

STRATEGIC PATENT ACQUISITIONS

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In recent years, we have seen a dramatic upsurge of “strategic patent acquisitions.” We define this as the acquisition of a portfolio of patents reading on a specified area such as flash memory, biosensors, database management, or wireless digital messaging, which may be asserted against “target products” in that area. In this article, we examine the economic effects of strategic patent acquisitions and discuss their antitrust implications.

Antitrust attorneys and economists regularly study the economic effects of one species of asset acquisitions, namely mergers and acquisitions, that typically involve the transfer of an entire line of business from one party to another. Our analysis has much in common with merger analysis: we study how a strategic patent acquisition changes economic incentives and trace through the likely economic effects of those changed incentives.

Antitrust has long been interested in the implications of transactions involving the transfer of assets from one party to another, including mergers. In today’s economy, where intellectual property is often the key source of competitive advantage, antitrust issues naturally and commonly arise when patents are transferred from one party to another. Some of the economic effects of patent acquisitions—such as enhancing market power by consolidating ownership of substitute technologies—are familiar but appear with new twists. Others—such as evading a commitment to license on reasonable terms, or removing the ability of a patent defendant to counterattack—are more novel. These effects are amenable to economic analysis.

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For the past 20 years, it has been popular to assert that intellectual property is not fundamentally different from other assets. While that general rubric has its appeal, it does not address fundamental differences between most forms of real property, such as real estate, and questionable patents with vague boundaries. These differences are meaningful for assessing the effects of patent acquisitions. In particular, a patent is by definition a right to exclude, or more precisely a right to go to court to try to either exclude a party alleged to infringe the patent or to extract royalties from that party. Transferring probabilistic “exclusion rights” is fundamentally different from transferring more conventional assets, such as production facilities, or other intangible assets, such as trade secrets, brand names, or skilled personnel.

The likely economic effects of a strategic patent acquisition hinge on differences between the assets and the business model of the firm selling the patent portfolio and those of the firm acquiring it. Notably, these effects depend on whether the selling firm and/or the acquiring firm has a financial interest in targeted products or substitutes or complements to targeted products. We organize our analysis accordingly.¹

The first branch of our analysis involves strategic patent acquisitions by “pure” Patent Assertion Entities (PAEs). The pure PAE business model involves purchasing patents, often in large numbers, and obtaining revenues by asserting those patents, with no conventional lines of business. By definition, pure PAEs have no financial interest in targeted products or substitutes or complements to them. The core competency of PAEs is to acquire and monetize patents.

The second branch of our analysis involves “hybrid” PAEs. Hybrid PAEs are those having contractual relationships with downstream firms, i.e., firms that sell targeted products or substitutes to them. We distinguish hybrid PAEs from pure PAEs.

The third branch of our analysis involves strategic patent acquisitions by downstream firms, whose goals vary but can be defensive (arming themselves against patent litigation) or offensive (raising rivals’ costs). The antitrust anal-

¹ Our economic analysis focuses on the party with the financial interest in the outcome of royalty negotiations or court judgments associated with a patent, as distinct from the formal legal owner of that patent. If the transaction involves assigning the patent to Party A, while giving Party B control over litigation of that patent and Party C the right to any resulting revenues, we treat Party C as the “owner” in our analysis. Patent Assertion Entities (PAEs) are known to engage in many complex transactions, including transactions involving shell companies, that appear designed to make it difficult to track certain PAE activities. For example, rights are licensed to some and sold to others, a portfolio is divided up among funds held by different shell companies but controlled by the same entity, or one party controls the patents but has a contract calling for it to share royalties with another party. We do not focus on these distinctions below, but rather subsume the beneficiaries of the PAE’s activities into the role of “owner.”

ysis of strategic patent acquisitions by downstream firms became particularly relevant with several large transactions reviewed by the Department of Justice in 2011 and 2012.² We briefly discuss these transactions below.

Part I of this article describes the evolving market for patents, highlighting the growing role of PAEs. Part II discusses a variety of tactics used by PAEs to obtain payments from targets in excess of reasonable royalties. Part III develops an economic model to analyze the effects of enhanced PAEs' monetization on innovation and consumers. The empirical findings from Parts I and II combined with the economic framework from Part III suggest that the enhanced monetization of patents by PAEs we are seeing is generally harmful to innovation and to consumers. Part IV describes different types of sellers and different types of patent portfolios that may be sold or assembled. Part V analyzes the effects of patent acquisitions by different types of buyers: pure PAEs, hybrid PAEs, and downstream firms. Part VI concludes.

I. THE GROWING ROLE OF PATENT ASSERTION ENTITIES

The number of patents issued by the U.S. Patent and Trademark Office has risen by 170 percent over the past two decades, from 107,331 in 1993 to 290,083 in 2013.³ In the last few years, we have seen a marked shift in how those patents are used: far more patents are being purchased and asserted by specialists, i.e., PAEs.⁴

Figure 1 illustrates that the number of patent cases filed by Non-Practicing Entities (NPEs) has grown substantially over the past several years.⁵ As shown in Figure 1, NPEs brought 3608 patent lawsuits in 2013, nearly five times the number they brought in 2010. These NPEs include PAEs, universities and research institutions, individual inventors, and operating companies asserting patents outside their areas of products and services. From 2010 to

² Professor Scott Morton was the Deputy Assistant Attorney General for Economics at the Antitrust Division while these transactions were under review. Professor Shapiro was not involved in these transactions.

³ U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE & ACCOUNTABILITY REPORT 192 tbl.6 (2013), www.uspto.gov/about/stratplan/ar/USPTOFY2013PAR.pdf. Data are for fiscal years.

⁴ This phenomenon was noted and discussed in the March 2011 report by the Federal Trade Commission. FED. TRADE COMM'N, THE EVOLVING IP MARKETPLACE 49–72 (2011), available at www.ftc.gov/reports/evolving-ip-marketplace-aligning-patent-notice-remedies-competition-report-federal-trade (discussing ex post patent transactions). The term “Patent Assertion Entity” refers to organizations that primarily purchase existing patents and monetize them. By contrast, while “Non-Practicing Entities” also do not use the patents to provide goods and services, they may engage in innovation and technology transfer. For example, a university may be an NPE but is not a PAE.

⁵ Figures 1–4 rely on data about patent litigations provided to us by RPX Corp. These data are based on the official data provided by PACER (Public Access to Court Electronic Records).

2013, the share of all patent lawsuits that was brought by NPEs more than doubled, from 30 percent to 67 percent.⁶

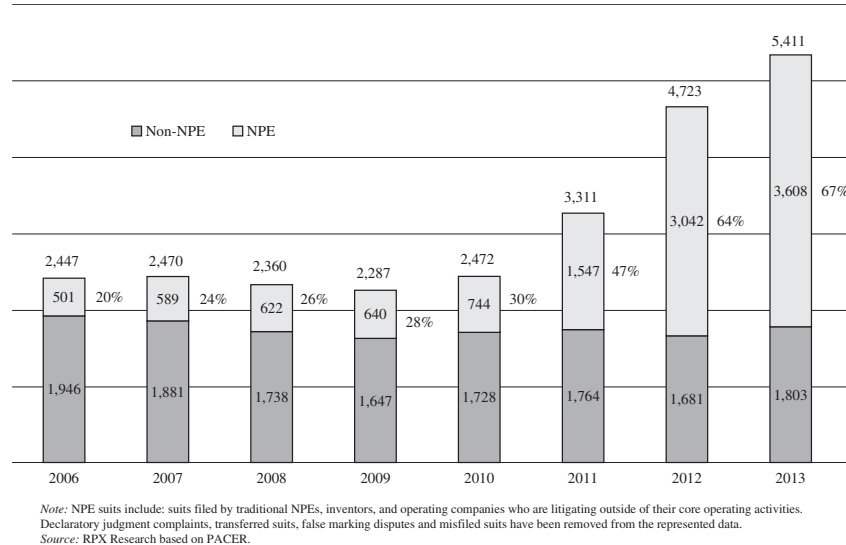


FIGURE 1:
NUMBER OF PATENT CASES FILED BY NPEs AND NON-NPEs

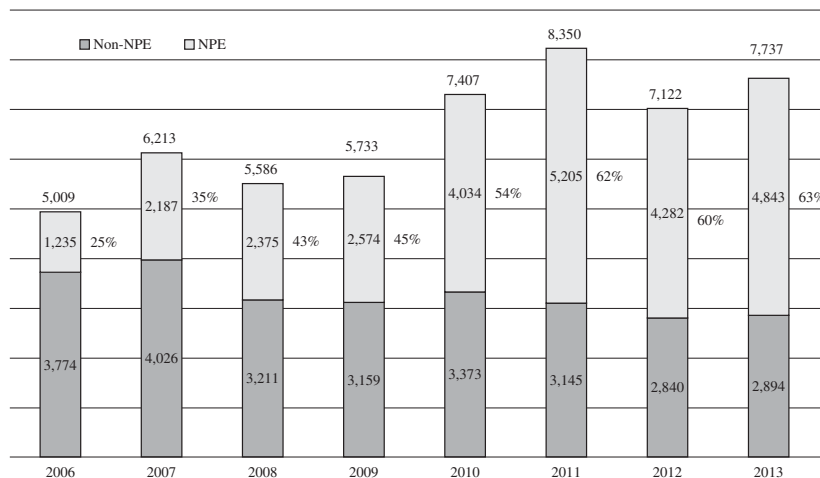
This NPE activity is predominantly due to PAEs: in 2013, RPX data indicate that PAEs accounted for 91 percent of the 3608 patent cases brought by NPEs.⁷

A similar picture emerges if one looks at the number of patent *defendants* rather than the number of patent lawsuits. Figure 2 shows the number of defendants in patent cases initiated each year from 2006 through 2013. During 2013, 63 percent of the defendants in patent cases were sued by NPEs.

Figure 3 provides information about the size distribution of defendants who were sued for patent infringement by NPEs during 2013, where defendant size is measured by revenues. More than half of the unique defendants, and about one-third of the total number of defendants, were companies with less than \$10 million in revenues during the previous calendar year.

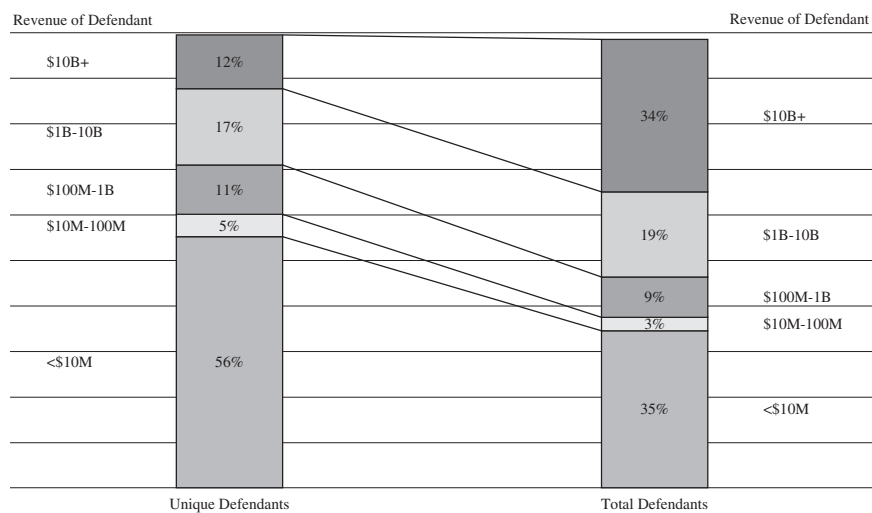
⁶ This is consistent with the findings in Robin Feldman, Tom Ewing & Sara Jeruss, *The AIA 500 Expanded: The Effects of Patent Monetization Entities*, 17 UCLA J.L. & TECH. 1, 7 (2013). They find that Patent Monetization Entities filed 58.7% of all patent cases in 2012, up from 24.6% in 2007. *Id.* Their study is based on 13,000 patent litigations filed during 2007–2008 and 2011–2012; 52% of the asserted patents had been transferred from their original owner. *Id.* at 6–8.

⁷ See *supra* note 5.



Note: When calculating the number of defendants, a given firm is counted each time it is sued. NPE suits include: suits filed by traditional NPEs, inventors, and operating companies who are litigating outside of their core operating activities. Declaratory judgment complaints, transferred suits, false marking disputes and misfiled suits have been removed from the represented data. Source: RPX Research based on PACER.

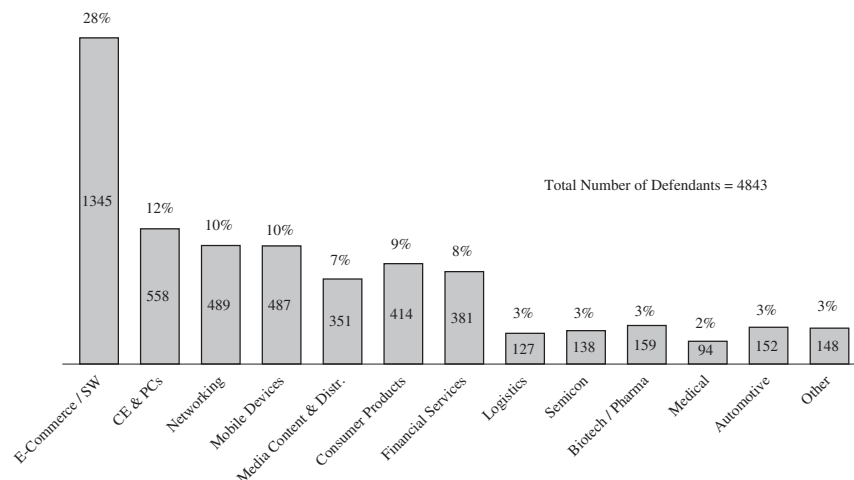
FIGURE 2:
NUMBER OF DEFENDANTS IN PATENT CASES FILED BY
NPEs AND NON-NPEs



Note: When calculating Total Defendants, a given firm is counted each time it is sued. When calculating Unique Defendants, a given firm is counted only once, regardless of how many times it is sued. Revenue of Defendant is based on recent annual results, typically for 2012. Source: RPX Research based on PACER.

FIGURE 3:
SIZES OF DEFENDANTS IN PATENT CASES FILED BY
NPEs IN 2013

Figure 4 shows the distribution of NPE defendants across sectors, out of a total number of NPE defendants in 2013 of 4843 (as shown in Figure 2).



Note: Sector classification of each NPE defendant is based on the sector classification of the case in question. Therefore, a given company may be counted as an NPE defendant in multiple sectors, to the extent it was sued in cases that were classified in different sectors. *Source:* RPX Research based on PACER.

FIGURE 4:
NUMBER OF DEFENDANTS IN PATENT CASES FILED BY NPEs
IN 2013, BY SECTOR

About two-thirds of NPE defendants were sued based on products and services in the information and communications technology sector (e-commerce, software, consumer electronics and personal computers, networking, mobile devices, and media content and distribution). This confirms that NPEs tend to target technology companies. However, defendants in NPE patent infringement actions come from a wide range of industries.⁸ This reflects the fact that technology is now used in every sector of the economy. For example, software patents can be used to extract royalties from financial institutions.⁹

Furthermore, there is growing evidence that PAEs are targeting end users, such as retailers who use Wi-Fi equipment, not just the companies making that equipment. Restaurants and supermarkets, among many others, have been

⁸ Patent Freedom, which tracks NPE lawsuits and classifies the defendants by industry, reports that 50% of NPE defendants in 2011–2012 were outside the high-tech sector, up from 41% in 2005–2006. *NPE Exposure by Industry*, PATENT FREEDOM, www.patentfreedom.com/about-npes/industry/.

⁹ In May and June of 2013, Intellectual Ventures filed eight lawsuits against financial institutions, alleging patent infringement on electronic banking and security products and services. Tracy Kitten, *Patent Lawsuits Target Eight Banks*, BANK INFO SECURITY (June 25, 2013), www.bankinfosecurity.com/patent-trolling-targeting-banks-a-5858/op-1.

targets of PAEs.¹⁰ These businesses often do not have in-house counsel to evaluate the patents and determine if the claim has any validity, nor do they have litigation expertise or scale.

PAEs also are increasingly seeking exclusion orders at the International Trade Commission (ITC). This is a result in part of the Supreme Court's decision in *eBay*, which made it much harder for NPEs to obtain injunctions in patent infringement cases.¹¹ Colleen Chien and Mark Lemley report that NPEs brought 25 percent of the Section 337 ITC cases in 2011, which accounted for 51 percent of the total number of respondents.¹² The ITC itself reports that about 33 percent (13 out of 40) of the Section 337 cases brought in 2012 were by NPEs, and that slightly more than half of the cases brought by NPEs were brought by PAEs.¹³ The ITC also reports that cases brought by PAEs in 2012 account for more than half of all respondents.¹⁴

These data on patent litigations and ITC cases should leave no doubt that PAEs are playing an increasingly important role in the patent ecosystem. In highlighting these data we do not mean to suggest that the full impact of PAEs can be seen by looking at patent litigations and ITC actions alone. These visible actions are just the tip of the iceberg. Surely, there are far more patent assertions than actual patent litigations, and these assertions impose various costs on targets, including legal expenses, design-around costs, and settlement costs.¹⁵

Increased opportunities for patent monetization, particularly in the information technology sector, have resulted in the rise of institutions to facilitate the sale of patents.¹⁶ The financial services industry is enthusiastic about developing this market as a new asset class, in part because patent assets can help investors diversify risk since the return on a patent portfolio may not be highly correlated with returns on other assets such as stocks or commodities.

¹⁰ See, e.g., Comments of Food Mktg. Inst. & Nat'l Rest. Ass'n to the Fed. Trade Comm'n and U.S. Dep't of Justice on Patent Assertion Entities 7–9 (Apr. 5, 2013), www.justice.gov/atr/public/workshops/pae/comments/paew-0068.pdf.

¹¹ *eBay Inc. v. MercExchange LLC*, 547 U.S. 388 (2006).

¹² Colleen V. Chien & Mark A. Lemley, *Patent Holdup, the ITC, and the Public Interest*, 98 CORNELL L. REV. 1, 18 fig. 4 (2012). These figures vary quite a bit from year-to-year, and 2011 may be an outlier.

¹³ U.S. INT'L TRADE COMM'N, FACTS AND TRENDS REGARDING USITC SECTION 337 INVESTIGATIONS 2 (Apr. 15, 2013), www.usitc.gov/press_room/documents/featured_news/sec337factsupdate.pdf. The ITC refers to PAEs as "Category 2" NPEs. Category 2 NPEs played a far larger role at the ITC in 2011 and 2012 than in previous years. However, their share of respondents fell sharply in the first quarter of 2013. *Id.* at 4.

¹⁴ *Id.* at 4.

¹⁵ Patent holders can impose these costs on their targets without actual patent litigation. See Christopher R. Leslie, *Patents of Damocles*, 83 IND. L.J. 133 (2008).

¹⁶ See Andrei Hagiu & David B. Yoffie, *The New Patent Intermediaries: Platforms, Defensive Aggregators, and Super-Aggregators*, J. ECON. PERSP., Winter 2013, at 45.

Hedge funds and pension funds provide capital to invest in patent portfolios that can generate licensing revenue.

In response to the demand for this new asset, PAEs have created investment vehicles. Investors, working through PAEs, create a demand for patents to include in the investment portfolio. Many companies holding patents naturally look for opportunities to “unlock value” and obtain cash by selling their patents to PAEs. This in turn fuels further patenting, creating more raw material for PAEs.

PAEs seek to keep abreast of industry knowledge and trends so that they can locate valuable patents and purchase them inexpensively. Indeed, having good information about potential licensees and past licensing deals or settlement terms is critical to the PAE business model. Some PAEs require their business partners to sign very stringent non-disclosure agreements to keep this information private.

PAEs adopt diverse business strategies to exploit these opportunities. Some PAEs are mass aggregators, purchasing thousands of patents. Aggregating related patents can enhance monetization if litigation by the PAE based on the combined portfolio is profitable while litigation of the smaller constituent portfolios is not. A large portfolio may especially be needed if many of the patents involved are weak. Mass aggregation of related but weak patents may thus allow the PAE to achieve a rather novel type of scale economy. Other PAEs assert a small number of patents against many targets. One version of this involves assertions that have elements of nuisance suits, where targets can settle for less than the cost of litigation.

II. OUTSIZED THREATS AND UNREASONABLE ROYALTIES

We now explore the tactics used by PAEs to most effectively monetize the patents they have acquired. Understanding these tactics will help us identify the strategic patent acquisitions most likely to enable PAEs to extract payments from downstream firms that exceed reasonable royalties.¹⁷ These are the acquisitions most likely to deter innovation and harm consumers.

We treat patents that earn reasonable royalties as part of a well-functioning market for ideas. If the patent covers a useful innovation that another party wishes to use and the two parties agree to a royalty reflecting that value, innovation and consumers are likely to benefit. The owner of the patent is

¹⁷ Since we are focused on strategic patent acquisitions, our analysis does not address NPE activity unrelated to acquisitions. In particular, a number of NPEs are the remnants of practicing entities that no longer offer products in the market. The economic impact of these NPEs can be very similar to that of PAEs, and they exploit similar flaws in the patent system, but they are outside the scope of this article if they are not acquiring patents.

compensated for its investment and assumption of risk; the user of the technology is able to incorporate a valuable innovation into its products, which benefits consumers.

Reasonable royalties, based on a hypothetical ex ante negotiation, should never exceed the ex ante incremental value of the patented technology.¹⁸ Reasonable royalties will thus be small relative to the value of the downstream product if the technology has close ex ante substitutes, especially if it covers one feature in a complex device or service. We are especially concerned about the adverse economic effects of royalties that are far in excess of reasonable royalties.

The basic economics of bargaining teaches that the outside options, or “threat points,” of the two parties greatly influence the negotiated outcome.¹⁹ If the PAE can make patent litigation highly unattractive to the downstream firm, it can drive up the negotiated royalty rate. The prospect of an injunction or exclusion order causing the downstream firm to lose all the revenue from the affected product for the period of the exclusion can serve precisely this function. Injunctions and exclusion orders, where available, can thus provide the patent holder with an outsized threat, i.e., a threat far greater than the value to the user of the patented technology. Facing such an outsized threat, the downstream firm may agree to an elevated royalty rate, especially if the firm’s managers are risk averse.

The recent case between Microsoft and Motorola in the Western District of Washington illustrates this dynamic.²⁰ The original demand letter from Motorola reportedly was for an amount in excess of \$4 billion. In court, Motorola sought \$400 million. Microsoft claimed the reasonable royalty was \$1.2 million. Judge Robart ruled that the reasonable royalty was \$1.8 million annually.²¹ In this case, Microsoft rolled the dice and won (so far). But most users

¹⁸ This follows immediately if one defines reasonable royalties as the royalties that would be negotiated between willing parties prior to infringement, since it would never make economic sense for the licensee to pay more than the incremental value of the patented technology.

¹⁹ See generally HOWARD RAIFFA, *THE ART AND SCIENCE OF NEGOTIATION* (1982). The same concept is captured by the notion of a party’s “Best Alternative to Negotiated Agreement,” or BATNA. In licensing negotiations, the BATNA often is litigation, a risky prospect for both sides.

²⁰ *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823-JLR, 2013 WL 2111217 (W.D. Wash. Apr. 25, 2013) (Robart, J.) (Findings of Fact and Conclusions of Law). The patent holder in this case was Motorola, not a PAE. This case illustrates how large a gap can be found in practice between what the patent holder and the user consider to be a reasonable royalty, in negotiations prior to litigation and in litigation.

²¹ There was voluminous press covering the trial and reporting these figures. See, e.g., *Microsoft Filing Says Google’s Motorola Is Entitled to \$1.2 million in FRAND Royalties for 2012*, FOSS PATENTS (Nov. 8, 2012), www.fo SSPATENTS.COM/2012/11/microsoft-filing-says-google-motorola.html; *April Was Disastrous for Google on the Android Patent Front: Eight Major Losses, Two Smaller Wins*, FOSS PATENTS (Apr. 26, 2013), www.fo SSPATENTS.COM/2013/

settle rather than litigate, and they can be greatly influenced by an outsized threat, even one that is unlikely to come to transpire. Illustrating using these numbers, a risk-neutral licensee facing a demand of \$400 million, and whose own view was that a \$1.2 million is a reasonable royalty, would accept a royalty of \$6 million in negotiations to avoid even a 1.2 percent chance of losing in court.²² That \$6 million payment would be drastically lower than the \$400 million demand, yet more than three times the reasonable rate of \$1.8 million. In this way, the use of the outsized threat can raise the negotiated royalties, i.e., increased monetization for the patent holder.²³

PAEs have strong incentives to devise large and credible “outsized” threats. Arguably, devising outsized threats is a core competency of PAEs (along with identifying valuable patents and acquiring them inexpensively). If the threat is large enough, and credible enough, the target firm will pay more than a reasonable royalty. Actual litigation can be quite rare. Viewed this way, the PAE business model does reward innovation, of a sort—innovation in creating methods by which the PAE can credibly threaten the practicing entity with very large costs if it does not sign a license. In the next section, we discuss several methods used by PAEs to achieve this goal.²⁴ Our list is no doubt incomplete, and we expect PAEs to continue to develop new tactics.

A. WHOLE BUSINESS RISK

The simplest way to create an outsized threat is to put at risk more of the downstream firm’s business than just the reasonable royalty rate applied to the target products. PAEs employ a variety of tactics to put the entire downstream business at risk, even if the patents owned by the PAE contribute relatively little to that business.

1. *Injunctions and Exclusion Orders*

It is difficult for PAEs to get injunctions after *eBay*,²⁵ particularly on standard-essential patents (SEPs) where a commitment to license on fair, reasonable, and non-discriminatory (FRAND) terms has been made. However,

04/april-was-disastrous-for-google-on.html; Jorge L. Contreras, *So That’s What “RAND” Means?*, PATENTLYO (Apr. 27, 2013), patentlyo.com/patent/2013/04/so-thats-what-rand-means-a-brief-report-on-the-findings-of-fact-and-conclusions-of-law-in-microsoft-v-motorola.html.

²² This is because the expected royalty payment from litigation is: $\$400 \text{ million} \times 1.2\% + \$1.2 \text{ million} \times (1 - 1.2\%) = \6 million . If the user is risk averse, or if one accounts for litigation costs, an even smaller chance of losing would justify settling for \$6 million.

²³ Of course, the user may go to court to establish that it should pay \$1.8 million, not \$6 million, as Microsoft did in this case. This approach is risky however, and requires the user to bear the cost of litigation. These factors may cause users, especially smaller ones, to pay more than the expected value of the reasonable royalty rate.

²⁴ Some of these same tactics are also used by other types of patent holders.

²⁵ *eBay, Inc. v. MercExchange, LLC*, 547 U.S. 388 (2006).

exclusion orders at the ITC are available to PAEs,²⁶ and the Orange Book process in Germany can result in injunctions.²⁷ The risk of injunctions appears to be quite low, but it is not zero. Risk averse business executives may be willing to pay significantly higher royalties rather than accept even a small risk of an exclusion order.

By statute, the ITC is required to consider the public interest,²⁸ which may very well not be served by allowing injunction threats, especially on SEPs with FRAND commitments. The DOJ, the PTO, and the FTC have all urged the ITC to consider this aspect of consumer welfare.²⁹ However, the ITC has not accepted that advice. To the contrary, the ITC recently issued an exclusion order in an SEP case against Apple covering older iPhones and iPads.³⁰ The ITC explicitly rejected Apple's FRAND defense, concluding that "public interest factors . . . do not preclude issuance of the limited exclusion order and cease and desist order [and] FRAND declarations did not preclude that rem-

²⁶ See *InterDigital Commc'ns, LLC v. ITC*, 707 F.3d 1295 (Fed. Cir. 2013) (holding that the domestic industry requirement is satisfied by significant investment in the licensing of the patent in question). More recently, a different Federal Circuit panel has interpreted the domestic industry requirement to necessitate that the patent holder's investment be directed at a licensing program that would encourage adoption of its patented technology. See *Motiva, LLC v. ITC*, 716 F.3d 596 (Fed. Cir. 2013).

²⁷ An injunction in Germany stops an implementer from selling its product in a large and important economy, and is therefore costly. The law in Germany is favorable to those seeking injunctions. A defense to an injunction is a decision known as the "Orange-Book-Standard." This decision says that the implementer can defend against the request for injunctive relief by claiming the patent owner is abusing a dominant position under Article 102 TFEU (formerly EC Article 82). The two conditions that must hold for this defense to succeed are that the implementer has made an unconditional FRAND offer and that it pays the patent owner accordingly. To take this route the implementer may also have to give up any claim of invalidity of the patent. See, e.g., Bundesgerichtshof [BGH] [Federal Court of Justice] May 6, 2009, Docket No. KZR 39/06 (Ger.), available at juris.bundesgerichtshof.de/cgi-bin/rechtsprechung/document.py?Gericht=bgh&Art=en&Datum=2009-5-6&nr=48134&pos=8&anz=15 (translated in *Orange-Book-Standard*, INTELLECTUAL PROPERTY EXPERT GROUP, www.ipeg.eu/wp-content/uploads/EN-Translation-BGH-Orange-Book-Standard-eng.pdf). This process creates a great deal of litigation. See Florian Mueller, *Judge Now Feels Sanctions Against Samsung and Its Attorneys over Patentgate Are Warranted*, FOSSPATENTS (Nov. 9, 2013), www.fosspatents.com/2013/11/judge-now-feels-sanctions-against.html.

²⁸ 19 U.S.C. § 1337(d)(1).

²⁹ See U.S. Dep't of Justice, Antitrust Div. & U.S. Patent & Trademark Office, Policy Statement on Remedies for Standards-Essential Patents Subject to Voluntary F/RAND Commitments (2013), available at www.justice.gov/atr/public/guidelines/290994.pdf; Third Party U.S. Fed. Trade Comm'n's Statement on the Public Interest, *In re* Certain Gaming and Entertainment Consoles, Related Software, and Components Thereof, Inv. No. 337-TA-752 (June 6, 2012), available at www.ftc.gov/os/2012/06/1206ftcgamingconsole.pdf.

³⁰ *In re* Certain Electronic Devices, Including Wireless Communications Devices, Portable Music and Data Processing Devices, and Tablet Computers, Inv. No. 337-TA-794 (June 4, 2013), available at www.usitc.gov/secretary/fed_reg_notices/337/337-794_notice06042013sgl.pdf.

edy.”³¹ Fortunately, the ITC’s exclusion order was vetoed by the President, acting through the United States Trade Representative.³²

While that veto will discourage patent holders from seeking ITC exclusion orders on SEPs, the ITC remains an attractive forum for patent holders who have not made FRAND commitments. Furthermore, while the case against Apple was brought by Samsung, a large manufacturer, the ITC’s narrow view of the public interest test can only serve to embolden PAEs seeking ITC exclusion orders.

2. *Suing Customers*

Younger products or businesses may have customers who are less attached to the product and have more elastic demand. The product may not be critical to the customer, but only desirable. A customer who is sued by a PAE over such a product may simply decide to stop buying the product.³³ At the DOJ/FTC PAE workshop held in December 2012, a representative from Union Square gave an example of this outcome.³⁴ A firm in which his firm invested had developed a way to market products for major brands with personalized online avatars. It was targeted by two different PAEs, one of which sued both the firm and the firm’s customers, such as American Express and General Motors. Customers did not want the legal hassle involved with buying a service they felt was an optional part of their marketing program. Customers stopped buying the service and in three months revenue fell in half. A growing firm with 70 employees was eventually reduced to a small operation with only five employees.

3. *Strategic Timing*

A PAE can study the business of the target and choose timing and publicity for its lawsuit that causes disproportionate harm. For example, a PAE can file a significant lawsuit just prior to the target’s IPO or other funding event. If the

³¹ *Id.* at 3.

³² See Letter from Michael B.G. Froman, U.S. Trade Representative, to Irving A. Williamson, Chairman, U.S. Int’l Trade Comm’n (Aug. 3, 2013), available at www.ustr.gov/sites/default/files/08032013%20Letter_1.pdf.

³³ This tactic can also take the form of nuisance suits filed against customers, which also can lead to an outsized threat. A prominent recent example of a PAE employing this tactic is Innovatio IP Ventures, which has reportedly sent some 8,000 demand letters to commercial users of Wi-Fi, such as restaurants, coffee shops, and hotels, for infringing Wi-Fi SEPs Innovatio purchased from Broadcom. See *Catching Up On . . . Innovatio IP Ventures, LLC’s Litigation Activities*, THE ESSENTIAL PATENT BLOG (Jan. 3, 2013), essentialpatentblog.com/2013/01/catching-up-on-innovation-ip-ventures-llcs-litigation-activities/.

³⁴ Transcript at 147–50, PAE Activities Workshop (Dec. 10, 2012) [hereinafter *PAE Workshop Transcript*] (Brad Burnham, Managing Partner, Union Square Ventures), available at www.ftc.gov/sites/default/files/documents/public_events/Patent%20Assertion%20Entity%20Activities%20Workshop%20pae_transcript.pdf.

lawsuit scares off investors, the news could drive down the price of the IPO. This threat can allow the PAE to extract a significant fraction of the value of the business in the form of licensing payments.

B. EVASION OF COMMITMENTS

1. *Standard-Essential Patents*

Holders of SEPs have commonly committed to license them on FRAND terms. Unfortunately, these FRAND commitments typically are not very well defined. Original patent owners who made a FRAND commitment and then sold those patents may not effectively bind subsequent owners to that commitment. The European Telecommunications Standards Institute (ETSI) recently voted to adopt language that requires SEP owners to bind subsequent sellers, but it has not yet updated its guidelines.³⁵ Other SSOs have generally not made it clear that the FRAND commitment travels with the patent.³⁶ Many holders of SEPs do license at FRAND rates, perhaps due to concerns about reputation or retaliatory conduct by others in their industries. However, a PAE that does not plan to abide by FRAND can buy a portfolio of SEPs and create an outsized threat. Buying a portfolio of SEPs can be very profitable for the PAE if the original SEP owner is obligated to charge a low royalty but the new owner can evade FRAND commitments, engage in holdup, and charge a higher royalty.

2. *Evasion of Implicit Contracts and Imperfect Enforcement*

The cross-licensing behavior of downstream firms may be held in check by implicit contracts and multi-project relationships. These firms may cooperate in areas such as regulation, lobbying, standard setting, design of complementary products, and so forth. Initiating patent litigation against another downstream firm may cause “blowback” in terms of patent litigation or in another aspect of the relationship. This limits the ability of downstream firms to monetize their patents. These restraints do not apply to PAEs, which do not operate in the industry and have no current or future products. As a result, implicit contracts between industry participants do not apply to PAEs. Put differently, PAEs will find it profitable to break implicit contracts in return for greater licensing income.³⁷ For example, it was not clear that Novell’s promises to the

³⁵ Press Release, Eur. Telecomm. Standards Inst., IPR Dialogue Continues at ETSI (May 6, 2013), available at www.etsi.org/news-events/news/672-2013-05-etsi-ipr-committee-dialogue.

³⁶ See COMM. ON INTELLECTUAL PROP., NAT’L ACADEMIES, PATENT CHALLENGES FOR STANDARD-SETTING IN THE GLOBAL ECONOMY (Keith Maskus & Stephen A. Merrill eds., 2013), available at www.nap.edu/openbook.php?record_id=18510&page=1.

³⁷ There are a number of possible commitments patent holders could make that might not survive patent transfer, including:

- Red Hat’s commitment not to exercise its patent rights against open source software

Open Software Foundation would fully hold in the event its patents were sold.³⁸

C. SECRECY

PAEs often demand royalties without disclosing the contents of the portfolio they are offering to license. This creates difficulty for the potential licensee in determining the reasonable royalty for the portfolio. The market for ideas cannot function efficiently without full information on the nature of the product being sold. This is one possible source of competitive harm from secrecy.

As economists, we naturally presume that a PAE keeping the contents of its portfolio secret does so because secrecy is more profitable than transparency. This suggests that making more complete information about the PAE's patent portfolio available to target companies would lower expected royalty rates.

Some PAEs create shell companies to hold patents and assert them. This practice may make it difficult to determine who actually owns which patents and whether they are patents for which target firms already have licenses. A target firm may find it difficult to determine if a patent was in the portfolio of a previous owner on the date at which the target firm took a portfolio license from that firm. If so, a licensee could end up paying for intellectual property to which it already has rights. Existing explicit contracts of this sort are harder to enforce in an environment characterized by secrecy.

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- Commitments of patents to defensive patent organizations such as the Open Invention Network
 - Twitter's pledge to only use employee-owned patents defensively
 - Google's recent pledge not to assert certain patents against open source software (subject to a defensive termination agreement)
 - Promises not to 'stack royalties' (often part of FRAND commitments), where a company agrees not to charge more than a certain royalty percentage for all of its patents that apply to a particular product.

Daniel O'Connor, Senior Dir., Pub. Policy & Gov't Affairs, Computer & Commc'ns Indus. Assoc., Patent Assertion Entity Activities Workshop: Comments of Computer & Commc'ns Indus. Ass'n 6 (Apr. 5, 2013) (citations omitted), *available at* www.justice.gov/atr/public/workshops/pae/comments/paew-0065.pdf.

³⁸ See Press Release, U.S. Dep't of Justice, Statement of the Department of Justice's Antitrust Division on Its Decision to Close Its Investigations of Google Inc.'s Acquisition of Motorola Mobility Holdings Inc. and the Acquisitions of Certain Patents by Apple Inc., Microsoft Corp. and Research in Motion Ltd. 3-4 (Feb. 13, 2012) [hereinafter Statement of the Antitrust Division], *available at* www.justice.gov/atr/public/press_releases/2012/280190.pdf (discussing whether change in ownership of patents would allow new owner to avoid licensing commitments and ultimately concluding it would not).

D. EXCESSIVE DAMAGES AWARDS

1. *Stacking*

PAEs may be able to take advantage of the problem of royalty stacking. A PAE may demand what appears to be a reasonable royalty—before one considers royalties owed on the other patents that read on the same product or standard. This is a common problem in the information technology sector. It may be somewhat ameliorated in the case of non-PAE licensors who cross-license and cooperate with others in the industry and have their own products at risk and so are less inclined to ask for disproportionate royalties. It may be difficult for a jury or judge to analyze the extent of stacking, since other patent owners are not present in the litigation. Judge Robart’s recent *Microsoft v. Motorola* opinion³⁹ was refreshingly clear on this point: just because other patent owners have not yet extracted royalties and the stacking problem has not yet placed a heavy toll on the target products is not a reason to allow a patent holder to extract an unreasonable royalty.

2. *Unreasonable Royalties*

The courts have continued to struggle with the difficult task of determining reasonable royalties in patent infringement cases. Unfortunately, the commonly-used *Georgia Pacific*⁴⁰ list of factors for the jury to consider is open-ended and unstructured.⁴¹ This unstructured approach creates a real risk that the royalties determined by the jury will greatly exceed the royalties that would have resulted from a negotiation taking place prior to the infringement. While the courts have made progress in this area, e.g., by limiting the situations in which royalties can be based on the total market value of the infringing products,⁴² they also have missed opportunities to make the determination of reasonable royalties simpler and more accurate.⁴³

³⁹ *Microsoft Corp. v. Motorola, Inc.*, No. C10-1823-JLR, 2013 WL 2111217 at 86 (W.D. Wash. Apr. 25, 2013).

⁴⁰ *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116 (S.D.N.Y. 1970).

⁴¹ See, e.g., Daralyn J. Durie & Mark A. Lemley, *A Structured Approach to Calculating Reasonable Royalties*, 14 LEWIS & CLARK L. REV. 627 (2010).

⁴² See *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51 (Fed. Cir. 2012) (holding entire market value formula is inappropriate when allegedly infringed patent does not drive demand for the entire product); *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292 (Fed. Cir. 2011) (same).

⁴³ Notably, the Federal Circuit has stated that it “is wrong as a matter of law to claim that reasonable royalty damages are capped at the cost of implementing the cheapest available, acceptable, noninfringing alternative.” *Mars, Inc. v. Coin Acceptors, Inc.*, 527 F.3d 1359, 1373 (Fed. Cir. 2008).

E. SPAWNING PAES

A powerful weapon available to a PAE is to *create* a stacking problem as a strategic threat. This tactic requires a large portfolio that reads on the target product(s). A large portfolio may be divided into pieces and transferred to several other PAEs that the original PAE has incentivized to sue the recalcitrant target firm. The large size of the PAE's portfolio is critical here if many of the patents are of low quality and therefore less useful in court. For the strategy of spawning PAEs to be effective, the initial PAE must be able to give each successor PAE a credible threat. Each sub-portfolio must be large enough and strong enough that the successor PAE can credibly go to court based on its portfolio. Indeed, spawning multiple PAEs may make it possible to have a larger combined number of patents-in-suit than would have been possible for the original PAE. If each successor PAE is incentivized to litigate against the target company, the original PAE has created a royalty stacking problem that did not previously exist. In one scenario, the PAE has purchased the patents in small groups that were weak; prior to acquisition, the original patent owner did not have a strong enough portfolio of patents to cover the assertion costs. In this scenario, there is no royalty stacking problem in the but-for world.

F. REPUTATION

An important complement to any of these tactics, critical to a successful PAE business model, is credibility in carrying through on outsized threats. The would-be licensee must believe the outsized threat to be a real possibility. If the PAE has developed a reputation for seeking high royalties, obtaining injunctions, or obtaining large awards in litigation, then threats to do so in the current negotiation are more credible to the potential licensee. Many feasible threats are self-enforcing, such as seeking royalties based on the total market value of the infringing products. Some threats, such as unleashing multiple PAEs on the licensee, could result in lower total royalties for the PAE, either because of the reduction in quantity sold (due to double-marginalization) or because the target firm may fail under the weight of the royalty demands.⁴⁴

However, the risk that carrying through on the threat or litigation will be unprofitable for the PAE so far as this particular target is concerned may be acceptable to a PAE that operates in many sectors with many current and future licensees. Put simply, the PAE may find it profitable in the longer run to lose money on the target company if the PAE can establish a reputation for following through on its threats. The basic economics of reputation indicates that investing to establish reputation for toughness will likely be part of a

⁴⁴ Recall the example of the avatar business from the PAE Workshop. In three months, the firm was reduced from 70 to only a few employees. See *supra* text accompanying note 34.

successful PAE strategy.⁴⁵ This applies, for example, to bringing nuisance suits, which (by definition) are individually unprofitable for the plaintiff but can be profitable if they induce future targets to settle to avoid litigation costs.

III. THE EFFECTS OF PAES ON INNOVATION AND CONSUMERS

PAEs are specialists, a species that commands considerable respect from economists. The PAE business model is profitable precisely because PAEs are able to extract more value from the patents they acquire than were the previous owners. Economists generally welcome voluntary asset transfers, unless there is some basis to conclude that the private gains from trade driving the transfer do not correspond to a superior allocation of resources. We now study that question as it pertains to PAEs.

To illustrate the basic tradeoffs, consider the following two narratives.

- *Pro-PAE Narrative:* An inventor has discovered and patented valuable technology, but she lacks the assets to exploit it herself and is having difficulty finding downstream firms that can do so. She also is having difficulty locating downstream firms that have copied her technology and are not paying royalties. She sells her patent to a PAE that is skilled at finding downstream firms to which the technology can be transferred. The PAE also is good at locating unscrupulous firms that have copied the patented technology and are using it without paying, by hiding and by ignoring demand letters. The PAE also is skillful at negotiating reasonable royalties, in part due to its litigation capabilities. In this narrative, the PAE improves the functioning of the market for ideas, enhances returns to inventors, and promotes innovation.

- *Anti-PAE Narrative:* The PTO issues a software patent that is broad and vague but could be read to cover a small portion of code developed independently and embedded in high-revenue products or services sold by a downstream firm. Had the downstream firm known in advance about the patent, it could easily have selected an equally effective alternative approach that surely would not infringe. However, redesigning its products or services later to eliminate any chance that a jury might find them to be infringing would be expensive and time-consuming. The original patentee is not capable of effectively asserting it, or refrains from doing so for fear that the downstream firm will reciprocate with its own patent infringement action. The patent is sold at a low price to a PAE that is skillful at monetizing such patents, perhaps based on the chance of obtaining a very large damages award from the jury. The PAE is immune from any retaliatory patent infringement action. The PAE may also employ tactics such as threatening a patent infringement action just

⁴⁵ See, e.g., Paul Milgrom & John Roberts, *Predation, Reputation, and Entry Deterrence*, 27 J. ECON. THEORY 280 (1982).

before the target company seeks to go public, seeking an ITC exclusion order, and suing the target company's customers. As a result, the downstream firm bears costs, including royalties, far in excess of any value it receives from the original patentee or the PAE. In this narrative, the PAE imposes a tax on the downstream firm that harms consumers in the short-run and innovation in the long run.

We have no doubt that there are some real-world circumstances that look much like the pro-PAE narrative and others that look much like the anti-PAE narrative. An economic model combined with empirical evidence can help us move beyond these narratives and evaluate the overall impact of growing PAE activity on innovation and consumers.

A. ECONOMIC MODEL OF PATENT MONETIZATION

In the Appendix, we develop an economic model designed to illuminate these basic tradeoffs and distinguish between these two competing narratives. The model studies the effects on innovation and on consumers of *enhanced monetization*, which by definition means that the PAE can capture a greater share of the downstream firm's operating profits. In principle, as the narratives above indicate, the model allows monetization to help or harm consumers, depending on the strength of various factors in the environment. For example, suppose an important reason that PAEs stimulate innovation is by channeling money to small inventors who then have a greater financial incentive to innovate. Our model has a parameter, $[1 - \alpha]$, that represents the proportion of PAE license revenue that reaches the inventor. If this proportion is very small, the financial incentive to the would-be innovator is also very small. This in turn means the incentive to innovate is small and therefore the benefit to consumers from this effect is also small. Our model provides a condition that balances the costs and benefits of enhanced monetization.

We show that enhanced monetization is more likely to *promote* innovation and benefit consumers, the larger is:⁴⁶

- the share of the cost the PAE imposes on the downstream firm that is paid to the original patentee. $[1 - \alpha]$
- the responsiveness of the original patentee's R&D investments to receiving royalty income via the PAE, i.e., how strongly the patentee

⁴⁶ The variables in brackets are those used in the model in the Appendix. The conclusions reported here are captured in the inequality at the very end of the Appendix, which states that

increased monetization reduces welfare if $(1 - \alpha) \frac{dx/x}{d\sigma^p} [\epsilon_{xx} + \epsilon_{sx} \frac{S}{V}] < \frac{dy/y}{d\sigma^M} [\epsilon_{sy} \frac{S}{V}] + \alpha$.

increases its innovative output in response to an increase in royalty income. $[\frac{dx/x}{d\sigma^P}]$

- the spillover (i.e., the positive externality that is not included in the value of market exchange) from the original patentee's R&D efforts to the downstream firm's profits. Internalizing this positive externality is a benefit of monetization. $[1 - \varepsilon_{V\chi}]$
- the spillover (again, above and beyond price paid) in the form of consumer benefits resulting from the original patentee's R&D. If consumers benefit from the patentee's innovative activity, and if that benefit is not fully captured in the price of the product, then there is an additional benefit to monetization. $[\varepsilon_{S\chi}]$

Enhanced monetization is more likely to *deter* innovation and harm consumers, the larger is:

- the reduction in the downstream firm's investment in its own products due to payments to the PAE. The manufacturer may reduce its efforts to invent new versions of its product,⁴⁷ or to invent entirely new products, because these investments earn a lower rate of return due to the payments to the PAE. $[\frac{dy/y}{d\sigma^M}]$
- the consumer benefit resulting from the downstream firm's investments in its own products. Again, all consumers may not pay their full valuation for the final product. If consumers get consumer surplus from new products and if investment in those has declined due to the PAE, this is a welfare loss. $[\varepsilon_{S\gamma}]$
- the share of the cost the PAE imposes on the downstream firm that goes to cover legal fees and other transaction costs, i.e., the leakier is the bucket transferring money from downstream firms to patentees, the less incentive for increased innovation that benefits all parties. $[\alpha]$

In the Pro-PAE narrative, the original patentee discovered a valuable invention that generated positive spillovers for the downstream firm as well as significant consumer benefits. Furthermore, PAE enforcement activities are reasonably efficient, so a large share of the costs imposed on downstream firms are returned to the original patentee. With this configuration of variables, enhanced PAE monetization tends to promote innovation and benefits consumers.

⁴⁷ See, e.g., Catherine Tucker, Patent Trolls and Technology Diffusion (Apr. 14, 2014) (unpublished manuscript), available at papers.ssrn.com/sol3/papers.cfm?abstract_id=1976593.

In the Anti-PAE narrative, the original patentee's invention generated few if any spillovers to the downstream firm or consumers, yet the patent is strong enough to impose significant costs on the downstream firm. The downstream firm's investments benefit consumers, but those investments are discouraged by PAE costs. Worse yet, only a small fraction of those PAE costs make their way back to the original patentee. With this configuration of variables, enhanced PAE monetization tends to discourage innovation and harm consumers.

B. EMPIRICAL EVIDENCE

The empirical evidence on PAEs, taken as a whole, supports the conclusion that enhanced monetization by PAEs is discouraging innovation and harming consumers. This is the same conclusion recently reached by the Obama Administration, which stated: "A review of the evidence suggests that, on balance, such patent assertion entities (PAEs) (also known as 'patent trolls') have had a negative impact on innovation and economic growth."⁴⁸

First, the available evidence indicates that a relatively small share of the costs imposed by PAEs on targets is returned to the original patentees.⁴⁹ In other words, the transfer of funds from allegedly infringing downstream firms to patentees is done using a very "leaky bucket." Transferring funds using a very leaky bucket is only beneficial if the marginal impact of greater funds on innovation is far larger for those receiving the funds (here, patentees) than for those providing the funds (here, downstream firms).

However, we have seen no evidence indicating that the R&D investments by patentees are far more responsive to future royalty income received via PAEs than the R&D investments made by downstream firms are to the costs PAEs impose upon them. Nor have we seen evidence indicating that the investments undertaken by patentees whose patents are later sold to PAEs are far more beneficial to consumers than are the investments undertaken by the firms targeted by those PAEs. Indeed, in cases where the original patentee's operating business failed and the patent was sold to a PAE and then asserted against a downstream firm with large revenues, we would expect the opposite to be true.

Therefore, given how leaky the PAE bucket is, for enhanced PAE monetization to promote innovation and benefit consumers would require that the investments undertaken by patentees who later sell their patents to PAEs gen-

⁴⁸ EXECUTIVE OFFICE OF THE PRESIDENT, PATENT ASSERTION AND U.S. INNOVATION 2 (2013), available at www.whitehouse.gov/sites/default/files/docs/patent_report.pdf.

⁴⁹ See James Bessen & Michael J. Meurer, *The Direct Costs from NPE Disputes*, 99 CORNELL L. REV. 387 (2014); James E. Bessen, Jennifer Ford & Michael J. Meurer, *The Private and Social Costs of Patent Trolls*, REGULATION, Winter 2011–2012, at 26.

erate very substantial spillovers to downstream firms. Spillovers from patentees to subsequent implementers certainly can be substantial when downstream firms build on important inventions discovered by patentees that would not otherwise be made until much later, if ever. But there are no such spillovers in situations where downstream firms develop their own technology only to be subject later to patent infringement claims. In particular, if the downstream firm independently invented the technology or solution, without any copying or technology transfer from the patentee, then these spillovers are zero. In general, our conversations with experts and our reading of the literature suggests that the spillovers associated with software patents are quite low.⁵⁰

These empirical regularities—a low share of funds channeled to patentees, patentees who are not more productive at innovation than manufacturers, and little or no technology transfer done by PAEs—all tend to make the “monetization is good” condition fail. If the data show that additional PAE monetization discourages innovation and harms consumers, then payments to PAEs far in excess of reasonable royalties lessen competition.

Embedded in our economic model are two types of competition, both of which are hindered. First, royalties in excess of the value of the technology being licensed may well cause the downstream firm to raise its prices, thereby harming consumers. Second, innovation will be discouraged if market participants are not being competitively compensated for their R&D investments. When the PAE takes a share of the downstream firm’s profits that exceed the value of the licensed technology, the downstream firm’s share of its own operating profits is necessarily reduced, making it impossible for the downstream firm to receive the competitive return associated with the risk it takes and the investment it makes. If the downstream firm rationally anticipates holdup by the PAE, it will invest in fewer, or different, products than in the absence of the PAE. For example, if a PAE has developed a portfolio to target a particular industry, a new entrant into that industry may be deterred from selling its product or may alter its product to avoid the PAE “tax.” In such a case, the products offered will not be those that a competitive market would generate.

C. IMPLICATIONS FOR STRATEGIC PORTFOLIO ACQUISITIONS

The *raison d’être* of PAEs is to enhance the monetization of the patents they acquire. Our Pro-PAE and Anti-PAE narratives illustrate that enhanced

⁵⁰ The available empirical evidence suggests that a very small fraction of patent infringement cases involve defendants who have copied the patented technology from the patentee as opposed to unintentional infringement such as independently developing similar technology. See Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421 (2009).

monetization can promote innovation in some circumstances and harm innovation in other circumstances. Our economic model provides a framework for making these distinctions. Using the framework provided by our model, we read the empirical evidence as supporting the conclusion that enhanced monetization by PAEs, *overall*, is discouraging innovation and harming consumers.

This suggests that patent acquisitions by PAEs, a central element of their monetization strategy, often discourage innovation and harm consumers. However, the analysis in this Part of the article is rather general.⁵¹ We have not distinguished here between different types of patent portfolios, sellers, or buyers. When a given transaction is evaluated in practice, these particulars will rightly receive close attention.

In the remainder of this article we show how to apply our general framework of PAE monetization—the outsized threats discussed in Part II and the evaluation of economic effects in Part III—to several types of transactions involving patent portfolios. Importantly, when these transactions have the characteristics highlighted above—especially a very leaky bucket with little or no technology transfer—our model demonstrates that PAEs cannot point to increased innovation as a procompetitive benefit that could offset other harms.

IV. SALES OF PATENT PORTFOLIOS

A. TYPES OF SELLERS

As with merger analysis, the likely economic effects of the sale of a patent portfolio depend on differences between the business model and the other assets owned by Firm A, which is selling the portfolio, and Firm B, which is buying the portfolio. Before looking at different buyers, we discuss different sellers/status quo situations regarding the patent portfolio of Firm A.

Acquisition-specific harm requires a change in market outcomes: one such change might come about due to a difference in the nature of the licensing behavior and plans of the buyer versus the seller of the patents. We have in mind four general scenarios that could describe Firm A's use of the patents: (a) they are not being asserted, perhaps because the owner is not skilled at identifying target companies and/or pursuing them for royalties or litigating against them, or perhaps because the patents are so weak that the owner, lacking scale, does not find assertion profitable; (b) they are not available for license; (c) they are being bartered, either in the form of *détente* or a cross-

⁵¹ Our overall assessment of the effects of enhanced PAE monetization is somewhat analogous to the statement that highly concentrating mergers on the whole are likely to lead to a lessening of competition. Even if one accepts this proposition as having a sound basis in economic theory and empirical evidence, merger enforcement can still benefit by looking at such mergers on an individual basis to determine their likely effects.

license, giving Firm A design freedom rather than royalty income; or (d) they are (or will be) earning reasonable royalties. We focus here on categories (a), (b) and (c), treating (d) as the baseline.

In scenario (a), where the patents are not being asserted, downstream firms lack licenses to some of the patents in the portfolio Firm A is selling. This is a common circumstance that can arise for a number of reasons, most commonly because the patents may be so weak and vague that Firm A has not previously asserted them. Yet Firm B may have capabilities and economies of scale that would allow it to seek royalties in an efficient way. For example, Firm A could be an individual inventor who has patented a few weak software patents and has little ability to find potential licensees or negotiate with them. Furthermore, if the patents have a high likelihood of being invalid or not infringing, the individual inventor may not find it profitable to initiate litigation to attempt to force potential licensees to pay royalties. A sale of these patents to Firm B might cause royalty rates to increase from zero to a reasonable level. While such an increase raises marginal costs to licensees, those licensees were arguably using a valuable input for free when Firm A was not asserting. If the patent acquisition by Firm B causes users to pay a reasonable royalty, we consider that beneficial in terms of innovation and long-run consumer welfare. However, if Firm B is able to obtain excessive royalties, this would create harm of the type discussed above.

In scenario (b), Firm A may simply have refused to license to downstream firms that value the patented technology. In this situation, knowledge of both firms' business models is important. The most common reason Firm A may have refused to license is that the technologies are critical to Firm A's product which it wants to remain differentiated from competing products. Suppose Firm B makes the same type of product as Firm A. If B were to acquire the patents, it might mimic Firm A's strategy by using them to enhance its own product and not license them to others. The licensing environment for other parties would be unchanged. Alternatively, if Firm B is a PAE, a strategy of refusing to license would not make sense as a revenue model. Rather, Firm B will seek to earn royalties from the patents it has acquired. As above, these royalties could be at a reasonable level, or Firm B might use outsized threats to extract excessive royalties.

In scenario (c), where the patents are offered in barter, implicit royalties earned by Firm A are likely to be related to Firm A's other assets. For example, Firm A may operate in an industry where cross-licensing is common, where partners have valuable patent portfolios, and where opportunities to cooperate on complementary products are common. In such a case, Firm A will find cross-licensing to be strategically attractive and may value those benefits more than the cash it could generate from its patent portfolio. When it sells its patents to Firm B, the new owner may not be in that same situation; in

particular, a PAE has no need for design freedom and will place no value on a cross-license. Therefore, we can predict that the PAE will end the practice of cross-licensing and instead charge royalties for the technology.

Some downstream firms may have already licensed the patents, or a subgroup of them, from Firm A. If Firm B keeps the contents of its patent portfolio secret, these downstream firms may not realize they are already licensed and may therefore pay for a license that is duplicative. Sorting out effects can become especially complex when Firm A owns a broader group of related patents than is contained in the portfolio being sold. This includes the case where Firm A is splitting up its portfolio, keeping part and selling part to a PAE.

B. TYPES OF PATENT PORTFOLIOS BEING ASSEMBLED

As usual when patents are involved, we need to look at upstream technology markets (the markets where these patents are licensed) and at downstream product markets (the markets for products using the patented technology). Ultimately, we are interested in the impact of strategic patent acquisitions on downstream product prices, variety, and innovation.

In this Section we discuss several different types of patent portfolios. Naturally, the effect of a patent portfolio changing hands depends upon the patents in that portfolio and how they relate to other patents owned by the selling and buying parties. We are especially interested in portfolio acquisitions designed to create the type of outsized threats discussed above. One may need to look at a series of patent acquisitions, not just one in isolation, to determine how the resulting patent portfolio is being used and the effects of those acquisitions.

1. *Many Unrelated Patents*

The simple act of acquiring a large number of patents may not create any economic harm of the type discussed in this article. Suppose the acquiring PAE were to purchase hundreds or even thousands of randomly selected, unrelated patents. Given the huge number of existing U.S. patents, many of which are weak and vague, it is unlikely that this PAE would own very many patents that plausibly read on products in any given technical or product area. Such a portfolio would not be very effective in allowing the PAE to credibly threaten a downstream firm with holdup, since most patents would simply be irrelevant to that firm. The accumulation of unrelated patents, even in large numbers, does not enhance their market power.

2. *Related Patents Selected to Read on the Same Products*

A more realistic scenario involves the PAE carefully selecting patents to purchase that read on a target product or product line. The target products may be specific to one firm or to several firms in one industry. Naturally, PAEs are more likely to target successful products, i.e., those earning substantial revenues. The selected patents may not be substitutes or complements in the technical sense, but they are related in the sense that they may plausibly read on the same product. The accumulation of a large number of related patents may allow for successful outsized threats against the target products or product lines. The patents may cover very different aspects of the product (e.g., hardware vs. software). They may even comprise a significant fraction of patents in a particular technology area.

Searching for successful products and then purchasing patents that might read on those products turns the normal process of technology transfer on its head. In the classic technology transfer scenario, the patentee who has discovered a valuable technology transfers that technology to licensees who then, one hopes, develop successful products using the patented technology. In contrast, the PAE strategy starts by identifying products that are already successful and then seeks patents that can be asserted against those products. This is an explicitly ex post strategy based on outsized threats.

3. *Patents Covering Substitute Technologies*

The PAE may purchase patents covering the actual technology used by target products and the most promising design-around technologies for those same products. If a target firm were to attempt to choose another technology for its product, it might find that the PAE also has patents that read on the most promising alternatives. These types of acquisition are effectively horizontal mergers in technology markets. By purchasing a large share of all the patents reading on a product or product line, along with the most promising design-around alternatives, a PAE may be able to acquire monopoly power in the relevant technology market.

The relevant technology markets may involve ex ante technology substitution (at the time the products were designed) or ex post substitution (after the products have already been designed). Normally, a downstream firm's options are more restricted once it has committed itself to certain product designs. Therefore, ex post technology markets are narrower than ex ante technology markets, making it easier to accumulate market power in the ex post markets.

V. BUYERS OF PATENT PORTFOLIOS

A. PURE PAES

Our first fact pattern involves Firm A selling its portfolio to a stand-alone PAE.⁵² In the simplest case, there is just one such transaction, although the reasoning can easily be extended to cover the case where the PAE is aggregating related patents from multiple sources. Perhaps the PAE has capabilities, knowledge, and scale that simply make it more effective at licensing the patents. As noted above, a sale to a specialist who is effective at licensing IP is not, without further details, a competition problem.

However, suppose that the business model of the PAE is to increase profits from the portfolio by devising and making outsized threats against potential licensees, which it will drop in exchange for payment of supracompetitive royalties. This forces us to ask: Why would Firm A not engage in the same behavior? Our discussion of how PAEs engineer outsized threats explains how the transaction can increase the likelihood of outsized threats leading to supracompetitive royalty rates.

First, Firm A may not have the scale or ability to assert the patents at all. Second, Firm A may be constrained by having its own products on the market that are also exposed to the threat of injunction or exclusion. If Firm A pursued an injunction against a licensee, that licensee might locate suitable patents of its own and retaliate with an injunction against Firm A. In this situation, the injunction tactic becomes much less effective. A PAE on the other hand, does not face product market retaliation of any kind.

Third, the PAE is not bound by implicit contracts and may be able to find loopholes in explicit contracts that allow it to charge higher royalties. Such behavior on the part of a practicing entity might hurt its reputation with trading partners going forward. Retaliation, or “blowback” from downstream firms in other areas that Firm A values, such as joint product development or lobbying, would constrain Firm A but not the PAE.

In addition, Firm A may not be able to conceal the extent of its portfolio or hide its patents in shell companies as effectively as the PAE. If Firm A has been an operating company for some time and has filed for patents, participated in SSOs, released products, and generally been open about its technology strategy, concealment will be more difficult.

Some of the other outsized threats we discussed above are inefficiencies associated with litigation, such as the risk of whole product royalties, the risk

⁵² Scenario C from the DOJ/FTC PAE Workshop provided a simple example along these lines. See *PAE Workshop Transcript*, *supra* note 34, at 180–85.

to customers, and so forth. Firm A may be willing to litigate, in which case it will be similar to the PAE. However, Firm A's industry may be in a state of détente with regard to patent litigation, which would prevent it from monetizing its patents.

For all these reasons, we expect a portfolio transfer from Firm A, a practicing entity, to a pure PAE to result in additional monetization of the patents, very possibly leading to payments in excess of reasonable royalties. Based on our general analysis above, such excessive royalties raise prices in the short run and discourage innovation in the long run, resulting in less effective competition in the sector.

B. HYBRID PAES

Hybrid PAEs are those having contractual relationships with downstream firms. These relationships can take various forms. For example, a hybrid PAE may have an agreement to share with a downstream firm the revenues earned by asserting the patents. Alternatively, a hybrid PAE can take the form of a joint venture between a pure PAE and a downstream firm. Under this form, when the joint venture acquires the patents, the downstream firm retains a license for itself and perhaps for other parties it favors, such as its platform partners. The joint venture is then incentivized to assert the patents against the rivals to the downstream firm.

1. *Patents Acquired from Outside the Industry*

We first consider the case in which the hybrid PAE is acquiring patents from outside the downstream firm's industry. For example, the PAE may identify a concentrated market with high revenues and then approach one downstream firm in this industry to "invest" in a "fund" in its industry. The PAE's financial contribution and the downstream firm's investment are combined to purchase a large group of patents. These patents are selected to target the main products of the industry, as described above. The downstream firm receives a license to the patents in the fund. The PAE then asserts those patents against that investor's product market rivals and shares the resulting revenue with the downstream firm.

All the tactics used by pure PAEs to enhance monetization can also be applied by hybrid PAEs. However, there is an additional effect. To the extent that the hybrid PAE successfully charges higher royalties for the patents it controls, it will raise the costs of the downstream firm's rivals. Facing rivals with higher costs, the downstream firm will benefit from incremental demand for its products. Additionally, outsized threats such as injunctions or customer lawsuits become less costly to carry out in this structure because they also drive demand away from rival products to the downstream firm's product

where the downstream firm earns a margin. The PAE and the downstream firm may structure the investor's payment as a lump sum and its rivals' payments as per-unit royalties to ensure that rivals have higher marginal costs than the investor. This structural asymmetry will increase the likelihood that rivals raise their price to consumers, increasing diversion to the downstream firm. The additional profits from such diversion can be shared between the PAE and the downstream firm.

This analysis suggests that strategic patent acquisitions of outside patents by hybrid PAEs can be more harmful to consumers than acquisitions of the same patents by pure PAEs. Put simply, the hybrid PAE has a greater incentive to raise the costs of target firms than does the pure PAE. However, unlike the pure PAE case, there is one downstream firm, namely the one participating in the hybrid PAE, that does not face any running royalties.

Notice that "investing" in this context may not be as voluntary for downstream firm as it sounds. If the downstream firm understands the PAE's strategy, it may conclude that if it refuses to invest the PAE will just turn to one of its product market rivals, leaving the downstream firm on the receiving end of the PAE's licensing demands. In this fashion, the PAE can fabricate a prisoners' dilemma between downstream firms, leaving them all worse off.

2. Patents Acquired from a Downstream Firm

We now consider the case in which the hybrid PAE acquires patents from one downstream firm in order to assert them against that downstream firm's rivals. This can occur, for example, if a downstream firm with a strong patent portfolio, seeing its sales decline, decides to capture value by teaming up with a PAE to assert its patents against other downstream firms. While the competitive effects in this scenario are similar to those above, there may be no asset sale. Rather, the downstream firm may seek expertise in monetizing its portfolio by contracting for services with the PAE or creating a joint venture with a PAE.

Again, we should ask how the hybrid PAE can monetize the patents more effectively than the downstream firm could on its own. After all, the downstream firm might hire a professional management team to handle its licensing. We can infer from the creation of the hybrid PAE that enlisting the help of the PAE enhances monetization. We are again concerned with harm that arises from outsized threats that result in higher royalties than the downstream firm would achieve on its own. For reasons given above, the hybrid PAE may well have greater ability to direct outsized threats at product market rivals, especially if the downstream firm can impede retaliation by keeping its role secret from the target firms.

Here, too, the PAE may profit at the expense of downstream firms and consumers by creating a prisoners' dilemma between two or more downstream firms. A PAE may do this by identifying an industry with strong patent portfolios and successful products but no licensing revenue. Suppose the lack of revenue is due to a history of détente in the industry. The major firms understand that each has a strong portfolio and if one firm initiates patent litigation the others will retaliate. The PAE may approach each firm, offering to team up to attack that firm's rivals, warning that it will be picking one downstream firm as its partner and the downstream firm being approached is better off as a partner in a hybrid PAE than as a target.

It is also interesting to consider the case where another downstream firm with its own patent portfolio responds by forming its own hybrid PAE. The net effect is that both downstream firms must pay higher royalties, some of which go to the two PAEs. Consumers are worse off. This example highlights the important role of secrecy in some PAE strategies. The original firm that joins with the PAE may want to keep its relationship confidential in order not to induce its rival to do the same.

Another fact pattern arises when *two* downstream firms combine their patents in a joint venture with a PAE who is incentivized to raise their rivals' costs. In this instance it is important to understand whether the combination of the two portfolios increases the joint venture's ability to credibly impose outsized threats on potential licensees. To the extent that each downstream firm could carry out the strategy on their own, the combination of their portfolios may eliminate a stacking problem, while at the same time allowing the PAE to charge supracompetitive royalties. To the extent that each of the two portfolios is weak, but the combined portfolio is strong enough to be credibly asserted, the combination permits credible outsized threats that were not credible beforehand.

C. DOWNSTREAM FIRMS

The final case we consider is where a downstream firm purchases patents relevant to its industry from a party that does not compete in the downstream market. The acquiring firm thus obtains an input that its downstream rivals need. This fact pattern shares much with vertical mergers, which have been much studied in antitrust economics. Vertical mergers can harm competition if the acquiring firm has the ability and incentive to raise the costs of its downstream rivals.⁵³ Even if raising the price of the input is not profitable considering the input market alone, doing so may still be worthwhile if it

⁵³ See generally Patrick Rey & Jean Tirole, *A Primer on Foreclosure*, in 3 HANDBOOK OF INDUSTRIAL ORGANIZATION 2145, 2155–82 (Mark Armstrong & Robert Porter eds., 2007).

allows the acquiring firm to earn higher profits downstream based on its cost advantage there.⁵⁴

The antitrust analysis of strategic patent acquisitions by downstream firms became particularly relevant with several large transactions reviewed by the DOJ in 2011 and 2012. Novell and Nortel both entered bankruptcy and auctioned off their patent portfolios. The first auction was for the Novell patents, which were purchased by a consortium of Apple, Oracle, and EMC in early 2011. Many of those patents had been committed royalty-free to the Open Invention Network (OIN) and were part of the Linux core of the Android operating system. An open question was whether Novell's commitments to OIN would survive the sale of the patents to Apple.

The Nortel portfolio consisted of 6000 largely telecommunications patents, including many SEPs encumbered by FRAND commitments. The Nortel portfolio sold in June 2011 for far more than had been expected, to a consortium consisting of Apple, RIM, Microsoft, and others. Google had placed a stalking horse bid for this portfolio but failed to acquire it as the sale price rose to \$4.5 billion. Again, an open question was how the FRAND commitment on the SEPs would be interpreted by a new owner, perhaps one engaged in significant product market competition against licensees. The Nortel transaction was a powerful indication of the value the participants in the "platform wars" placed on patents as strategic assets.⁵⁵ After these two losses, in August 2011 Google offered to buy the Motorola business and its patent portfolio for \$12.5 billion. The Motorola portfolio contained over 17,000 patents, including many SEPs.

During the DOJ investigations, Microsoft issued a public statement pledging that "Microsoft will not seek an injunction or exclusion order against any firm on the basis of those [standard] essential patents."⁵⁶ Apple wrote a letter to the European Telecommunications Standards Institute (ETSI) stating that: "Seeking an injunction would be a violation of the party's commitment to FRAND licensing."⁵⁷ Google also issued a letter describing the conditions under which it would seek injunctive relief.⁵⁸ That letter is more difficult to

⁵⁴ *Id.* at 2155.

⁵⁵ See, e.g., Charles Arthur et al., *Nortel Patents Sold for \$4.5bn*, *GUARDIAN* (July 1, 2011), www.guardian.co.uk/technology/2011/jul/01/nortel-patents-sold-apple-sony-microsoft (stating Google would have used the portfolio to protect its Android operating system and that the value of the transaction was "unprecedented").

⁵⁶ *Microsoft's Support for Industry Standards*, *MICROSOFT* (Feb. 8, 2012), www.microsoft.com/en-us/legal/intellectualproperty/IPLicensing/ip2.aspx.

⁵⁷ Apple's letter is quoted in the DOJ closing statement. *Statement of the Antitrust Division*, *supra* note 38, at 5.

⁵⁸ Letter from Allen Lo, Deputy Gen. Counsel, Google, to Gordon Day, President, Inst. of Elec. & Elec. Eng'rs (Feb. 8, 2012), available at www.google.com/press/motorola/pdf/sso-letter.pdf.

understand, but a reasonable interpretation is that Google will not seek an injunction against any willing licensee. The January 2013 consent decree between Google and the FTC strengthens Google's commitment.⁵⁹ The DOJ allowed all three transactions to close without conditions on February 13, 2012.⁶⁰

In this analysis, it is important that the downstream firm's rivals may be infringing, so that they need to license the patents. It is not critical that the downstream firm itself practice the patents. An example that illustrates this point is when the buyer already has a license to the patents, so that there are no efficiencies from the acquisition, but there are greater incentives to assert the patents against its rivals.

An interesting real-world example is Google's purchase of the Motorola Mobility patent portfolio. Motorola was already asserting its patents vigorously. However, it presumably was maximizing licensing revenues and did not have a preference as to which mobile platform paid those revenues. Once acquired by Google, however, Google would have more interest in extracting royalties from its market competitors, such as Apple, Microsoft, and RIM, rather than firms using its Android system. Moreover, Google would not have the same disincentive to carry out an injunction or exclusion order as would Motorola. For Motorola, an exclusion order reduces sales of infringing products and therefore ultimate royalties, causing Motorola to earn lower profits. However, exclusion of a device made by Apple or Microsoft would likely increase Android sales as consumers turn to substitute products in the absence of their first choice device. While licensing revenues would be lost, gross margin and advertising profits on the sales of Android devices would be gained. Under this reasoning, the sale of the patent to a downstream firm creates additional incentive to engage in outsized threats and charge supracompetitive royalties.

VI. CONCLUSION

In this article we have explained how patent portfolio acquisitions can harm consumers and discourage innovation. The market for ideas functions well when valuable innovations are licensed at competitive royalty rates, thereby enabling firms to create products consumers desire while stimulating innovation.

⁵⁹ *In re Motorola Mobility, LLC, & Google Inc.*, FTC File No. 121-0120 (Jan. 3, 2013), available at www.ftc.gov/os/caselist/1210120/130103googlemotorolado.pdf (agreeing, among other things, to give potential licensees at least six months before filing an injunction against them).

⁶⁰ Statement of the Antitrust Division, *supra* note 38.

We have identified a number of fact patterns under which a strategic patent acquisition allows the entity acquiring the patents to impose costs on downstream firms based on outsized patent assertion threats. PAEs are especially skilled at the tactics behind such assertion threats. Credible outsized threats act like a “tax” on downstream firms, raising prices, distorting innovation markets, and harming competition, contrary to the goals of our antitrust laws.

The harm caused by PAEs could, in theory, be offset by increased incentives for innovation based on money collected by PAEs and returned to innovators. The critical elements of the environment required for this to occur are set out in our model. Patent monetization harms consumers and decreases social welfare if the asserted patents do not create substantial value for the target products or consumers and if the original innovator does not receive a significant fraction of costs imposed by the PAE on its targets. The empirical evidence strongly supports these assumptions, indicating that additional patent monetization by PAEs is problematic from a public policy perspective. Further reform of the patent system could go a long way to rein in behavior by patent holders that stifles rather than promotes innovation.

We have focused on harms arising from a change of ownership of one or more patents.⁶¹ The specific facts concerning the transaction will be important in determining the presence and extent of these harms. We have shown how the effects of a strategic patent acquisition are affected by the market positions of the selling and buying parties, by the patent portfolio itself, and by the acquiring party’s assertion tactics. For example, if the initial owner of the patents has not been asserting them, but the new owner will use them to make an outsized threat, the impact on consumers of that change in assertion strategy can be analyzed.

We have paid special attention to patent acquisitions by PAEs. We emphasize the distinction between pure and hybrid PAEs. Pure PAEs are neutral with respect to the downstream firms. This is not true of either the hybrid PAE or a downstream firm acquiring patents. Patent acquisitions by hybrid PAEs and downstream firms are more likely to raise antitrust issues than are patent acquisitions by pure PAEs.

We consider the hybrid PAE model to be the most troubling. We have in mind a hybrid PAE that is using outsized threats to obtain payments in excess of reasonable royalties, while working with a practicing entity that has its own incentive to raise its rivals’ costs. The costs imposed by PAEs on downstream firms are particularly harmful to consumers when these costs discourage or distort innovation, e.g., by keeping off the market products that would other-

⁶¹ As noted above, we use the term “ownership” to refer to any party with a financial interest in the revenue generated by the patent.

wise have been introduced or by causing a whole industry to pick an inferior technology.

The PAE business model is not going away any time soon. To the contrary, the empirical evidence summarized above shows that the role played by PAEs in patent litigation has grown in recent years. Fully addressing the harms to consumers and innovation caused by the PAE business model will require a variety of public policy responses, including patent reform and antitrust enforcement.

APPENDIX

ECONOMIC MODEL OF PATENT MONETIZATION

We present here a model showing the economic effects of more effective monetization by PAEs. This model is designed to illuminate the fundamental economic forces at work and is necessarily simplified to serve that purpose.

There are two firms in the model, the original patentee, P , and a manufacturer, M , as well as consumers. The original patentee is the firm that originally conducted the R&D leading to the patents in question, not the PAE that later acquires those patents. The patentee chooses an investment level, x , and the manufacturer chooses an investment level y . Both firms' investments are directed at developing new technology, obtaining patents, and/or developing and marketing products. We assume that each firm chooses its investment level to maximize its profits.

The patentee's expected operating profits from investing x are denoted by $P(x)$. These are measured gross of the patentee's investment level. The manufacturer's (expected) operating profits from investing y are denoted by $V(x,y)$. These profits are measured gross of the manufacturer's investment level. Neither firm's operating profits account for any royalties M may be required to pay to P . We assume that greater investment by P may lead to the creation of technology that is valuable to M , so $V_x(x,y) \geq 0$. Consumer surplus is denoted by $S(x,y)$; we assume that greater investment by P may benefit consumers, so $S_x(x,y) \geq 0$.

Without patent protection, the payoffs to the two firms would simply be $P(x) - x$ and $V(x,y) - y$ if their investment levels are x and y . Lacking any patent protection, there would be under-investment by the patentee (in comparison with the welfare optimum) if the patentee's R&D investments generate positive spillovers for consumers or for the manufacturer. However, this does not necessarily imply that increased monetization raises total welfare.

We now introduce patent protection and monetization. Suppose that P is able to obtain patents and assert those patents against M , imposing costs on M equal to a fraction θ of M 's operating profits, namely $\theta V(x,y)$. However, P does not receive this entire amount; a share α of these costs instead is consumed by transaction costs.⁶² We are interested in situations where the patents

⁶² We assume that these transaction costs involve the use of valuable resources and thus count as social deadweight loss. They are a drain on patent holders, manufacturers, and consumers. The larger is α , i.e., the leakier is the PAE bucket, the lower is social welfare. However, our main goal here is not to look at changes in α , but to examine the effects of a larger θ , i.e., enhanced monetization. Our model shows how α and θ interact; enhanced monetization is more likely to reduce welfare the leakier is the PAE bucket.

are sold to a PAE that asserts them against the manufacturer. In this context, the parameter α measures how leaky is the bucket associated with PAE enforcement activities. However, the analysis here applies more generally to patent assertion activities.

The total payoff to the patentee is now $\pi^P(x,y) \equiv P(x) - x + (1 - \alpha)\theta V(x,y)$. The first-order condition for x is given by $\pi_x^P(x,y) = 0$. The total payoff to the manufacturer is now $\pi^M(x,y) \equiv (1 - \theta)V(x,y) - y$. The first-order condition for y is given by $\pi_y^M(x,y) = 0$. Together, these two first-order conditions determine x and y given the parameter θ . We know that increased monetization raises P 's investment level and lowers M 's investment level.

Total welfare is the sum of the two firms' profits plus consumer surplus.

$$W = \pi^P(x,y) + \pi^M(x,y) + S(x,y).$$

We are interested in the welfare effects of enhanced monetization by PAEs. This is captured by an increase in the parameter θ . Totally differentiating W with respect to θ , and applying the envelope theorem associated with the first-order conditions for x and y , $\pi_x^P(x,y) = 0$ and $\pi_y^M(x,y) = 0$, gives

$$\frac{dW}{d\theta} = \frac{\partial W}{\partial \theta} + [\pi_x^M + S_x] \frac{dx}{d\theta} + [\pi_y^P + S_y] \frac{dy}{d\theta}.$$

The direct effect on W of increasing θ is to increase transaction costs: $\partial W / \partial \theta = -\alpha V$. The impact on M of greater investment by P is given by $\pi_x^M = (1 - \theta)V_x$. The impact on P of greater investment by M is given by $\pi_y^P = (1 - \alpha)\theta V_y$. Making these substitutions, we get

$$\frac{dW}{d\theta} = -\alpha V + [(1 - \theta)V_x + S_x] \frac{dx}{d\theta} + [(1 - \alpha)\theta V_y + S_y] \frac{dy}{d\theta}.$$

Therefore, increased monetization reduces welfare if and only if

$$[(1 - \theta)V_x + S_x] \frac{dx}{d\theta} < \alpha V + [(1 - \alpha)\theta V_y + S_y] \left| \frac{dy}{d\theta} \right|.$$

We can express the two investment levels in terms of the shares of the manufacturer's operating profits that each firm receives. The patentee receives a share $\sigma^P \equiv (1 - \alpha)\theta$ of those profits. Using $d\sigma^P / d\theta = (1 - \alpha)$, we have $dx / d\theta = (dx / d\sigma^P)(d\sigma^P / d\theta) = (dx / \sigma^P)(1 - \alpha)$. Likewise, the manufacturer receives a share $\sigma^M \equiv (1 - \theta)$, so we have $dy / d\theta = -dy / d\sigma^M$. Rewriting the key welfare condition, increased monetization reduces welfare if and only if

$$[(1-\theta)V_x + S_x] \frac{dx}{d\sigma^P} (1-\alpha) < \alpha V + [(1-\alpha)\theta V_y + S_y] \frac{dy}{d\sigma^M}.$$

We next convert this expression into elasticities, dividing and multiplying by V , S , x , and y as needed, to get

$$[(1-\theta)\varepsilon_{Vx} + \varepsilon_{Sx} \frac{S}{V}] \frac{dx/x}{d\sigma^P} (1-\alpha) < \alpha + [(1-\alpha)\theta\varepsilon_{Vy} + \varepsilon_{Sy} \frac{S}{V}] \frac{dy/y}{d\sigma^M}.$$

Here ε_{Vx} is the elasticity of V with respect to x , and likewise for the other ε terms. Note that all variables in this expression are unit-free.

This expression may appear a bit daunting, but it has a natural interpretation. The bracketed term on the left-hand side measures the positive spillovers to the manufacturer and consumers, respectively, associated with greater investment by the patentee. Increased monetization generates more spillovers to the extent that investment by P goes up when P gets a larger share of M 's profits, which is captured by the remaining two terms. The impact on investment by the patentee is measured in unit-free terms, i.e., the proportional change in investment, dx/x , and how it changes with the share captured by the patentee. The consumer surplus term is weighted by S/V to capture the relative importance of proportionate increases in consumer surplus in comparison with profits. With a very leaky bucket, α is close to unity and the left-hand side must be small.

Turning to the right-hand side, the first term reflects the added transaction costs resulting from an increase in monetization, including legal costs and the opportunity cost of executive time spent defending patent litigation. The second term captures the adverse impact on welfare as investment by M is discouraged. The bracketed term measures the spillovers associated with that investment, to the patentee and to consumers. The final term measures the extent that investment by M goes down when M keeps a smaller share of its operating profits.

We can simplify this expression considerably by setting $\theta = 0$. Setting $\theta = 0$ raises the left-hand side of the inequality and lowers the right-hand side, making it harder for the inequality to be satisfied. So, *increased monetization reduces welfare if*

$$[\varepsilon_{Vx} + \varepsilon_{Sx} \frac{S}{V}] \frac{dx/x}{d\sigma^P} (1-\alpha) < \alpha + [\varepsilon_{Sy} \frac{S}{V}] \frac{dy/y}{d\sigma^M}.$$

To match the bullet points in the text, we re-order the terms on each side to read:

$$(1-\alpha)\frac{dx/x}{d\sigma^P}[\varepsilon_{Vx} + \varepsilon_{Sx}\frac{S}{V}] < \frac{dy/y}{d\sigma^M}[\varepsilon_{Sy}\frac{S}{V}] + \alpha.$$

This is the expression discussed in the text.

