our model assumes firms are risk neutral. This assumption generally holds, but even if it did not, it would not alter our conclusions.

Entrants are typically public corporations with a market capitalization that exceeds the potential patent damages from the case at hand. In those circumstances, the entrant's managers and shareholders have incentives to behave in a risk-neutral manner that maximizes expected profits. In other situations, entrants might be risk averse, in which case they might not enter at

53. See *FTC v. Ind. Fed'n of Dentists*, 476 U.S. 447, 460–61 (1986) (“[P]roof of actual detrimental effects, such as a reduction of output, can obviate the need for an inquiry into market power, which is but a ‘surrogate for detrimental effects.’”); *Toys “R” Us, Inc. v. FTC*, 221 F.3d 928, 937 (7th Cir. 2000) (Wood, J.) (“[T]he share a firm has in a properly defined relevant market is only a way of estimating market power, which is the ultimate consideration. The Supreme Court has made it clear that there are two ways of proving market power. One is through direct evidence of anticompetitive effects.” (citations omitted)); *Allen-Myland, Inc. v. Int’l Bus. Machs. Corp.*, 33 F.3d 194, 209 (3d Cir. 1994) (Easterbrook, J.) (“Market share is just a way of estimating market power, which is the ultimate consideration. When there are better ways to estimate market power, the court should use them.” (quoting *Ball Mem’l Hosp., Inc. v. Mut. Hosp. Ins., Inc.*, 784 F.2d 1325, 1336 (7th Cir. 1986))); *United States v. Baker Hughes Inc.*, 908 F.2d 981, 992 (D.C. Cir. 1990) (Thomas, J., joined by Ruth Bader Ginsburg, J.) (same); see also IIB PHILLIP E. AREEDA, HERBERT HOVENKAMP & JOHN L. SOLOW, *ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION* 108 (3d ed. 2007) (“[D]irect indicators of market power . . . can be independent of market definition and are sometimes superior to it. . . . [M]arket definition may not be necessary to prove market power.”).

54. See *FTC v. Watson Pharm., Inc.*, 677 F.3d 1298, 1315 (11th Cir. 2012) (making such a claim).

risk even though a risk-neutral entrant would. But this would merely expand the set of cases for which the proof for strong patents applies, which proved anticompetitive effects. Thus, whether or not risk aversion would deter at-risk entry, a reverse payment that exceeds anticipated litigation costs would be anticompetitive.

Risk aversion is unlikely to be a serious issue for the patent holder. Because the patent holder does not face the risk of patent damages, aversion to loss is not relevant to it. Although individuals might sometimes prefer to avoid variation in profits by accepting certain profits with lower expected value, this is unlikely to be relevant for a publicly held corporation, which generally has incentives to maximize expected profits on behalf of a diversified set of shareholders. Managers who do not maximize expected profits increase the risk that their conduct will be punished by product markets, capital markets, labor markets, takeover threats, shareholder voting, and lower valuation of their stock options. Further, because the issue for patent holders is merely variation in the degree of profits, decisions to litigate are unlikely to create a risk that the corporation will go out of existence that could override those ordinary managerial incentives.

In any event, to the extent that risk aversion could cause managers of the patent holder to enter into settlements that fail to maximize its expected corporate profits, that effect reflects an undesirable agency cost that can only be exacerbated by reverse payments that make such settlements more likely. Facilitating managerial risk aversion that reduces expected firm profits is certainly not a procompetitive efficiency that could justify the anticompetitive effects of a reverse payment settlement. Indeed, considering possible managerial risk aversion would only strengthen the case for invalidating reverse payments that exceed the patent holder's litigation costs. The reason is that, to the extent that managerial risk aversion might make a difference, it means that if managers were allowed to make reverse payments that exceed the patent holder's anticipated litigation costs, the managers might do so in order to get a more certain exclusion period even though the settlement lowers expected corporate profits. Allowing managers to make reverse payments of this size would accordingly lower the expected corporate profits on the underlying innovation, reducing incentives to innovate below optimal levels. Curbing this possible distortion of innovation incentives from managerial risk aversion would thus provide another benefit from condemning reverse payments that exceed the patent holder's anticipated litigation costs.

III. Settlements Without Reverse Payments That Exceed Litigation Costs

If the reverse payment does not exceed the patent holder's anticipated litigation costs, then we can no longer be sure that the settlement exclusion period will *necessarily* exceed the expected litigation exclusion period and the optimal patent exclusion period. But we prove below that such a

settlement *usually* will have these anticompetitive effects. We do so by modeling the simple case of a settlement that sets an exclusion period but has no reverse payment. The FTC, DOJ, and many prominent antitrust and patent scholars have assumed that such a settlement will likely produce a settlement exclusion period that equals the expected litigation exclusion period.⁵⁵ We prove that this widespread assumption is incorrect; instead entry-excluding settlements with no reverse payment are usually anticompetitive. This necessarily means that entry-excluding settlements are also usually anticompetitive if they have a positive reverse payment that is lower than anticipated patent holder litigation costs because increasing the reverse payment from zero to any positive amount can only increase the settlement exclusion period that the patent holder would demand and that the entrant would accept.

Because this subset of settlements is not susceptible to proofs showing that they are necessarily anticompetitive, it may make sense to allow rebuttal through direct inquiry into the expected litigation exclusion period or the optimal patent exclusion period. Although that inquiry is difficult, it can be bounded in various ways that we describe below. To the extent those bounds do not apply and a court concludes that such a direct inquiry is too unreliable, the best substantive solution would be to preclude rebuttal because most such settlements are anticompetitive. However, the better method for resolving these cases might be procedural rather than substantive. The underlying problem that makes it possible for patent holders and entrants to collude in settlements that benefit themselves at the cost of buyers is the ordinary legal rule that patent law does not give buyers standing to challenge dubious patents. Thus, a possible procedural solution to address such settlements would be to give buyers standing to challenge the patent's validity.

A. Proof That Even Settlements with Zero Reverse Payment Are Usually Anticompetitive

Because we are just trying to get a rough sense of likelihood, rather than prove necessary effects, we adopt the simplifying assumption that the entrant and patent holder perceive the same patent strength of θ and same anticipated litigation cost C . Although their perceptions could vary, that possibility could increase or decrease the likelihood of anticompetitive settlements and thus it has no clear effect on the overall likelihood. Otherwise, we use the same model as in Part II. Although we illustrate this proof formally below, the intuition is easy to grasp. Any delay in entry increases the patent holder's profits by more than it decreases the entrant's profits (i.e., $P_N - P_Y > E$). Therefore, the patent holder will be less willing to accept a shorter exclusion period in order to avoid litigation costs than the entrant is willing to accept a

55. See *supra* note 22; see *infra* Part IV.

longer exclusion period to avoid litigation costs. This will push the range of possible settlement exclusions higher.

In a Hatch-Waxman case, there is the additional factor that settlement guarantees the first-filing generic a 180-day period of generic exclusivity after the settlement exclusion period ends, whereas with litigation the odds are θ that the first-filing generic will lose the patent litigation and never get any generic exclusivity period. This factor will make the first-filing generic even more willing to accept a longer exclusion period to get a settlement, especially because a generic's profits during any period of generic exclusivity far exceed its profits during any period when it has to compete with other generics. In other words, this factor means that in a Hatch-Waxman case, T_{\max} would be much greater than calculated in the proof that follows, and thus the odds would be even higher that a settlement without any reverse payment will exclude entry for longer than the expected litigation exclusion period and the optimal patent exclusion period, and the magnitude of the additional exclusion can be much greater. Because the proof that follows does not rely on this additional factor, it conservatively understates the likelihood and magnitude of anticompetitive effects in a Hatch-Waxman case and also shows that the problem exists even outside the Hatch-Waxman context.

1. Strong Patent.—Take first the case of a strong patent. As shown above, the patent holder's expected litigation payoff is $LP_N + (1 - L)[\theta P_N + (1 - \theta)P_Y] - C$. Without a reverse payment, its settlement payoff is $TP_N + (1 - T)P_Y$. It will accept a settlement only if the latter is greater than the former, which one can rearrange to show that the minimum settlement exclusion period it will accept is $T_{\min} = \theta + L(1 - \theta) - C/(P_N - P_Y)$. Therefore, T_{\min} will exceed the optimal patent exclusion period whenever $L(1 - \theta) > C/(P_N - P_Y)$, which can be rearranged as $(1 - \theta)L(P_N - P_Y) > C$. In words, the minimum settlement exclusion period will exceed the optimal patent exclusion period whenever the patent holder's anticipated litigation costs are less than the additional supracompetitive profits it expects to make because the strong patent deters entry during litigation even when in fact the patent holder would have lost. Thus, even without any reverse payment, there are some cases where the minimum settlement exclusion period will necessarily exceed the optimal patent exclusion period but other cases when it will not.

With a strong patent, the expected litigation exclusion period is $L + \theta(1 - L)$, which is the same as $\theta + L(1 - \theta)$. Therefore, T_{\min} is always lower than the expected litigation exclusion period by $C/(P_N - P_Y)$.

However, T_{\min} just tells us the bottom edge of the bargaining range. To get the full bargaining range, one needs to also know the maximum settlement exclusion period that the entrant would accept. The entrant's expected litigation payoff is $(1 - L)(1 - \theta)E - C$. Without a reverse payment, its settlement payoff is $(1 - T)E$. It will accept a settlement only if the latter is greater, which one can rearrange to show that the maximum settlement

exclusion period it will accept is $T_{\max} = \theta + L(1 - \theta) + C/E$. This maximum thus always exceeds the optimal patent exclusion period by $L(1 - \theta) + C/E$. It also always exceeds the expected litigation exclusion period by C/E . Because bargaining can produce a settlement anywhere between T_{\min} and T_{\max} , the above analysis proves that, for strong patents, settlements without any reverse payment can produce a settlement exclusion period that exceeds both the optimal patent exclusion period and the expected litigation exclusion period.

Given that any settlement between T_{\min} and T_{\max} is possible, it makes some sense to assume that all such settlements are equally likely. Under this assumption, the middle of this settlement range equals the average expected settlement exclusion period, T_{avg} . Given the above, $T_{\text{avg}} = \theta + L(1 - \theta) + C/(2E) - C/(2(P_N - P_Y))$. T_{avg} will thus exceed the expected litigation exclusion period, $\theta + L(1 - \theta)$, whenever $C/(2E) > C/(2(P_N - P_Y))$, which is true if $P_N - P_Y - E > 0$, which is always true because the patent holder's profits without entry exceed joint profits with entry. T_{avg} will exceed the optimal patent exclusion period by this amount plus $L(1 - \theta)$.

Therefore, even with zero reverse payment and a strong patent, the middle of the settlement range always exceeds both the expected litigation exclusion period and the optimal patent exclusion period. This rebuts the prevailing view that settlements without reverse payments will do neither. To the contrary, the above proof establishes that, if we assume all settlements in the bargaining range are equally likely, settlements without reverse payments are usually anticompetitive.

To get some sense of just how likely these anticompetitive effects are in an average case, we need to estimate the average for some of these parameters. Given the data summarized above, \$10 million appears to be a good high-end estimate of average litigation costs, so we will use that as our average estimate of C . The lion's share of reverse payment settlements have occurred in pharmaceutical markets, where on average, the residual patent term is 90.2 months and monthly pre-entry sales by the patent holder are \$72.6 million.⁵⁶ This means average total sales for a patent holder during the

56. This data is drawn from Professor Scott Hemphill's invaluable survey of 143 patent settlements from 1984 to 2008. See generally C. Scott Hemphill, *An Aggregate Approach to Antitrust: Using New Data and Rulemaking to Preserve Drug Competition*, 109 COLUM. L. REV. 629 (2009); C. Scott Hemphill, *Drug Patent Settlements Between Rivals: A Survey* (March 12, 2007) (unpublished manuscript), available at <http://academiccommons.columbia.edu/catalog/ac%3A129331>. We use the date of the settlement agreement, rather than the expiration of the 30-month Hatch-Waxman stay, as the best indicator of when generic entry was first possible because sometimes the Hatch-Waxman stay gets extended for other reasons, like pediatric exclusivity. If one instead uses the expiration of the 30-month stay, the residual patent period would be 93.2 months. Because our focus is on the prospective issue of how likely it is that settlements that exclude entry would be anticompetitive if no reverse payment were allowed, we combine results from settlements that did and did not have a reverse payment. If one instead wanted to ask about the likelihood that past settlements without any reverse payment were anticompetitive, then the

remaining patent term would be \$6.548 billion. The average length of patent litigation after the end of the automatic Hatch-Waxman stay is about 18 months.⁵⁷ We can thus estimate that on average $L = 18/90.2 = 0.1996$.

On average, a single generic entrant prices at 70%–88% of the pre-entry price charged by the patent holder.⁵⁸ To get a single average, we average these figures to estimate the generic price is 79% of the patent holder's pre-entry price. (With multiple generic entrants, the drop in price is much higher, so the results with the assumption here of only one generic entrant are quite conservative.) Empirical studies show that incumbent drug prices remain fairly constant in response to entry.⁵⁹ Costs are around 20% of the patent holder's pre-entry price,⁶⁰ which suggests that on average $P_N = 80\%$ of \$6.548 billion = \$5.238 billion. Generic producers get 40%–50% of the market.⁶¹ To get a single average, we average these to estimate a 45% generic market share. Because the empirical evidence indicates that generic entry does not alter total market volume,⁶² this means that on average $P_Y = \$2.881$ billion and $E = \$1.732$ billion.⁶³

Given these numbers, the average threshold probability to have a strong patent $\theta^* = E/(P_N - P_Y) = 47.2\%$. Therefore, in the average pharmaceutical case, the patent holder's odds of winning the patent would have to exceed 47.2% to be a strong patent that deters at-risk entry.

For such a strong patent, if we plug the above values into the equation for T_{\min} , we get that $T_{\min} = 0.1954 + 0.8004\theta$. Thus, in the average case, the

residual patent period for only those settlements would be 75.4 months and the average monthly sales figure would be \$42.4 million. This would not alter our qualitative conclusions. See *infra* section III(A)(3) (showing that cutting the residual patent period and annual profit level in half would actually make it somewhat *more* likely that settlements without reverse payments are anticompetitive).

57. See GREENE & STEADMAN, *supra* note 17, app. C.

58. Frank & Salkever, *supra* note 32, at 84 fig.3 (reporting 70%); Reiffen & Ward, *supra* note 32, at 43–44 (reporting 88%).

59. In fact, incumbents increase their drug prices slightly in response to generic entry, but because the price increase is only 0.7% with one generic entrant, we treat it as unchanged. Frank & Salkever, *supra* note 32, at 87. Apparently, the incumbent makes more money by keeping its price high and selling only to price-insensitive customers than the incumbent would make if it lowered its price to compete with the generic for price-sensitive customers.

60. Reiffen & Ward, *supra* note 32, at 43.

61. Frank & Salkever, *supra* note 32, at 89.

62. See Gautier Duflos & Frank R. Lichtenberg, *Does Competition Stimulate Drug Utilization? The Impact of Changes in Market Structure on US Drug Prices, Marketing and Utilization*, 32 INT'L REV. L. & ECON. 95, 106–07 (2012) (concluding that net volume is unchanged by entry into drug markets because entry leads to a decline in both prices and marketing expenditures, which “approximately offset” each other's effects on output).

63. Because the patent holder profit per sale is unchanged, $P_Y = 55\%$ of P_N . The generic who is a single entrant has a price that is 79% of the patent holder's with the same marginal cost of 20%, and thus earns 59% of the patent holder gross sales for 45% of volume, which means average monthly profits of 59% of 45% of \$72.46 million = \$19.2 million. Thus, if it could obtain those profits for the entire residual patent period, it would get \$1.732 billion.

minimum settlement exclusion period exceeds the optimal patent exclusion period whenever $0.1954 + 0.8004\theta > \theta$, which is true whenever $\theta < 97.9\%$. Therefore, even without any reverse payment, the minimum settlement exclusion period exceeds the optimal patent exclusion period in the average case unless the patent holder is all but assured of winning the patent litigation.

We can also ascertain the portion of the settlement range that exceeds the optimal patent exclusion period in the average case. Given the above, this portion is 100% for patent strengths between 47.2% and 97.9%. For extremely strong patents with strengths from 97.9% to 100%, the portion of the settlement range above $\theta = (T_{\max} - \theta)/(T_{\max} - T_{\min})$. Plugging the values into the equation for T_{\max} , we get that $T_{\max} = 0.2054 + 0.8004\theta$. Inserting that into the prior equation, we find that (given average numbers) the portion of the settlement range that exceeds the optimal patent exclusion period is $20.54 - 19.96\theta$. Over this range of extremely strong patents, this portion drops from 99% to 58% as the patent strength goes from 97.9% to 100%.

For a strong patent, the expected litigation exclusion period is $L + \theta(1 - L) = 0.1996 + 0.8004\theta$. The portion of the settlement range above the expected litigation exclusion period in the average case is $(T_{\max} - 0.1996 - 0.8004\theta)/(T_{\max} - T_{\min}) = 58\%$ for all patent strength levels that constitute a strong patent.

In sum, even with zero reverse payment and a strong patent, the middle of the settlement range produces an exclusion period that always exceeds both the expected litigation exclusion period and the optimal patent exclusion period. Assuming parties are equally likely to reach any settlement in the bargaining range, this means that settlements without reverse payments are usually anticompetitive. Further, using actual average numbers for such settlements, the settlement exclusion period for a strong patent is 100% likely to exceed the optimal patent exclusion period unless the patent is extremely strong (more than 97.9% certain to win). Even for extremely strong patents whose patent strength ranges from 97.9% to 100%, the settlement is still 58% to 99% likely to exceed the optimal patent exclusion period. Further, the settlement exclusion period is 58% likely to exceed the expected litigation exclusion period for all levels of patent strength that qualify as a strong patent.

2. *Weak Patent.*—Next consider a weak patent. As shown above, the patent holder's expected litigation payoff is $P_N\theta + P_Y(1 - \theta) - C$. It will accept a settlement without a reverse payment if this is exceeded by its settlement payoff of $TP_N + (1 - T)P_Y$. Thus, $T_{\min} = \theta - C/(P_N - P_Y)$. Accordingly, a settlement exclusion period that is lower than the optimal patent exclusion period is always possible without a reverse payment. Indeed, T_{\min} is always lower than the optimal patent exclusion period by $C/(P_N - P_Y)$. The expected litigation exclusion period for a weak patent is $\theta(1 - L)$. Thus, T_{\min} will exceed the expected litigation exclusion period if

$\theta L > C/(P_N - P_Y)$, which can be rearranged as $\theta L(P_N - P_Y) > C$. Accordingly, there are some cases where the minimum settlement exclusion period will necessarily exceed the expected litigation exclusion period.

The entrant's expected litigation payoff given a weak patent is $L[E - \theta(P_N - P_Y)] + (1 - L)(1 - \theta)E - C$. It will accept a settlement without a reverse payment if this is exceeded by its settlement payoff of $(1 - T)E$. Thus, $T_{\max} = \theta(1 - L) + (1/E)[\theta L(P_N - P_Y) + C]$. This maximum thus always exceeds the expected litigation exclusion period by $(1/E)[\theta L(P_N - P_Y) + C]$. This maximum also exceeds the optimal patent exclusion period if $(1/E)[\theta L(P_N - P_Y) + C] > L\theta$. This can be rearranged as $\theta L(P_N - P_Y - E) + C/E > 0$. This is always true given that joint profits without entry exceed joint profits with entry and litigation costs are positive. Therefore, the maximum settlement exclusion period always exceeds both the optimal patent exclusion period and the expected litigation exclusion period. Accordingly, for weak patents as well as strong, settlements without any reverse payment can produce settlement entry dates that exceed both the optimal patent exclusion period and the expected litigation exclusion period.

Given the above, $T_{\text{avg}} = \theta + \theta L(P_N - P_Y - E)/2 + C/(2E) - C/(2(P_N - P_Y))$. The second term is positive because joint profits without entry exceed joint profits with entry, so T_{avg} will always exceed the optimal patent exclusion period, θ , if $C/(2E) > C/(2(P_N - P_Y))$. This is always true given that $P_N - P_Y - E > 0$. Thus, T_{avg} will always exceed the optimal patent exclusion period. The expected litigation exclusion period for a weak patent is $\theta(1 - L)$, thus T_{avg} will exceed this expected exclusion period by this amount plus θL .

Therefore, even with zero reverse payment and a weak patent, the middle of the settlement range always exceeds both the expected litigation exclusion period and the optimal patent exclusion period. If we assume all settlements in the bargaining range are equally likely, settlements without reverse payments are usually anticompetitive for weak patents as well as strong.

Using the numbers above, we can get a sense of just how likely these anticompetitive effects are in the average case. Given those numbers, a weak patent exists if $\theta < 47.2\%$. For such a weak patent, if we plug the above values into the equation for T_{\min} , we get that $T_{\min} = \theta - 0.004243$. Plugging in the values into the equation for T_{\max} , we get that $T_{\max} = 0.005774 + 1.072\theta$. The portion of the settlement range above $\theta = (T_{\max} - \theta)/(T_{\max} - T_{\min}) = (0.005774 + 0.072\theta)/(0.010017 + 0.072\theta)$. This ranges from 58% to 90% for weak patents. Thus, if we assume parties are equally likely to reach any settlement in the bargaining range, a settlement with no reverse payment is 58% to 90% likely to exceed the optimal patent exclusion period even for a weak patent that cannot deter at-risk entry.

The expected litigation exclusion period for a weak patent is $\theta(1 - L) = 0.8004\theta$. The minimum settlement exclusion period $T_{\min} = \theta - 0.00424$. Thus, the minimum settlement exclusion period exceeds the expected litigation exclusion period if $\theta - 0.00424 > 0.8004\theta$, which is true if

$\theta > 2.1\%$. Accordingly, even without any reverse payment, in the average case the minimum settlement exclusion period exceeds the expected litigation exclusion period other than for a very weak patent that is less than 2.1% likely to win the patent litigation.

We can also ascertain the portion of the settlement range that exceeds the expected litigation exclusion period. Given the above, this portion is 100% for patent strengths between 2.1% and 47.2%. For patent strengths less than 2.1%, the portion of the settlement range that exceeds the expected litigation exclusion period is $(T_{\max} - 0.8004\theta)/(T_{\max} - T_{\min}) = (0.005774 + 0.2716\theta)/(0.010017 + 0.072\theta)$. Over this range of extremely weak patents, this portion ranges from 58% to 99%.

Accordingly, for a weak patent, like a strong one, a settlement with no reverse payment still results in a settlement range whose midpoint always exceeds both the expected litigation exclusion period and the optimal patent exclusion period. Assuming parties are equally likely to reach any settlement in the bargaining range, this means that settlements without reverse payments are usually anticompetitive. Further, using actual average numbers for such settlements, a settlement is 100% likely to exceed the expected litigation exclusion period unless the patent is extremely weak (less than 2.1% likely to win). Even for extremely weak patents whose patent strength ranges from 0% to 2.1%, the settlement is still 58% to 99% likely to exceed the expected litigation exclusion period. Further, the settlement exclusion period is 58% to 90% likely to exceed the optimal patent exclusion period.

3. *Summary.*—We have thus proven that, even with a zero reverse payment, a settlement that excludes entry for some period will produce a settlement range whose midpoint exceeds both the optimal patent exclusion period and the expected litigation exclusion period at *any* level of patent strength and for *any* level of market profits, residual patent period, litigation length, and litigation costs. Because we have no particular reason to assume that some settlements in the possible range are any more likely than others, it makes some sense to assume all of them are equally likely. If so, then we can say that all settlements that exclude entry for some period with no reverse payment are usually anticompetitive, regardless of the market particulars.

If we do use typical numbers for such settlements, we can go further and estimate the likelihood that they are anticompetitive. The graph below combines the above analysis to depict the portion of the bargaining range that exceeds the optimal patent exclusion period (vertical axis) at each level of possible patent strength (horizontal axis).

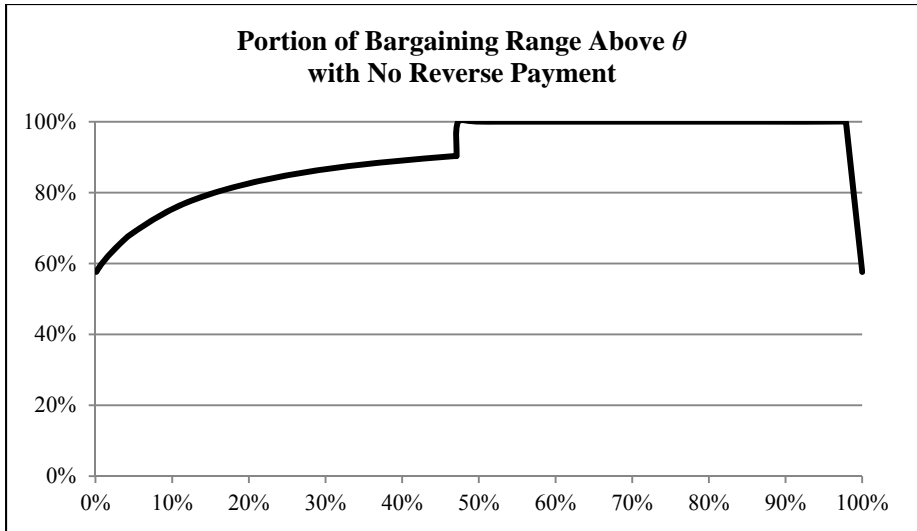


Figure 1.

As Figure 1 shows, this proportion exceeds 50% for all levels of patent strength. It ranges from 58% to 90% for weak patents (for which patent victory is less than 47.2% likely), but rises to 100% for strong patents (above this 47.2% threshold), unless the patent is extremely strong, in which case the proportion declines from 99% to 58% as the patent strength goes from 97.9% to 100%. It is thus at least 58% likely that the optimal patent exclusion period is exceeded at all patent strength levels, and usually the likelihood is much higher than that. Further, if the evidence shows that the patent was strong enough to deter at-risk entry, then the settlement will certainly exceed the optimal patent exclusion period unless patent victory was a slam dunk.

The next graph below combines the above analysis to depict the proportion of the bargaining range that exceeds the expected litigation exclusion period at each level of possible patent strength.

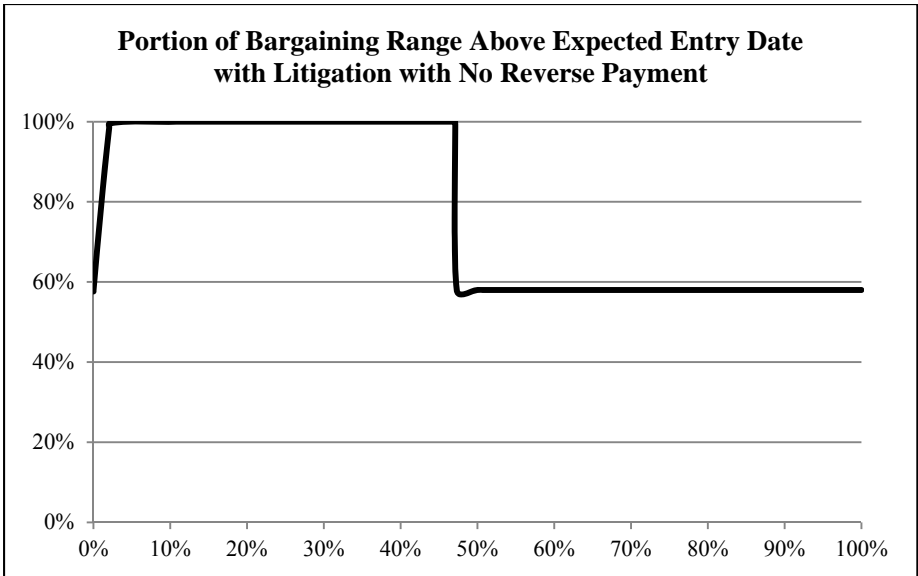


Figure 2.

This portion exceeds 50% for all levels of patent strength. It ranges from 58% to 99% for extremely weak patents (which are less than 2.1% likely to prevail), is 100% for all other weak patents (those 2.1% to 47.2% likely to win), and then drops back to 58% for strong patents. Thus, it is at least 58% likely that the expected litigation exclusion period is exceeded at all patent strength levels. Further, if the evidence indicates that the patent was weak enough that the entrant would have entered at risk, then the settlement will certainly exceed the expected litigation exclusion period unless a patent loss was virtually assured.

Further, the portion of possible settlement exclusion periods that will exceed *both* standards can be depicted by the following graph, which puts together the graphs above. The bottom edge of the range of likelihood is 58% with the likelihood increasing to 90% for some patent strength levels. In short, even without any reverse payment, the bulk of possible settlement exclusion periods will exceed both the expected litigation exclusion period and the optimal patent exclusion period at every possible level of patent strength.

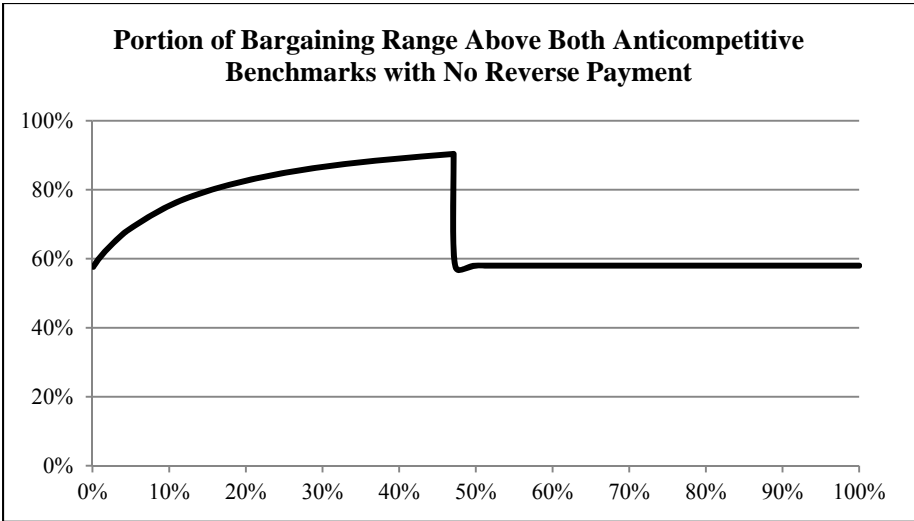


Figure 3.

The above analysis proved that these portions will exceed 50% regardless of the particular assumptions we make about market factors. To illustrate, suppose we cut in half our estimates of both the patent holder profits per month without entry and the residual patent period, so that the total patent holder profits without entry at stake are only one-fourth of what we estimated. Using the same analysis as above, we get the following graph for the portion of the bargaining range that is above both anticompetitive benchmarks for a settlement with zero reverse payment.

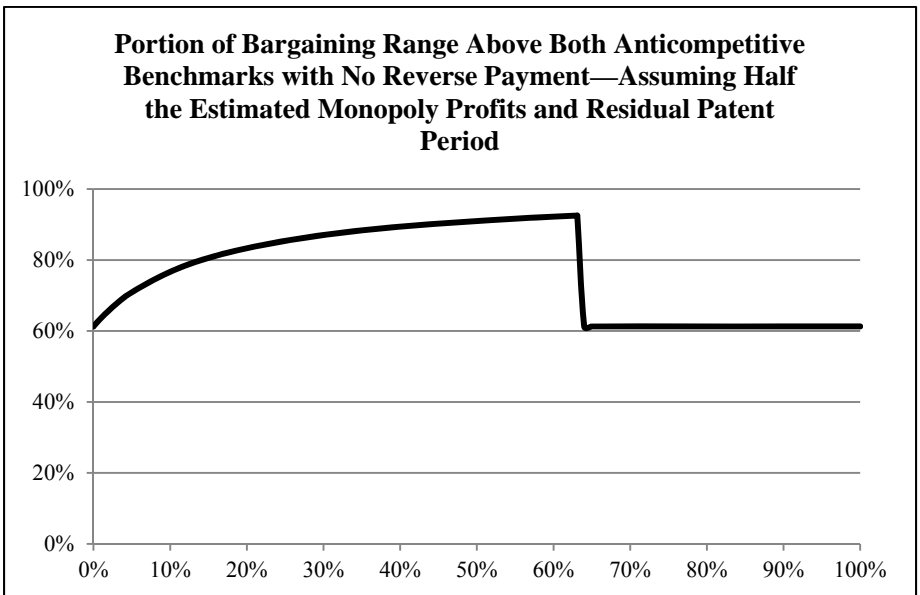


Figure 4.

With lower monthly profits and a smaller residual patent period, the threshold for a strong patent is higher (now 63.2%), but the portion of settlements that are above both anticompetitive benchmarks remains above 50% at each patent strength level. Indeed, the bottom of the range of likelihood is now higher, at 61%, as is the top of the range, now at 93%.

B. Grounds for Rebuttal and Possible Procedural Solution

The above analysis demonstrates that, even without any reverse payment, a settlement that excludes entry for some period will likely exceed both the expected litigation exclusion period and the optimal patent exclusion period. Because adding any reverse payment will only increase the settlement exclusion period, settlements with a reverse payment that is smaller than the patent holder's anticipated litigation costs are even more likely to cause these anticompetitive effects.

However, we cannot exclude the possibility that some such settlements might not be anticompetitive. This proof thus suggests that courts should in these cases also adopt a presumption of illegality, but allow it be rebutted by direct proof that the settlement exclusion period was shorter than the expected litigation exclusion period or the optimal patent exclusion period. The problem is that such a rebuttal would require the sort of direct case-by-case inquiry into probabilistic patent strength that many courts seek to avoid in antitrust cases.

One way to narrow the inquiry would be to add a market-power screen. Here such a screen makes sense because one cannot exclude the possibility that no market power exists if the reverse payment has not exceeded the patent holder's anticipated litigation costs. Further, there can be no harm to consumer welfare without market power, which is by definition the power to raise prices above competitive levels. However, this screen will not help in the typical patent settlement case where such market power can be proven.

Nonetheless, the above analysis can help bound the probabilistic analysis in a way that makes it more tractable. For example, suppose a court concludes that the relevant standard is whether the settlement exceeds the optimal patent exclusion period and that there is good evidence that at-risk entry would not have occurred. Then, if the case at hand matched average numbers for things like market profits and residual patent period, we know that the relevant standard must have been violated unless it was an extremely strong patent whose patent strength exceeded 97.9%. Even if courts would have difficulty assessing the precise probability of patent victory, it may be easier for courts to decide whether that lower bound seems likely to be exceeded. In an actual case, expert witnesses would simply plug in the case-specific values for market profits, residual patent term, expected litigation length, and anticipated cost to reach the appropriate lower bound for that case. Those values are easier to ascertain than the probability of patent victory.

Similarly, suppose a court concludes that the relevant standard is whether the settlement exceeds the expected litigation exclusion period and that there is good evidence that at-risk entry would have occurred. Then it can conclude that the relevant standard must have been violated unless it was an extremely weak patent, with the upper bound being 2.1% with typical numbers or by using another upper bound based on case-specific numbers.

However, a court will not be able to set upper and lower bounds that guarantee that both standards are violated in the same case. Thus, if it wants to allow rebuttal under both standards at once, then it cannot avoid a direct inquiry into probabilistic patent strength. Given the difficulty with this sort of inquiry, this might be unattractive but there may be no better alternative.

If courts do not think they can reliably assess probabilistic patent strength, one solution would be not to allow rebuttal at all. This would reach the wrong result in some cases, but by hypothesis, the problem is that courts cannot distinguish those cases. Therefore, their substantive choices are to either condemn all such settlements or allow them all. Given our proof that most settlements without reverse payments are anticompetitive, allowing all such settlements would produce worse results than condemning them all. To be sure, the magnitude of anticompetitive harm is much smaller without a reverse payment, but that does not make such harms desirable, and antitrust law generally has no exception for small anticompetitive harms.

Given the problems with these possible substantive responses, the better solution in such cases might be procedural. The underlying problem that allows anticompetitive patent settlements is that patent law ordinarily does not allow buyers to sue to prevent the anticompetitive exclusion of rivals through invalid patents. If patent law did allow such buyer standing, then patent holders and entrants could not collude in settlements that bar patent scrutiny of dubious patents at the expense of buyers. Those buyers would have a strong interest in challenging dubious patents.

There may well be good reasons to change this patent rule against buyer standing generally. But at a minimum, one could lift this bar on buyer standing in patent cases when the only rival or rivals that could have challenged the patent have settled in a way that prevents them from entering immediately. This sort of procedural remedy would sharply lessen the incentive for a patent settlement that excludes rivals because it could not preclude a buyer class action seeking to invalidate the patent.⁶⁴ When the patent is not dubious, then plaintiffs' attorneys would have little incentive to lose money by funding a class action to challenge the patent. But when the patent is dubious, they would have incentives to bring such a buyer class action, and courts could directly address the issue of whether the patent is

64. Because the suggestion is to allow only buyer patent actions to invalidate the patent prospectively, one need not worry that a risk of paying damages in such a buyer class action would deter the patent holder from ever entering into a settlement with the rival.

valid, rather than adjudicate the difficult issue of the probability with which the court thinks another court would have held the patent valid.

IV. Relationship to Prior Scholarship

Some leading antitrust and patent scholars have previously conjectured that reverse payments that exceed litigation costs should be deemed presumptively anticompetitive.⁶⁵ However, this conjecture has not previously been proven.⁶⁶ By providing this proof, we not only validate this conjecture, under two benchmarks that previously were usually conflated, but we also are able to more accurately specify the conditions under which this presumption holds and what sort of rebuttals should be permitted.

To begin with, while these scholars word this conjecture as applying when the reverse payment exceeds all litigation costs, our proof shows that the payment need only exceed the patent holder's anticipated future litigation costs. More importantly, our analysis proves that the appropriate grounds for rebuttal are very different from those suggested by prior proponents of this conjecture. None of them provide for rebuttals based on judgment-proof entrants or procompetitive justifications, which we show above are necessary. Further, they would all allow rebuttal based on grounds that our proof precludes.

Professors Hovenkamp, Janis, and Lemley would allow rebuttal by proof that (a) there was some "legitimate" likelihood of patent victory and (b) the settlement entry date was in the "range" of possible expected litigation exclusion periods.⁶⁷ We reject this possible rebuttal because our proof shows that the fact that a reverse payment exceeds the patent holder's anticipated litigation costs itself precludes the possibility that the settlement exclusion period is shorter than the expected litigation exclusion period. Nor, even if their proposed rebuttal could be established, would we find it sufficient because: (1) the fact that the odds of patent victory are "legitimate" does not mean that the settlement exclusion period did not exceed those odds and thus overreward innovation; and (2) the fact that the settlement exclusion period is within the "range" of the expected litigation exclusion period does not mean it did not exceed the actual expected litigation exclusion period and thus harm consumer welfare.

Professor Shapiro would allow this conjecture to be rebutted by proof of varying party estimates or risk aversion, and Professor Carrier would

65. See Michael A. Carrier, *Unsettling Drug Patent Settlements: A Framework for Presumptive Illegality*, 108 MICH. L. REV. 37, 75–76 (2009); Herbert Hovenkamp, Mark Janis & Mark A. Lemley, *Anticompetitive Settlement of Intellectual Property Disputes*, 87 MINN. L. REV. 1719, 1720, 1759 (2003); Carl Shapiro, *Antitrust Limits to Patent Settlements*, 34 RAND J. ECON. 391, 408 (2003).

66. Professor Shapiro does present proofs on other issues but not on this conjecture.

67. Hovenkamp, Janis & Lemley, *supra* note 65, at 1734–35.

similarly allow rebuttal based on informational asymmetries.⁶⁸ We would not do so because our proof indicates anticompetitive effects despite varying party estimates of patent strength, and we show that risk aversion would not alter our conclusions. Moreover, Shapiro's ultimate test is that patent settlements should be illegal if the settlement exclusion period exceeds the expected litigation exclusion period.⁶⁹ He thus uses only one of the two benchmarks we use and applies it as a case-by-case test rather than (as we do) as a policy benchmark by which to assess the desirability of a more administrable test. One problem with Shapiro's approach is that a settlement exclusion period could fail his benchmark and still be within the optimal patent exclusion period and thus help provide the patent holder with the appropriate reward for innovation.⁷⁰ Such a settlement might thus benefit *ex ante* consumer welfare more than it harms *ex post* consumer welfare, so that his test would not allay the concern of some courts about denying patent holders the full patent reward they deserve. The other problem is that his test requires a case-by-case inquiry into the probability of patent victory,⁷¹ which involves the sort of inquiry into the patent merits that the patent settlement was trying to avoid and the sort of probabilistic patent assessment that many courts have been reluctant to undertake in antitrust cases.

Finally, while we prove that even settlements without any reverse payment are generally anticompetitive, these prior scholars assumed that a settlement with no reverse payment will produce a settlement exclusion period that equals the expected litigation exclusion period. Hovenkamp, Janis, and Lemley thus favor a presumption of legality for such settlements with the only rebuttal being proof that the patent was a sham.⁷² Shapiro concludes that settlements without reverse payments should be per se legal.⁷³ Carrier also seems to advocate per se legality if there is no reverse payment or if the reverse payment is less than litigation costs.⁷⁴ Because we have

68. Shapiro, *supra* note 65, at 408; Carrier, *supra* note 65, at 77. Professor Carrier would also allow rebuttal if a cash-strapped generic needs cash quickly. *Id.* To the extent he means to rely on varying risk aversion, we would not allow rebuttal. To the extent he means that the generic might be judgment-proof, we agree with that possible ground for rebuttal, as limited by the conditions we prove are necessary to establish it.

69. Shapiro, *supra* note 65, at 396, 407–08.

70. Shapiro mistakenly conflates the expected litigation exclusion period with the optimal patent exclusion period, *id.* at 396, but as we show above, the former can be less than the latter when at-risk entry would have occurred without settlement.

71. *Id.* at 397.

72. Hovenkamp, Janis & Lemley, *supra* note 65, at 1762–63. They do suggest another possible rebuttal consisting of evidence that a reverse payment was actually made, but such evidence would mean that this presumption does not apply in the first place.

73. Carl Shapiro, *Antitrust Analysis of Patent Settlements Between Rivals*, ANTITRUST, Summer 2003, at 70, 72.

74. Carrier, *supra* note 65, at 76–77.

disproved their underlying assumption, we show that presumptive or conclusive legality is inappropriate even without any reverse payment.

Other professors have not focused on the relationship between reverse payments and litigation costs at all. Professors Daniel Crane and Thomas Cotter have instead focused on the absolute odds of patent victory. Crane argues that one should allow reverse payment settlements when the *ex ante* probability of patent victory is high but not when it is low.⁷⁵ But even if the probability of patent victory is high, a settlement exclusion period that is higher than merited by that probability would still be undesirable, and even if the probability of patent victory is low, a settlement exclusion period that is lower than merited by that probability would still be desirable. Thus, his test does not correspond to social desirability of the patent settlement and also requires the sort of case-by-case inquiry into the probability of patent victory that patent settlements and many courts in antitrust cases seek to avoid. Moreover, our proof shows that such a probabilistic inquiry into the patent merits is unnecessary when the reverse payment exceeds the patent holder's anticipated litigation costs.

Cotter shows that it can be rational for a patent holder to offer the entrant a reverse payment even if the odds of patent victory are high, and concludes from this that although reverse payments should be presumptively unlawful, this presumption should be rebuttable by proving the odds of patent victory are high, with "high" meaning at least 50% and certainly being provable by showing 75% odds.⁷⁶ However, the fact that a patent holder finds it rational to make a reverse payment tells us nothing about whether the settlement is desirable, especially because a settlement that excludes entry funds that reverse payment with other people's money—namely the money of buyers. Moreover, whether the probability of patent victory exceeds 50% or 75% also tells us nothing about the settlement's desirability. Even if the probability were 75%, a settlement that excludes entry for more than 75% of the residual patent period would still be anticompetitive, and even if the probability were 10%, a settlement entry date that covers less than 10% of the residual patent period would still be procompetitive. Further, his test also requires a difficult case-by-case inquiry into the probability of patent victory. Our proof shows that whether a reverse payment exceeds litigation costs provides a more reliable indicator of social desirability, without requiring any such case-by-case inquiry into what the probability of patent victory might be.

75. Daniel A. Crane, *Exit Payments in Settlement of Patent Infringement Lawsuits: Antitrust Rules and Economic Implications*, 54 FLA. L. REV. 747, 779–96 (2002).

76. Thomas F. Cotter, *Refining the "Presumptive Illegality" Approach to Settlements of Patent Disputes Involving Reverse Payments: A Commentary on Hovenkamp, Janis & Lemley*, 87 MINN. L. REV. 1789, 1807, 1812 & n.92 (2003).

Professor Blair argues that one should simply apply a rule of reason to reverse patent settlements to determine if their net effects are procompetitive.⁷⁷ But his rule would presume legality, which our proof shows is unwarranted, especially if the reverse payment amount exceeds anticipated litigation costs. Nor does he provide clear guidance as to how courts could conduct the suggested rule-of-reason analysis. Further, he suggests that one should not infer likely illegality unless the reverse payment is close to the amount of entrant profits from entry. We prove that the key comparison is instead to the patent holder's anticipated litigation costs.

Professors Willig and Bigelow argue that reverse payments may sometimes be necessary for desirable patent settlements, and they conclude from this that settlements with reverse payments thus should not be presumptively unlawful.⁷⁸ However, when one examines the details, one sees that their argument applies for a desirable settlement only when the reverse payment amount is "less than the incumbent's litigation costs."⁷⁹ Our proof shows this possibility goes away when the reverse payment amount exceeds those litigation costs, which fully justifies the presumption.

Further, Willig and Bigelow consider only whether desirable settlements are possible, not whether they are likely. We prove that even without *any* reverse payment, the lion's share of settlement exclusion periods that the parties could reach would be anticompetitive. This justifies presumptive condemnation even without a reverse payment, and thus even more strongly justifies it with a positive reverse payment amount, which only increases the share of possible settlements that are anticompetitive. Finally, in the end Willig and Bigelow simply argue that courts should sustain patent settlements if the settlement entry date is earlier than the expected entry date.⁸⁰ Their test thus, like Shapiro's ultimate test, both: (1) ignores the potential disjunction between the expected litigation exclusion period and the optimal patent exclusion period; and (2) requires the sort of case-by-case inquiry into the probability of patent victory that patent settlements and many courts seek to avoid.

Conclusion

In assessing whether patent settlements are anticompetitive, it is relevant to use two benchmarks that are often conflated: (1) whether the

77. Roger D. Blair & Thomas F. Cotter, *Are Settlements of Patent Disputes Illegal Per Se?*, 47 ANTITRUST BULL. 491, 533–34 (2002) (reporting the views of just Professor Blair).

78. See Willig & Bigelow, *supra* note 37, at 659–62, 667–77.

79. *Id.* at 671. Much of their analysis actually addresses a different question: whether a reverse payment might be necessary for patent settlement *without* showing that settlement would actually be desirable. Our proof shows that although this is true, a reverse payment that exceeds litigation costs is necessary only for undesirable settlements.

80. *Id.* at 662, 677.

settlement harms *ex post* consumer welfare by excluding the entrant for longer than expected from litigation; and (2) whether the settlement harms *ex ante* welfare by exceeding the optimal patent exclusion period and thus the optimal reward for innovation. However, courts have been reluctant to apply such benchmarks in a case-by-case way because it would require the sort of inquiry into the patent merits that settlement aims to avoid, with the addition of a probabilistic twist that is conceptually difficult for courts to resolve.

Our proof avoids this administrative difficulty by proving that, under ordinary conditions, a patent settlement with a reverse payment that exceeds the patent holder's anticipated litigation costs is *always* anticompetitive under both benchmarks. We prove that this is true even if the patent holder and alleged infringer differ in their estimates of patent victory. We also show that this claim should not be defeated by claims that market power was lacking, that the parties were risk averse, or that the particular settlement exclusion period did not violate the two benchmarks. On the other hand, we show that rebuttal is appropriate when the entrant would have entered at risk and is judgment proof to a sufficient extent. We also show that rebuttal is appropriate when there are other procompetitive justifications.

Finally, we show that, contrary to conventional wisdom, patent settlements that exclude entry without any reverse payment are also usually anticompetitive. However, such settlements are not always anticompetitive, so a broader array of rebuttal would be advisable. To the extent that those rebuttals require a probabilistic inquiry into the patent merits that is too difficult for the courts, then the best solution may be the procedural one of giving buyers standing to challenge the patent's validity.

Appendix

Proof That Reverse Payments Cannot Be Necessary for Settlement If Joint Profits with Entry Exceed the Patent Holder's Profits Without Entry

Weak Patent

$$T_{\max} = \theta_E (1 - L) + [\theta_E L(P_N - P_Y) + C_E + R]/E$$

$$T_{\min} = \theta_P - (C_P + R)/(P_N - P_Y)$$

The parties can settle only if $T_{\max} > T_{\min}$

$$\theta_E(1 - L) + [\theta_E L(P_N - P_Y) + C_E + R]/E > \theta_P - (C_P + R)/(P_N - P_Y)$$

Thus, if R increases by ∂ from 0 or any positive number, the left side (T_{\max}) will increase by ∂/E and the right side (T_{\min}) will increase by $\partial/(P_N - P_Y)$.

Therefore, if $P_N - P_Y < E$ (just $P_N < P_Y + E$ rearranged) then $\partial/E < \partial/(P_N - P_Y)$, meaning that increasing a settlement payment by ∂ can only make it less likely that $T_{\max} > T_{\min}$. A corollary is that if $P_N - P_Y < E$ but the parties nevertheless settled, the parties must have necessarily been able to settle without any reverse payment.

Strong Patent

$$T_{\max} = \theta_E + L(1 - \theta_E) + (C_E + R)/E$$

$$T_{\min} = \theta_P + L(1 - \theta_P) - (C_P + R)/(P_N - P_Y)$$

Increasing R by ∂ from 0 or any positive number can only reduce $T_{\max} - T_{\min}$ if $P_N - P_Y < E$ because then T_{\max} would increase by only ∂/E and T_{\min} would increase by the greater $\partial/(P_N - P_Y)$. Therefore, if $P_N - P_Y < E$ but the parties nevertheless settled, the parties must have necessarily been able to settle without any reverse payment.