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# An Empirical Look at the “Brokered” Market for Patents

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## ABSTRACT

*We study five years of data on patents listed and sold in the quasi-public “brokered” market. Our data covers almost 39,000 assets, an estimated eighty percent of all patents and applications offered for sale by patent brokers between 2012 and 2016. We provide statistics on the size and composition of the brokered market, including the types of buyers and sellers who participate in the market, the types of patents listed and sold on the market, and how market conditions have changed over time. We conclude with an analysis of what our data can tell us about how to accurately value technology, the costs and benefits of patent monetization, and the brokered market’s ability to measure the impact of changes to patent law.*

## I. INTRODUCTION

Scholars, attorneys, and business professionals have long bemoaned the lack of available data on the market for patent transactions.<sup>1</sup> While resources exist to value cars, real estate, coins, comic books, and myriad other goods and services, no equivalent exists for patent rights.<sup>2</sup> Despite producing billions of

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1. See, e.g., Mark A. Lemley & Nathan Myhrvold, *How to Make a Patent Market*, 36 HOFSTRA L. REV. 257, 257–59 (2007) (describing problems created by the “blind market” for patents and proposing mandatory publication of patent license and sale terms as a solution); Anne Kelley, *Practicing in the Patent Marketplace*, 78 U. CHI. L. REV. 115, 116–17 (2011) (“[B]oth scholars and practitioners are seeking ways to improve how patents are valued, with scholars often calling for greater disclosure of sale terms to aid in setting market prices and practitioners focusing on refining methods for predicting a patent’s value to their own clients.”).

2. See, e.g., KELLEY BLUE BOOK, <https://www.kbb.com/car-values/> (last visited May 22, 2018) (listing price estimates for used cars); REDFIN, <https://www.redfin.com/>

dollars in annual revenues worldwide,<sup>3</sup> the market for licensing and buying patent rights operates in near total darkness. Virtually all deals are negotiated in secret and thereafter come to light only rarely.<sup>4</sup> As a result, potential buyers and sellers often have a hard time locating one another and, when they do, often cannot agree on the appropriate methodology for determining a price, let alone what that price should be.<sup>5</sup>

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(last visited May 22, 2018) (listing price estimates for residential real estate); *Coin Price Guides*, COINWEEK, <http://www.coinweek.com/coin-prices/coin-price-guides/> (last visited May 22, 2018) (listing more than twenty publications and websites that estimate market prices for collectable coins); *Comic Book Price Guide*, WIKIPEDIA, [https://en.wikipedia.org/wiki/Comic\\_book\\_price\\_guide](https://en.wikipedia.org/wiki/Comic_book_price_guide) (last visited May 22, 2018) (listing more than ten publications and websites that estimate market prices for comic books).

3. See Federico Caviggioli & Elisa Ughetto, *The Drivers of Patent Transactions: Corporate Views on the Market for Patents*, 43 R&D MGMT. 318, 319 (2013) (collecting estimates that place annual, worldwide revenue from patent transactions as high as \$100 billion in 2003). *But see* Ashish Arora et al., *Markets for Technology in the Knowledge Economy*, 54 INT'L SOC. SCI. J. 115, 118 (2002) (estimating that the global market for all technology licensing is between \$30 and \$50 billion annually); Kelley, *supra* note 1, at 115 (reporting that the worldwide market for technology licensing “approached or exceeded \$90 billion per year since 2003”). Recent years have seen multiple public portfolio sales in the nine- to ten-figure range. *See, e.g.*, Andrew Martin, *Kodak to Sell Digital Imaging Patents for \$525 Million*, N.Y. TIMES (Dec. 19, 2012), <http://www.nytimes.com/2012/12/20/business/kodak-to-sell-patents-for-525-million.html>; Peg Brickley, *Nortel \$4.5-Billion Patent Sale to Apple, Microsoft, Others Approved*, WALL ST. J. (July 11, 2011, 3:14 PM), <https://www.wsj.com/articles/SB10001424052702303812104576440161959082234>; Zack Whittaker, *Chip Designer MIPS Acquired for \$60m; Patents Sold for \$350m*, ZDNET (Nov. 6, 2012, 10:53), <http://www.zdnet.com/article/chip-designer-mips-acquired-for-60m-patents-sold-for-350m/>.

4. *See* Lemley & Myhrvold, *supra* note 1, at 257 (noting that “[e]ven if [a] patent or ones like it have been licensed dozens of times before, the terms of those licenses, including the price itself, will almost invariably be confidential”); Kelley, *supra* note 1, at 130 n.82 (noting that “[t]he vast majority of IP licenses and technology sales occur on confidential bases” and that “confidentiality is often highly negotiated between the parties”). In our experience, parties to a patent transaction opt for confidentiality largely due to uncertainty about how the market and their competitors will interpret the sale. Nonetheless, some licenses and sales become public when, for example, securities regulations require their disclosure. *See infra* note 15. Others are occasionally admitted into evidence in patent suits. *See* Tejas N. Narechania & Jackson Taylor Kirklin, *An Unsettling Development: The Use of Settlement-Related Evidence for Damages Determinations in Patent Litigation*, 2012 U. ILL. J.L. TECH. & POL’Y 1, 19–25 (collecting court orders discussing the discoverability and admissibility of patent licenses).

5. Andrei Hagi & David B. Yoffie, *The New Patent Intermediaries: Platforms, Defensive Aggregators, and Super-Aggregators*, 27 J. ECON. PERSP. 45, 45–46 (2013) (“[P]atent buyers and sellers frequently have a hard time finding each other . . . and when buyers and sellers do find each other they usually negotiate under enormous uncertainty: prices of similar patents vary widely from transaction to transaction and the terms of the transactions (including prices) are often secret and confidential.”);

In addition to throwing sand in the gears of the market for patent rights, this lack of transparency contributes indirectly to many of the patent system's gravest ills. Many worry, for example, that damages awarded in litigation lack a meaningful connection to the real world value of patented technology, in part because so much of the market is unobservable.<sup>6</sup> A lack of reliable pricing information also opens the door for arbitrage, a factor contributing to the rise of "patent assertion entities" ("PAEs") – patent monetization specialists that are uniquely able to wield various forms of "holdup" power over the parties they sue in order to extract settlements that reflect more than the value of the asserted patent.<sup>7</sup> Conversely, the costs inherent in participating in an inefficient market contribute to the fact that many tech companies choose to turn a

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Caviggioli & Ughetto, *supra* note 3, at 326 (finding, in a survey of corporate parties involved in patent transactions, that "[w]hen asked to rate the major obstacles hampering the growth of these marketplaces, our respondents identify the most relevant factors as information asymmetries and lack of shared methods to assess the economic value of patents").

6. See, e.g., Jonathan S. Masur, *The Use and Misuse of Patent Licenses*, 110 NW. U. L. REV. 115, 121 (2015) (arguing that the process of awarding patent damages based on prior comparable settlements is "ineluctably circular"); Lemley & Myhrvold, *supra* note 1, at 257 (explaining that because the patent market lacks transparency "courts lack adequate benchmarks to determine a 'reasonable royalty' when companies infringe patents").

7. See Hagiu & Yoffie, *supra* note 5, at 51 ("In essence, nonpracticing entities act as arbitrageurs, first acquiring patents, typically from individual inventors or small companies, and then seeking licensing revenues from operating companies through litigation . . ."). The term "patent assertion entity" is typically defined to encompass all non-practicing patent enforcers, except universities, early stage startups, and IP holding subsidiaries of operating technology companies. See *Informational Hearing on Patent Assertion Entities Before the California Assembly Select Committee on High Technology* (Oct. 30, 2013), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2347138](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2347138) (statement of Brian J. Love, Assistant Professor of Law, Santa Clara Univ.). Because PAEs do not compete with the companies that they sue, they are able to take advantage of several holdup opportunities that are generally not available to operating companies. For example, because PAEs do not sell products that compete with those produced by alleged infringers, they are able to avoid countersuit and thus can generally leverage asymmetric litigation costs against the parties they sue. See *id.* In addition, because PAEs sue to recover monetary damages rather than injunctions to protect market share, they can strategically delay suit until alleged infringers are "locked in" to using the allegedly infringing technology and, thus, cannot easily switch to a non-infringing alternative. See Colleen V. Chien, *Holding Up and Holding Out*, 21 MICH. TELECOMM. & TECH. L. REV. 1, 14 (2014) ("By pursuing a patent license ex post, after a product has been created, rather than ex ante, at the time the product is being designed, the patent owner can leverage not only the economic value of the invention, but also the cost of changing the product.").

blind eye to the market entirely, a practice decried by many patentees as “hold-out” behavior designed to raise the cost of patent enforcement.<sup>8</sup> These concerns – each among the most debated patent law issues of the last quarter century – would see significant improvement in a world with a transparent market for patent rights. However, information about patent transactions has to date proven hard to collect and interpret.

Currently available information about the patent marketplace is largely anecdotal and qualitative in nature. Scholars have studied market conditions primarily by interviewing market participants<sup>9</sup> or conducting case studies of firms known to be active in the market.<sup>10</sup> Though a few studies have collected quantitative data on transactions, such studies generally suffer from methodological limitations that make their findings hard to generalize. For example, while several scholars have sought to study patent transactions by collecting patent reassignment information disclosed to the U.S. Patent and Trademark Office (“PTO”),<sup>11</sup> these studies are limited by, among other confounding factors, the fact that patent reassignments are voluntarily disclosed, that patent reassignments often reflect corporate mergers or name changes rather than actual sales, and that PTO records lack any information about the price paid for the patent.<sup>12</sup> Other scholars have attempted to overcome these hurdles by accessing data on actual transactions, but again their studies paint at best a partial,

8. See Chien, *supra* note 7, at 20 (defining patent hold-out as “the practice of companies ignoring patents and patent demands because the high costs of enforcing patents make[] prosecution unlikely”).

9. See Kelley, *supra* note 1, at 117 (presenting “a current view of the patent marketplace from a practitioner’s perspective”); Ashby H. B. Monk, *The Emerging Market for Intellectual Property: Drivers, Restraints, and Implications*, 9 J. ECON. GEOGRAPHY 469, 471 (2009) (presenting an analysis based on “numerous elite interviews with corporate executives, corporate IP lawyers, patent intermediaries and IP industry groups in Boston, Seattle and Silicon Valley”).

10. See Gary Dushnitsky & Thomas Klueter, *Is There an eBay for Ideas? Insights from Online Knowledge Marketplaces*, 8 EURO. MGMT. REV. 17 (2011) (studying thirty online IP marketplaces).

11. See Colleen V. Chien, *Software Patents as a Currency, Not Tax, on Innovation*, 31 BERKELEY TECH. L.J. 1669, 1678 (2016) (analyzing software patent transfers between 2012 and 2015); Alberto Galasso et al., *Trading and Enforcing Patent Rights*, 44 RAND J. ECON. 275, 277 (2013) (analyzing patent transfers from individual inventors between 1983 and 2000); Carlos J. Serrano, *The Dynamics of the Transfer and Renewal of Patents*, 41 RAND J. ECON. 686, 690 (2010) (analyzing PTO reassignment data from 1980 to 2001). For similar studies analyzing transfers of non-U.S. patents, see HENRY CHESBROUGH, EMERGING SECONDARY MARKETS FOR INTELLECTUAL PROPERTY: US AND JAPAN COMPARISONS 3–4 (Mar. 31, 2006), <http://www.inpit.go.jp/blob/katsuyo/pdf/download/H17esm-e.pdf> (comparing patent reassignment data from the United States and Japan); FABIAN GAESSLER & DIETMAR HARHOFF, PATENT TRANSFERS IN EUROPE: DATA AND METHODOLOGICAL REPORT (Sept. 4, 2016) (on file with authors).

12. See Serrano, *supra* note 11, at 691 (explaining that many recorded assignments do not represent “transaction[s] of patents across firm boundaries” and instead result

skewed picture of the market. While a handful of studies have collected data on patent transactions disclosed to the Securities and Exchange Commission ("SEC")<sup>13</sup> or patent auctions conducted by Ocean Tomo,<sup>14</sup> it is well known that these deals represent only the tip of the iceberg and, moreover, are far from representative of the broader market.<sup>15</sup>

In this Article, we take advantage of Richardson Oliver Law Group's ("ROL Group") unique position as an active participant in the patent marketplace to present what we believe to be the largest and most representative empirical study of the secondary market for patent rights. Our data spans five years of transactions, involving almost 39,000 patent assets, an estimated eighty percent of all patents offered for sale on the quasi-public "brokered" market during the period of our study.<sup>16</sup> For the first time, we provide near-comprehensive statistics on the size and composition of the brokered market, including the types of buyers and sellers who participate in the market, the types of patents listed and sold on the market, and how market conditions have changed over time. Our findings have importance for ongoing debates about how best to value patent rights, how to quantify the costs and benefits of patent monetization, and what impact recent changes to patent law have on companies with patent portfolios.

This Article proceeds as follows. Part II provides background on the secondary market for patents, including the types of entities that participate in the market. Part III explains our data collection methodology. Part IV provides descriptive statistics that summarize what we observe in the data, and, finally, Part V discusses what our data can tell us about the patent system.

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from "administrative events, such as a name change, a security interest, a correction, and so on" or "transactions between inventors-employers and their employees-assignees").

13. Chien, *supra* note 11, at 1697 (studying 1431 software-related patent transactions disclosed to the SEC that were sourced from ktMine); Thomas R. Varner, *An Economic Perspective on Patent Licensing Structure and Provisions*, 46 BUS. ECON. 229, 231 (2011) (studying 1458 patent licenses and transfers disclosed to the SEC).

14. Cristina Odasso et al., *Selling Patents at Auction: An Empirical Analysis of Patent Value*, 24 INDUS. & CORP. CHANGE 417, 424–25 (2015) (studying 535 lots auctioned by Ocean Tomo between 2006 and 2008); Katherine A. Sneed & Daniel K. N. Johnson, *Selling Ideas: The Determinants of Patent Value in an Auction Environment*, 39 R&D MGMT. 87, 89 (2009) (studying 121 Ocean Tomo lots resulting in fifty-one sales).

15. Transactions disclosed to the SEC, in particular, are especially large because regulations require the disclosure of only those deals that are "material" to the finances of a publicly traded company. See U.S. SEC. & EXCH. COMM'N, FORM 8-K, CURRENT REPORT PURSUANT TO SECTION 13 OR 15(D) OF THE SECURITIES EXCHANGE ACT OF 1934, <http://www.sec.gov/about/forms/form8-k.pdf> (requiring in Item 1.01 the disclosure of "material definitive agreement[s] not made in the ordinary course of business") (last visited May 22, 2018).

16. As we discuss *infra* in Part III, our coverage is higher for recent years and lower for earlier years.

## II. THE SECONDARY MARKET FOR PATENTS

Conceptually, the market for patent rights can be divided into deals that license the right to use patented inventions and deals that lead to the outright sale of one or more patents.<sup>17</sup> The market for patent sales can, in turn, be further subdivided into two market segments: first, a quasi-public “brokered” market of packages that are shopped to multiple potential buyers and, second, a private market of transfers that are negotiated in secret between specific parties.<sup>18</sup> Figure 1 provides a simple depiction of these market divisions.

The first “brokered” market segment consists of patent packages that are offered widely to prospective buyers and thus are generally observable to interested market participants, though typically subject to confidentiality agreements that render the market unobservable to the public at large.<sup>19</sup> Almost without exception, patents offered for sale in this quasi-public market are shopped by patent “brokers,”<sup>20</sup> and for this reason we refer to it as the “brokered market.” Brokers are, in effect, the intellectual property equivalent of real estate agents. They market patents on sellers’ behalf in an attempt to find and negotiate deals with potential buyers,<sup>21</sup> and in return, they take a fee of roughly twenty percent of deals that they close.<sup>22</sup>

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17. In reality, of course, many deals include both licenses and sales. However, as explained in greater detail *infra* in Part IV.A, the quasi-public brokered market that we study in this paper is almost entirely limited to pure patent sales. PTO assignment records suggest that roughly fourteen percent of patents change hands at least once before they expire. See Serrano, *supra* note 11, at 693 (reporting that, across technologies, transfer rates vary between roughly twelve and sixteen percent).

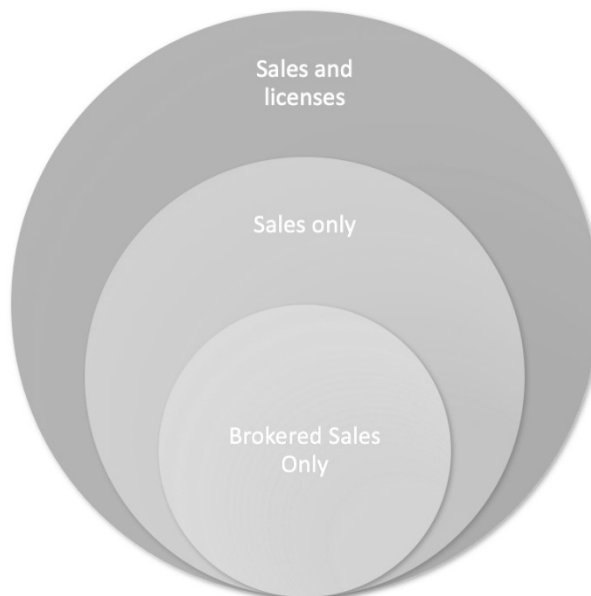
18. Kent Richardson, Erik Oliver & Michael Costa, *Inside the 2016 Brokered Patent Market*, INTELL. ASSET MGMT., Jan./Feb. 2017, at 34.

19. Kelley, *supra* note 1, at 135–36. In addition to hurdles caused by confidentiality obligations, even seasoned market insiders will invariably miss some portion of this market due to the dispersed and sometimes haphazard nature in which packages are circulated for sale by some brokers and sellers. *Id.*

20. In the data that we describe *infra*, more than ninety-eight percent of the packages that we observe were marketed through brokers. Fewer than two percent of patents were, to borrow a phrase from the real estate market, “for sale by owner.” See also Richardson, Oliver & Costa, *supra* note 18, at 36 (reporting that at least seventy-three brokers represented patent sellers in 2016). *But see* Kelley, *supra* note 1, at 121 (reporting that “[b]rokers facilitate three-quarters of the sales in the patent marketplace”).

21. In our experience, brokers often perform tasks such as selecting which patent assets to sell, setting asking prices, identifying potential infringement, identifying and contacting potential buyers, and establishing a procedure for prospective buyers’ diligence and bidding. Richardson, Oliver & Costa, *supra* note 18, at 35.

22. See Kent Richardson & Erik Oliver, *Turning the Spotlight on the Brokered Patent Market*, INTELL. ASSET MGMT., Jan./Feb. 2013, at 11, 16 (reporting an average commission rate of twenty-two percent); Kelley, *supra* note 1, at 121 (reporting that broker commissions range between ten and twenty-five percent).

**Figure 1: The Market for Patent Transactions**<sup>23</sup>

Patent purchases that take place outside the brokered market are both harder to observe and harder to categorize. Anecdotally, sales in this “private” market tend to be relatively large deals negotiated directly between buyers and sellers, often without the assistance of brokers. In our experience, private sales are more idiosyncratic in nature and frequently are motivated by a broader set of considerations that extend beyond the transferred patents. Consider for example one deal that became public in 2014. That year, Twitter purchased 900 patents from IBM in a \$36 million deal. However, the parties’ agreement followed a threat from IBM to file suit against Twitter shortly before its initial public offering, and the deal included cross-licensing terms in addition to the transfer of patents.<sup>24</sup>

Buyers, like sellers, also participate in the patent marketplace both indirectly through third parties and directly without representation. For buyers, however, the division is not nearly so stark across market segments. In both the private and quasi-public markets, buyers are often indirectly represented by patent “aggregators,” entities that are frequent purchasers and generally exist

23. This Figure is not intended to depict the relative sizes of each market subset, only their relationship to one another.

24. See, e.g., Klint Finley, *Twitter Pays \$36 Million to Avoid IBM Patent Suit*, WIRED (Mar. 7, 2014, 2:42 PM), <https://www.wired.com/2014/03/twitter-ibm/>.



to facilitate coordination among multiple buyers with similar interests.<sup>25</sup> “Defensive” aggregators like Allied Security Trust and RPX use a membership fee-based model to accumulate funds that can be used to purchase patents of interest to their members.<sup>26</sup> Generally, these patents fall into one of three categories: (i) patents currently being enforced against members, (ii) patents that members fear may be asserted against them in court down the road, or (iii) patents that members wish to hold for possible defensive use against competitors. That said, some entities that have been categorized as aggregators do buy with monetization in mind and thus are generally also considered PAEs.<sup>27</sup> Intellectual Ventures (“IV”), which owns upwards of 38,000 patents and applications,<sup>28</sup> is undoubtedly the most famous example. Though largely funded by operating technology companies like Microsoft, Intel, and Sony,<sup>29</sup> IV’s business model goes well beyond defensive acquisition. In fact, it is generally understood that IV earns the “vast majority” of its revenue from licensing its portfolio.<sup>30</sup>

Despite the large sums of money at stake and the sophistication of many buyers and sellers, there remains no central clearinghouse for patent offerings. However, several third-party platforms play an important and increasingly common role in bringing potential buyers and sellers together. For example, auction houses like Ocean Tomo exist to facilitate the sale of patents to the highest bidder.<sup>31</sup> In addition, online platforms have arisen in an attempt to

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25. See generally *Sell Your Patent*, RPX, <https://www.rpxcorp.com/rpx-sell-your-patent/> (last visited May 22, 2018).

26. *Company*, RPX, <https://www.rpxcorp.com/about-rpx/> (last visited May 22, 2018) (“By acquiring problem patents, RPX helps to mitigate and manage the risk of potential patent assertions for its growing client network.”); *About Us*, ALLIED SECURITY TRUST, <http://www.ast.com/about-us/asts-mission/> (last visited May 22, 2018) (“We are an independent member-based, not-for-profit cooperative that helps companies who use innovative technologies mitigate the risk of patent assertions and litigation by securing rights from patents available on the open market.”).

27. See, e.g., Erik Oliver, Kent Richardson & Michael Costa, *How Intellectual Ventures Is Streamlining Its Portfolio*, INTELL. ASSET MGMT., May/June 2016, at 9.

28. *Id.* at 10 (reporting that IV’s monetization funds collectively include 38,700 patents); Robin Feldman & Tom Ewing, *The Giants Among Us*, 2012 STAN. TECH. L. REV. 1, 1 (2012) (reporting in 2012 that IV “has accumulated 30,000–60,000 patents worldwide, which would make it the 5th largest patent portfolio of any domestic US company and the 15th largest of any company in the world”).

29. See Oliver, Richardson & Costa, *supra* note 27, at 9 (“Since its founding, it has reportedly raised over \$6 billion in capital. A large portion of this has come from corporate investors in the high-tech space, such as Microsoft, Intel, Sony, Nokia, Apple, Google, Yahoo, American Express, Adobe, SAP, NVIDIA and eBay.”).

30. See *id.* (“The vast majority of IV’s revenue does not come from making products or offering services. Rather, it comes from licensing its portfolio to other companies – IV is the quintessential NPE.”).

31. See *Intellectual Property Auctions*, OCEAN TOMO, <http://www.ocean-tomo.com/intellectual-property-auctions/> (last visited May 22, 2018) (explaining that the company conducts both “private” and “live” auctions). Though auctions are far less

connect buyers and sellers.<sup>32</sup> While some have failed,<sup>33</sup> others like the new IAM Market<sup>34</sup> have become quite successful. Today, an estimated twenty-five percent of patents offered for sale by brokers are listed by IAM,<sup>35</sup> and we anticipate that participation in online marketplaces will continue to grow in the coming years.

### III. METHODOLOGY

To learn more about the market for patents, we set out to identify as many patents as possible that were offered for sale on the brokered market between January 1, 2012, and December 31, 2016. To identify packages, we collected data from brokers as well as from online platforms. To collect data from brokers, we constructed and updated a list of known brokers and negotiated with each to obtain data on the patents that they offered during the period of our study.<sup>36</sup> In all, we were able to obtain data covering at least some portion of our study period from more than 100 brokers and sellers.<sup>37</sup> We also supplemented this data with listings posted to online platforms, primarily IAM Market, to identify as many additional packages as possible.

Though this collection procedure is imperfect, we believe that our sample is the most comprehensive studied to date.<sup>38</sup> To estimate the percent of the brokered market that our data covers, we benchmarked our data against internal

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common today, at least one study estimated that about ten percent of transferred patents were sold via auction. See Kelley, *supra* note 1, at 122 (reporting that “[t]en percent of the patents sold are currently sold through auctions”).

32. Prior to the rise of the Internet, third party publications also helped patent sellers spread the word about their inventions. For example, the NEW PRODUCT NEWSLETTER was published from 1954 to 1997. See, e.g., 37 INT’L NEW PRODUCT NEWSLETTER (Transcommunications Int’l Inc., Marblehead, Mass.), Jan. 1991, at 1 (on file with authors).

33. See, e.g., Jorge L. Contreras, *FRAND Market Failure: IPXI’s Standards-Essential Patent License Exchange*, 15 CHI.-KENT J. INTELL. PROP. 419 (2016) (describing the business model, launch, and subsequent failure of the Intellectual Property Exchange International, Inc. (“IPXI”).

34. IAM MARKET, <https://www.iam-market.com/> (last visited May 22, 2018).

35. See Richardson, Oliver & Costa, *supra* note 18, at 34 (reporting that between October 2015 and May 2016 the IAM Market “listed 194 packages, with 3,724 assets, from 17 sellers”).

36. In each case, we were allowed access only under non-disclosure agreement (“NDA”), and thus unfortunately our raw data cannot be made publicly available. We were successful in obtaining this data primarily because ROL Group frequently represents buyers in patent deals and, thus, brokers have a strong incentive to ensure that ROL Group is aware of new packages when they hit the market. *Patent Brokers*, RICHARDSON OLIVER L. GROUP, <http://www.richardsonoliver.com/brokers/> (last visited May 22, 2018).

37. A current list of active brokers is available online here: <http://www.richardsonoliver.com/brokers>.

38. For a summary of additional limitations to our data, see *infra* Part IV.

datasets maintained by multiple entities that operate large patent buying programs.<sup>39</sup> Based on these benchmark comparisons, we estimate that we were able to observe approximately fifty-five percent of all patents placed on the brokered market in 2012, approximately sixty-five percent of such patents in 2013, and approximately ninety-five percent of the brokered market in 2014, 2015, and 2016.<sup>40</sup>

We elected to limit our data collection to the brokered market and, thus, our database does not include any “private” transactions. We did so for two reasons. First, private transactions are rarely observable, and when they are, it is typically because they have been disclosed to the SEC. As discussed *supra*, transactions disclosed to the SEC tend to be unusually large relative to the size of the disclosing party.<sup>41</sup> In the context of private patent sales, we would expect the data to be biased even more so because private deals are disproportionately transacted between large parties, such as publicly traded technology companies and large aggregators. Second, in our experience, prices in private transactions are typically based on information gleaned from the quasi-public brokered market. Because private transactions tend to be unusually large and heterogeneous, parties to those transactions are generally unable to use other private deals to conduct price comparisons. Thus, it is our experience that the brokered market informs the price of patents in private transactions, but not vice versa.<sup>42</sup>

We collected a variety of information about each package that we identified. First, we made note of the specific assets<sup>43</sup> included in the packages, including their quantity, technology classes, and (for U.S. assets) the PTO “art unit” in which they were examined.<sup>44</sup> In addition, we hand coded each package

39. Unfortunately, we were only allowed to compare our respective data for the purposes of estimating coverage; we were not permitted to access any missing data. In addition, we have agreed not to disclose the names of the entities that assisted us in performing this benchmark.

40. In the latter half of 2013, we substantially expanded our data collection efforts, both by increasing the number of brokers from which we collected data and by increasing the number of packages we were able to review from each broker. We believe that our data for 2012 and 2013 is reasonably representative of the overall brokered market during those years despite constituting a much smaller sample than we were able to obtain in later years. As reported *infra* Part IV, we find a quite consistent distribution of package sizes, types of buyers, and patented technologies across all five years of our data.

41. See *supra* note 15.

42. Nonetheless, we are cognizant of the fact that private transactions constitute a large percentage, and likely the majority, of the total market for patent sales. Extrapolating from overall PTO assignment data, we believe it is reasonable to assume that the private market is roughly ten times larger than the brokered market. However, in the technology categories that dominate our data – computer hardware, software, and telecommunications – we estimate that about twenty to twenty-five percent of all transferred patents are sold on the brokered market.

43. “Assets” includes both issued patents and pending applications.

44. U.S. patent examiners are divided into nine “technology centers,” each of which is subdivided into a number of “work units” that, in turn, are further subdivided

as relating to one of four broad technology categories: software, hardware, communications, or "other." As discussed in greater detail below, the packages that we observed overwhelmingly related to computer or telecommunications technology.<sup>45</sup> We also noted whether each package was circulated to potential buyers along with "evidence of use" ("EOU") documentation, i.e., a document (sometimes in the form of a claim chart) explaining that one or more assets in the package may be infringed. When an EOU was provided, we additionally noted the company, product, and/or technology standard that was implicated.

When available, we also noted the asking price for the package provided by the seller's broker. As shown below in Table 2, roughly seventy-seven percent of the packages that we observed were offered with some form of pricing guidance. While some packages did include exact asking prices, it was more common for packages to indicate an anticipated range of value. When specific asking prices were not provided, we estimated the asking price as the midpoint of the range.<sup>46</sup>

In addition to collecting data on each package, we also identified the entity attempting to sell the patent, i.e., the broker's client. We further classified each seller as an individual inventor, PAE, operating technology company, defensive aggregator, or university or other research institution. For classification purposes, we defined a PAE as a non-practicing, for-profit entity that earns the majority of its revenue from patent licensing. For operating companies, we additionally noted whether the company was publicly traded or privately held.

Next, we determined to the best of our ability whether each offered package was ultimately sold. To determine which packages sold, we searched PTO assignment data for all U.S. patent assets that were placed on the market.<sup>47</sup> If a U.S. patent that was offered for sale was subsequently reassigned to a new owner,<sup>48</sup> we assumed that the asset was successfully sold along with all other assets in its package.<sup>49</sup> We conducted this search in July 2017 and made note

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into "art units." See *Patent Technology Centers Management*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/patent/contact-patents/patent-technology-centers-management> (last visited May 22, 2018).

45. See *infra* Part IV.C.

46. Approximately two percent of packages were listed with pricing information that we viewed as too vague to assign a specific number. We treat these packages as if they were provided without pricing information.

47. PTO assignment data is public and can be searched online. *Patent Assignment Search*, U.S. PAT. & TRADEMARK OFF., <https://assignment.uspto.gov/patent/index.html#/patent/search> (last visited May 22, 2018).

48. We scrutinized the assignments to exclude those that merely represent name changes or mergers.

49. In our experience, it is extremely rare for packages to sell in pieces. Rather they virtually always sell as a whole, or do not sell at all. Nonetheless, it is possible that this methodology somewhat overstates the per asset sales rate.

of all assignments dated on or before December 31, 2016.<sup>50</sup> For two reasons our sales data likely understates the rate of sale. First, patent assignments are voluntary and, thus, some sales may not have been recorded.<sup>51</sup> Second, packages often sit on the market for months before they are sold and, thus, some packages placed on the market likely sold (or will sell) in 2017 or thereafter.<sup>52</sup>

For packages that we identified as sold, we additionally identified the buyer. As with sellers, we categorized each buyer as a PAE, operating company (public or private), defensive aggregator, individual, or university. Finally, we determined whether any U.S. patent assets included in sold packages were subsequently litigated in district court or challenged before the Patent Trial and Appeal Board (“PTAB”). For those that we identified as asserted or challenged, we noted the date of the suit or challenge, as well as the parties named in the suit. Our data on assertions and challenges is current through September 2017.<sup>53</sup> As with sales, assertions often occur months after patents change hands. Thus, our assertion data likely understates the true rate of litigation and administrative challenge, particularly for patents placed on the market in 2015 and 2016.<sup>54</sup>

#### IV. FINDINGS

In this Part, we summarize our observations. First, we present statistics on the overall market, including the number and sizes of packages placed on the market, the asking prices for packages on offer, the rate at which packages sold, and the impact that package size and documentation had on sales. Next, we break the data down according to the types of entities involved in transactions. We take an especially close look at transactions involving privately held

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50. Thus, our data does not include any sales that actually occurred in 2017. We conducted the search in mid-2017 because sales are often recorded with the PTO weeks or months after they take place.

51. We believe that, while this is possible, it is likely a very rare occurrence. Buyers in the brokered market are mostly large, sophisticated businesses with very low risk tolerances.

52. As shown below in Figure 3, only about seventy-five percent of packages are sold within one year of their initial listing. There are two other less important reasons that this methodology may further understate the rate of sale: some packages may have resulted in a partial sale that did not include a U.S. asset, and a small number of observed packages did not include any U.S. assets. In our experience, the former is highly unlikely. While it is common for prices to reflect a small number of assets among the many included in a package, packages virtually always sell as a whole. With respect to the latter, fewer than four percent of observed packages did not include at least one issued U.S. patent.

53. We collected litigation and PTAB data by searching Docket Navigator for each sold U.S. patent. *See* DOCKET NAVIGATOR, <https://www.docketnavigator.com> (last visited May 22, 2018).

54. As shown below in Table 9, packages that were litigated were, on average, enforced in court about 187 days after they were purchased.

operating companies, PAEs, and universities. Finally, we present statistics on transactions across technologies and take a closer look at the market for certain types of patents, including those claiming business methods.

#### A. Overall Market Statistics

We begin with an overview of all observed packages that were offered for sale between 2012 and 2016. Table 1 below presents data on the quantity and sizes of these packages.

**Table 1: Overall Number of Packages and Assets Observed**

Year	Num. Packages Observed (Est. Total <sup>55</sup> )	Num. Patent Assets Observed (Est. Total)	Num. Issued U.S. Patents Observed (Est. Total)	Avg. (Median) Total Assets/Package	Avg. (Median) Issued U.S. Patents/Package
2012	199 (362)	3,761 (6,838)	1,809 (3,289)	18.9 (5)	9.1 (3)
2013	377 (580)	5,583 (8,589)	3,545 (5,453)	14.8 (4)	9.4 (2)
2014	657 (692)	9,999 (10,525)	6,923 (7,287)	15.2 (5)	10.7 (3)
2015	709 (746)	8,432 (8,876)	5,381 (5,664)	11.9 (5)	7.6 (3)
2016	663 (698)	11,218 (11,808)	6,242 (6,570)	16.9 (6)	9.5 (3)
<b>Total</b>	2,605 (3,078)	38,993 (46,636)	23,900 (28,263)	15.0 (5)	9.2 (3)

First, we find that asset packages are almost without exception made up exclusively of issued patents and pending patent applications. Less than one percent of the packages that we observed included another type of IP right or some form of know-how. Those rare packages that did include non-patent assets overwhelmingly listed a trademark (thirteen of seventeen packages).

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55. Our estimated totals assume that we observed fifty-five percent of the total brokered market in 2012, sixty-five percent in 2013, and ninety-five percent in 2014, 2015, and 2016. As discussed *supra* at notes 39–40, these coverage estimates are derived from comparing our data with data accumulated by other large market participants.

Three or fewer packages offered to transfer source code, a domain name, or some form of trade secret, like a customer list.<sup>56</sup>

On average, the packages we observed also consist primarily of issued U.S. patents. This is not surprising because, in our experience, it is usually U.S. patent assets that drive sales.<sup>57</sup> The United States is one of the largest technology markets in the world,<sup>58</sup> as well as one of the most litigious,<sup>59</sup> and both of these facts tend to increase the importance and value of U.S. patent rights. In our experience, buyers are also attracted to U.S. patents due to the availability of important information about them. Compared to patent offices in other parts of the world, the PTO makes a relatively large amount of data available to the public.<sup>60</sup> As a result, it is easier for buyers to perform due

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56. Feldman and Lemley make a similar finding in a study of licensing offers made by patentees to technology companies. See Robin Feldman & Mark A. Lemley, *Do Patent Licensing Demands Mean Innovation?*, 101 IOWA L. REV. 137, 153, 158 (2015) (finding that respondents in a survey of in-house counsel at technology companies overwhelmingly reported that patentee-initiated licenses led to the transfer of “[t]echnical [k]nowledge in addition to the [p]atent [l]icense” between “0-10%” whether or not the patentee was an NPE, university, or operating technology company). On the other hand, studies of patent transactions reported to the SEC have consistently found that at least some transactions include other IP assets or know-how. See Varner, *supra* note 13, at 232 (finding in a study of more than 1400 patent transactions reported to the SEC that fifty-six percent included know-how in addition to the license or sale).

57. This, of course, is not always true. For example, German patents are also highly sought after by many buyers, likely due to the jurisdiction’s high grant rate for injunctions and bifurcation of infringement and validity determinations. See Katrin Cremers et al., *Invalid but Infringed? An Analysis of the Bifurcated Patent Litigation System*, 131 J. ECON. BEHAV. & ORG. 218, 219 (2016).

58. For example, on a per capita basis, a patentee would have to obtain and enforce patent rights in at least five European countries to match the jurisdictional reach of one patent suit in the United States. See, e.g., *Population, Total*, WORLD BANK, <https://data.worldbank.org/indicator/SP.POP.TOTL> (last visited May 22, 2018) (showing that the U.S. population is roughly 323 million, approximately equal to that of France, Germany, Italy, Spain, and the United Kingdom combined).

59. Compared to the United States, which has seen more than 4000 patent suits filed each year since 2012, *Cases Filed by Year*, LEX MACHINA, <https://law.lexmachina.com/> (last visited Mar. 7, 2018), other nations see relatively few suits, see Brian J. Love et al., *Patent Assertion Entities in Europe*, in PATENT ASSERTION ENTITIES AND COMPETITION POLICY 104, 107 (D. Daniel Sokol ed., 2017) (reporting that there were less than 100 patent suits filed in the United Kingdom in twelve out of fourteen years during the period 2000–2013, and that there were less than 600 patent suits filed in Germany in eight out of nine years during the period 2000–2008).

60. In addition to existing databases like Public Patent Application Information Retrieval (“PAIR”), *Patent Application Information Retrieval*, U.S. PAT. & TRADEMARK OFF., <http://portal.uspto.gov/pair/PublicPair> (last visited May 22, 2018), the USPTO recently released multiple relational databases of U.S. patent-related data for free, bulk download by the public. See PATENTS VIEW, <http://www.patentsview.org> (last visited May 22, 2018); *Patent Examination Research Dataset (Public PAIR)*, U.S. PAT. & TRADEMARK OFF., [<https://scholarship.law.missouri.edu/mlr/vol83/iss2/7>](https://www.uspto.gov/learning-and-resources/electronic-</a></p>
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diligence on U.S. patent assets. For some types of foreign assets, it can even be difficult to determine whether a particular patent has expired or was abandoned, let alone to obtain and scrutinize its prosecution history. Thus, for the sake of efficiency (if not out of necessity) potential buyers often assess packages by focusing on the U.S. patent assets first and only reviewing the international counterparts later. Accordingly, buyers typically view the U.S. patents in a package as the primary source of value, as well as a proxy for the value of any related foreign assets in the package.

Looking across the period of our study, we see a general increase in the number of packages offered each year. Though the increase in our raw data is partly an artifact of our collection methodology, we see a roughly fifty percent increase even after correcting for improvement over time in our market coverage. That said, package sizes have remained relatively stable and, if anything, have generally trended downward in recent years. In short, from a high-level perspective what we see is a trend toward more, but smaller, packages.

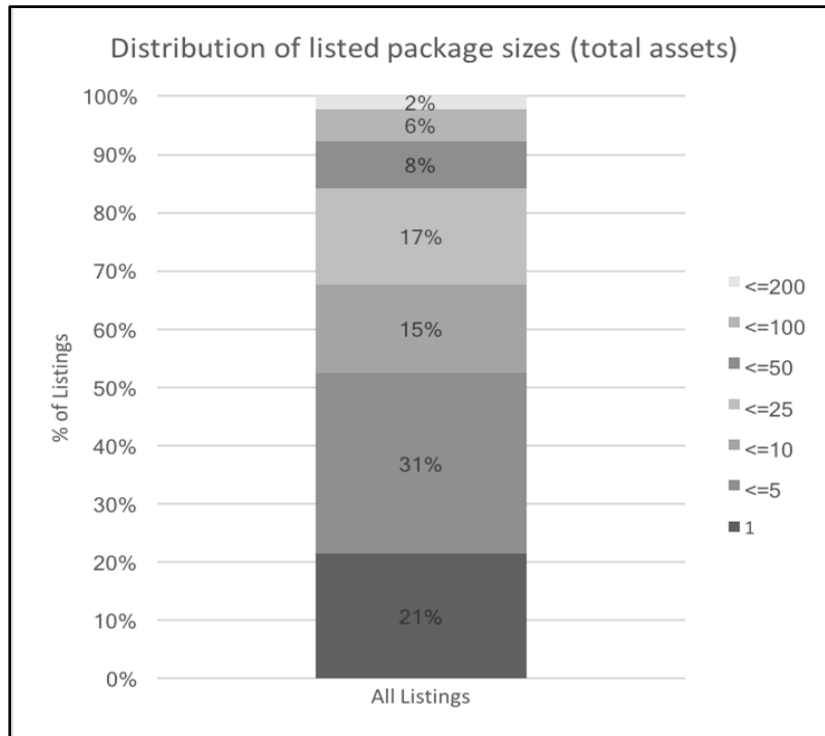
Looking closer at statistics on package size, we also see that each year's mean exceeds its median. As that suggests, we observed a small number of particularly large packages in each year that we studied. However, as shown below in Figure 2, most packages offered on the brokered market were quite small. More than two thirds of the packages listed during the period of our study contained ten or fewer total assets, and about half included five or fewer assets.<sup>61</sup> Though sales of large portfolios receive the most public attention, brokers rarely attempt to sell packages that exceed two dozen assets in size.

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data-products/patent-examination-research-dataset-public-pair (last visited May 22, 2018); *Patent Assignment Search*, U.S. PAT. & TRADEMARK OFF., <https://assignment.uspto.gov/patent/index.html#/patent/search> (last visited May 22, 2018).

61. The distribution of package sizes that we observed was also quite consistent across the period of our study.



**Figure 2: Distribution of Brokered Packages by Number of Assets**

Of the 2605 total packages that we observed during the period of our study, approximately seventy-seven percent were presented with an (at least approximate) asking price. As shown below in Table 2, the use of pricing guidance has dropped in recent years. However, we do not believe that this reflects a change in seller behavior but rather is an artifact of the increased importance of IAM Market, which does not require sellers to post pricing information. Excluding packages collected from IAM, we collected pricing data for approximately eighty-four percent of packages.

We do, however, observe a steep drop in asking prices, particularly when prices are viewed relative to the number of U.S. assets they contain. On one hand, the drop in prices likely reflects to some extent the general increase in supply of packages that we observed above. On the other, the thirty percent drop in median per-U.S.-asset asking prices that we observed seems unlikely to be purely endogenous. One possible explanation is that the decline in prices reflects recent substantive and procedural changes to U.S. patent law, especially the introduction of new administrative procedures for challenging issued patents<sup>62</sup> and the Supreme Court's tightening of the scope of patentable subject

62. The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified in various sections of Title 35) ("AIA"), established new procedures

matter.<sup>63</sup> Then again, we also find that the market grew in 2016, exceeding both 2014 and 2015 pricing levels. This observation is arguably more difficult to explain but may likewise reflect the dissipation of initial uncertainty about the long-term impact of the very same changes to the law that caused prices to dip in the two years prior. We investigate both hypotheses below when we examine the market for software and business method patents.<sup>64</sup>

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for challenging the validity of issued patents in administrative “trials” before the PTO’s PTAB. Since these procedures went into effect in September 2012, more than 8000 petitions for PTAB review have been filed. See *PTAB Overview*, UNIFIED PATENTS, <https://portal.unifiedpatents.com> (last visited May 22, 2018). For a comparison of the efficacy of post-grant review procedures before and after the AIA, see Brian J. Love & Shawn Ambwani, *Inter Partes Review: An Early Look at the Numbers*, 81 U. CHI. L. REV. DIALOGUE 93, 105 (2014) (concluding that, compared to their predecessors, post grant proceedings established by the AIA “result in the elimination of every challenged claim about twice as often, reach a final decision almost twice as quickly, and make accused infringers almost twice as likely to win motions to stay co-pending litigation”).

63. For a brief summary of the evolution of case law defining the bounds of patentable subject matter in the United States, see U.S. PATENT & TRADEMARK OFFICE, PATENT ELIGIBLE SUBJECT MATTER: REPORT ON VIEWS AND RECOMMENDATIONS FROM THE PUBLIC 1 (July 2017), [https://www.uspto.gov/sites/default/files/documents/101-Report\\_FINAL.pdf](https://www.uspto.gov/sites/default/files/documents/101-Report_FINAL.pdf) (“Between 2010 and 2014, the United States Supreme Court issued four decisions (*Bilski*, *Mayo*, *Myriad*, and *Alice*) that shifted the dividing line between eligible and ineligible subject matter.”).

64. See *infra* Part IV.C.

**Table 2: Asking Prices**

Year	Num. Packages Observed	Num. (%) with Price Guidance <sup>65</sup>	Avg. <sup>66</sup> (Median) Asking Price \$K/Asset	Avg. (Median) Asking Price \$K/U.S. Asset
2012	199	155 (77.9%)	\$283 (\$200)	\$471 (\$325)
2013	377	331 (87.8%)	\$275 (\$185)	\$382 (\$313)
2014	657	564 (85.8%)	\$196 (\$148)	\$275 (\$200)
2015	709	499 (70.4%)	\$174 (\$121)	\$256 (\$167)
2016	663	446 (67.3%)	\$193 (\$150)	\$267 (\$231)
<b>Total</b>	2,605	1,995 (76.6%)	\$210 (\$150)	\$302 (\$231)

Based on our analysis of PTO assignment records, we estimate that close to one quarter of the packages that we observed changed hands before the end of 2016.<sup>67</sup> As shown below in Table 3, about thirty to forty percent of packages listed between 2012 and 2014 ultimately sold during the period of our study. Though the figures reported for packages listed in 2015 and 2016 are considerably lower, this drop is explained in large part by the fact that packages often sell many months after they are initially listed. As shown in Figure 3, roughly thirty percent of sales that we observed took place more than one year after listing and about ten percent were completed more than two years later. That said, sales rates do seem to have fallen over time. We project that about twenty-one percent of packages listed in 2015 and twenty-two percent of 2016 packages will ultimately sell.

Though we are generally unable to observe sales prices, we are nonetheless able to roughly estimate them, at least in the aggregate. To approximate the correlation between asking and sales prices, we obtained actual pricing data

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65. As mentioned *supra*, the drop in pricing guidance shown in this column is largely the result of the rise in popularity of IAM Market. Excluding packages listed on IAM Market, we received pricing information for about eighty-four percent of all packages listed in 2015 and 2016.

66. Here and throughout (unless stated otherwise), the “averages” that we report are “five percent trimmed means” that omit the highest and lowest five percent of prices. This methodology produces more meaningful information because our pricing data includes several extreme outliers. *See, e.g.*, THE OXFORD HANDBOOK OF QUANTITATIVE METHODS: FOUNDATIONS 395–96 (Todd D. Little ed., 2013) (defining “trimmed mean” and explaining that “[o]ne major advantage of the trimmed mean . . . is that it is more resistant to outliers. . . [and thus] can make it easier to detect genuine differences among groups”).

67. As discussed *supra*, there are a number of reasons to believe that our sales statistics understate the actual sales rate to some extent. *See supra* notes 51–52.

for what we believe to be a reasonably representative sample of 120 deals completed by six companies.<sup>68</sup> In that sample, we observed that, on average, packages actually sold for about sixty-five percent of their asking price. The data presented in Table 3 below extrapolates this estimate to all packages that we identified as sold.<sup>69</sup>

Much like the asking prices discussed above, we estimate that per-asset sales prices fell during the period of our study with a steady decline each year through 2015 followed by a substantial increase in 2016. Overall, we find a roughly thirty-five percent decline in estimated per-asset prices paid for packages that were listed in 2016 compared to those that were listed in 2012. However, we also estimate that sales prices fell a much more modest five to ten percent when compared relative to the number of U.S. patent assets they contain.

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68. Again, we obtained this data under NDA and unfortunately cannot share the raw sales data nor disclose the names of the companies that assisted us in performing this pricing analysis. The entities that shared pricing data with us are a mixture of large operating companies and defensive aggregators, and the specific transactions that we analyzed overwhelmingly involved patents covering software and/or hardware related to information and communication technologies. As discussed *infra* in Parts IV.B and IV.C, operating companies and aggregators collectively account for about sixty percent of all brokered purchases, and almost ninety percent of all packages offered on the brokered market cover software, hardware, or communications technologies.

69. In other words, in the sales data reported in Table 3, we assume that packages sold (on average) for sixty-five percent of their asking price. To be clear, this estimate is unlikely to be accurate for any individual package. However, on average over a large group of packages, we believe it is reasonably accurate. See *infra* Table 3.

**Table 3: Sales Rates and Estimated Prices**

Year	Num. Packages Observed	Num. (%) Packages Sold <sup>70</sup>	Avg. (Median) Est. Sales Price <sup>71</sup> \$K/Asset Sold	Avg. (Median) Est. Sales Price \$K/U.S. Asset Sold
2012	199	74 (37.2%)	\$205 (\$163)	\$244 (\$211)
2013	377	128 (33.9%)	\$173 (\$147)	\$239 (\$204)
2014	657	179 (27.2%)	\$125 (\$81)	\$192 (\$163)
2015	709	119 (16.8%)	\$114 (\$81)	\$170 (\$130)
2016	663	37 (5.6%)	\$135 (\$106)	\$215 (\$203)
<b>Total</b>	2,605	537 (20.6%)	\$146 (\$108)	\$208 (\$163)

**Figure 3: Time to Sale**

To learn more about which package characteristics impact sales, we additionally investigated the effect of package size and EOU documentation. Ta-

70. The sales figures in this column reflect only those sales recorded by December 31, 2016. As discussed *supra*, many sales are recorded more than one year after the sold package was first listed; thus, our sales data for 2015 and 2016 likely underreport the eventual number of sales by about four and sixteen percentage points, respectively.

71. As discussed *supra*, these statistics were calculated by discounting the asking price of sold packages by thirty-five percent.

ble 4 presents our sales data broken down by package size. We see little correlation between package size and likelihood of sale. Overall, the size distribution of sold packages closely matches the size distribution of listed packages, which suggests to us that buyers have no clear preference for packages of a particular size.

On the other hand, we do observe a strong negative correlation between package size and average price paid per asset. While this decline in marginal prices likely reflects a volume discount to some extent, we believe that it also results from the fact that many sales are driven by interest in just a small number of included assets.

**Table 4: Effect of Package Size**

Package Size	2012	2013	2014	2015	2016	2012 -16
<b>1 Asset</b>						
% of Listed						
% of Sold <sup>72</sup>	18%	28%	17%	23%	22%	22%
Avg. Est. Sales Price	21%	21%	12%	11%	13%	15%
\$K/Asset	\$331	\$345	\$257	\$277	\$286	\$308
<b>2-5 Assets</b>						
% of Listed						
% of Sold	33%	31%	34%	32%	25%	31%
Avg. Est. Sales Price	31%	30%	27%	21%	25%	27%
\$K/Asset	\$238	\$196	\$195	\$160	\$177	\$195
<b>6-10 Assets</b>						
% of Listed						
% of Sold	17%	14%	15%	14%	17%	15%
Avg. Est. Sales Price	19%	15%	18%	20%	10%	17%
\$K/Asset	\$323	\$106	\$134	\$89	\$122	\$148

72. Hereinafter, all annual sales figures reflect sales (recorded before December 31, 2016) of patents that were *listed for sale* in the indicated year, not all sales *that took place* during the indicated year (regardless of when the purchased patent was listed). Thus, for example, the data in the first three rows of the adjacent column is meant to communicate: (i) that eighteen percent of all packages listed in 2012 included a single asset, (ii) that twenty-one percent of all packages listed in 2012 that sold before December 31, 2016, included a single asset, and (iii) that the average price paid for single-asset packages listed in 2012 (but sold any time before December 31, 2016) was about \$331,000.

Package Size	2012	2013	2014	2015	2016	2012 -16
<b>11-25 Assets</b>						
% of Listed	15%	12%	18%	17%	18%	17%
% of Sold	16%	12%	23%	30%	23%	21%
Avg. Est. Sales Price	\$124	\$80	\$77	\$86	\$32	\$83
\$K/Asset						
<b>26-50 Assets</b>						
% of Listed	8%	7%	7%	9%	8%	8%
% of Sold	6%	9%	9%	12%	14%	10%
Avg. Est. Sales Price	\$24	\$96	\$53	\$64	\$100	\$68
\$K/Asset						
<b>51-100 Asset</b>						
% of Listed	4%	5%	6%	4%	7%	6%
% of Sold	4%	11%	6%	5%	10%	7%
Avg. Est. Sales Price	\$10	\$70	\$49	\$35	\$38	\$49
\$K/Asset						
<b>101-200 Assets</b>						
% of Listed	6%	3%	2%	1%	2%	2%
% of Sold	3%	3%	5%	2%	4%	4%
Avg. Est. Sales Price	\$7	\$51	\$61	\$16	-	\$47
\$K/Asset						

As shown below in Table 5, about thirty-seven percent of the packages that we observed were circulated along with EOUs. This practice is yet another reason to believe that the sale of many packages is driven by interest in just a fraction of the included assets. An EOU is intended to convince potential buyers that the technology covered by at least one asset in the package is incorporated in a popular product, and the EOUs that we observed virtually always focused on one asset (or one family of assets), even when the offered package itself was quite large.

Moreover, our data suggests that EOUs are important to buyers. Packages listed with EOUs were disproportionately likely to sell and, in addition, appear to have sold at a premium. Overall, we estimate that packages with EOUs commanded per-asset prices that were about fourteen percent higher than those paid for packages without some evidence of use.

**Table 5: Effect of EOUs**

	2012	2013	2014	2015	2016	2012 -16
<b>Packages with EOU</b>						
% of Listed	30%	46%	32%	37%	39%	37%
% of Sold <sup>73</sup>	38%	56%	49%	57%	51%	51%
Avg. Est. Sales Price \$/Asset	\$246	\$170	\$141	\$120	\$156	\$155
<b>Packages without EOU</b>						
% of Listed	70%	54%	68%	63%	60%	63%
% of Sold	62%	44%	51%	43%	49%	49%
Avg. Est. Sales Price \$/Asset	\$175	\$179	\$109	\$100	\$102	\$134

Table 6 lists the companies most often mentioned in the EOUs that we observed. Perhaps not surprisingly, they are among the largest and highest grossing technology companies in the world. They are also among those sued most often for patent infringement. On the whole, we see little evidence that EOUs are meant to convey that implementing patented technologies would be valuable for buyers. Rather, it is our experience that EOUs are intended to demonstrate that assets in the package could be asserted in a lucrative lawsuit or licensing negotiation. This also tends to support our conclusion that sales are typically driven by just a fraction of included assets because, as a practical matter, a patentee generally cannot assert more than a handful of patents in any one lawsuit.<sup>74</sup>

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73. See *supra* note 72.

74. See Jonathan H. Ashtor et al., *Patents at Issue: The Data Behind the Patent Troll Debate*, 21 GEO. MASON L. REV. 957, 958 (2014) (finding that patentees asserted two to four patents per lawsuit on average between 1995 and 2011).



**Table 6: Most Mentioned Companies in EOUs**

Company (No. Mentions)	2016 (Fiscal) Annual Revenue (\$B)	No. U.S. Patent Cases in Which Named as Def. (2012-16) <sup>75</sup>
1. Google (171)	\$90.3 <sup>76</sup>	142
2. Apple (164)	\$215.8	268
3. Microsoft (132)	\$92.1	151
4. Samsung (116)	\$175.5 <sup>77</sup>	271
5. Cisco (74)	\$49.2	71
6. Facebook (57)	\$27.6	65
7. Amazon (51)	\$136.0	51
8. Oracle (46)	\$37.0	35

Finally, we estimate the size of the annual brokered market. Correcting for gaps in our data's coverage, we estimate that the brokered market for patent sales exceeded \$225 million per year. As with both asking and sales prices, our estimates suggest that the overall market dropped in recent years before rebounding in 2016. Though it is difficult, if not impossible, to estimate the total amount patentees collect each year in licensing revenue and lawsuit settlements, we think it is fair to say that these annual totals fall below three per-

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75. We collected this data by searching Lex Machina for all patent cases in which each company (or one of its subsidiaries) was named as a defendant. See *Cases Filed by Year*, *supra* note 59.

76. Revenue for Google's parent Alphabet, Inc. *Annual Revenue of Alphabet from 2011 to 2017 (in Million U.S. dollars)*, STATISTA, <https://www.statista.com/statistics/507742/alphabet-annual-global-revenue/> (last visited May 22, 2018).

77. 201.9 trillion KRW. For conversion of currency rates, see *XE Currency Converter: USD to KRW*, XE, <http://www.xe.com/currencyconverter/convert/?Amount=1&From=USD&To=KRW> (last visited May 22, 2018).

cent of annual revenue derived from U.S. patent litigation (including both settlements and damages awards)<sup>78</sup> and, moreover, constitute less than one percent of all revenue earned annually worldwide from patent licenses and sales.<sup>79</sup>

**Table 7: Estimated Annual Brokered Market Size (\$ Million)**

<b>2012</b>	_80
<b>2013</b>	-
<b>2014</b>	\$251
<b>2015</b>	\$229
<b>2016</b>	\$263

### *B. Buyers and Sellers*

Next, we look at the types of entities that participate in the brokered market. We compare the sales and purchasing activities of various kinds of market participants and also examine more closely the behavior of privately owned operating companies, PAEs, and universities.

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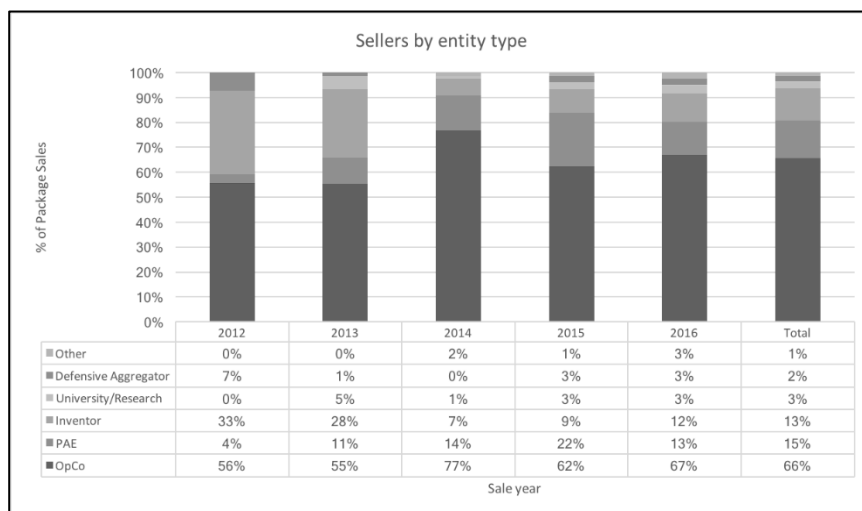
78. A survey conducted by RPX in 2012 placed the average settlement amount for U.S. patent suits filed by NPEs at \$1.33 million per case for small companies and \$7.27 million for large companies. See James Bessen & Michael J. Meurer, *The Direct Costs from NPE Disputes*, 99 CORNELL L. REV. 387, 400 (2014). Moreover, there were an average of 5409 U.S. patent cases filed each year between 2012 and 2016. See *Cases Filed by Year*, *supra* note 59. Further, according to Lex Machina, district courts awarded a total of about \$15 billion in patent damages awards between 2000 and 2013, OWEN BYRD ET AL., LEX MACHINA PATENT LITIGATION DAMAGES REPORT 1 (2014) (on file with authors) (reporting that during the period 2000–2013 U.S. courts awarded a total of \$15.4 billion in damages, fees, and costs in patent suits), though many of these awards were subsequently overturned or reduced on appeal. Roughly speaking, these figures safely place the annual revenue that patentees earned from U.S. patent litigation above \$8 billion.

79. As cited above, existing estimates of the average total revenue earned from patent transactions range from about \$35 billion to \$100 billion. See *supra* note 3.

80. Because sales often take place well after a package is listed, a large portion of sales that took place in 2012 and 2013 likely involved packages that were listed in 2010 and 2011, before we began collecting data. Thus, we lack sufficient evidence to estimate the size of the entire market in 2012 and 2013.

First, as shown below in Figure 4, we find that the majority of packages sold were listed by product-producing technology companies. In each year that we studied, operating companies were responsible for the majority of listed packages and, overall, operating companies listed about two thirds of all sold packages that we observed.

**Figure 4: Distribution of Sellers by Entity Type<sup>81</sup>**



Looking at other types of sellers, we observe two noteworthy trends. First, the percentage of packages sold by individual inventors dropped considerably – by more than fifty percent – during the period of our study. At the same time, the percentage of packages sold by PAEs increased by a factor of four. Though our data cannot say for sure, we do not believe that these trends are (directly) related.<sup>82</sup> We suspect that the decline in individual sellers reflects the general decline in prices discussed above. Because individuals typically offer especially small packages and enter the market on a one-time basis, they are likely more sensitive to declining prices than repeat sellers with higher volumes. We believe that the increase in sales by PAEs may result from decreasing returns to patent assertion following, for example, the introduction of new post-grant patent proceedings in late 2012<sup>83</sup> and the Supreme Court’s 2014

81. The “Other” category includes law firms, trusts, religious organizations, and packages for which we were unable to determine the owner.

82. For example, we do not believe that PAEs are increasingly re-selling patents privately sourced from individuals.

83. To date, almost 3600 PTAB petitions have been filed challenging NPE-owned patents, representing about forty-five percent of all PTAB petitions. *PTAB Search*, UNIFIED PATENTS, [https://portal.unifiedpatents.com/ptab/analytics/case-level/by-status-and-phase?up\\_entity=NPE+%28Patent+Assertion+Entity%29&up\\_entity=NPE+%28Small+Company%29&up\\_entity=NPE+%28Individual%29](https://portal.unifiedpatents.com/ptab/analytics/case-level/by-status-and-phase?up_entity=NPE+%28Patent+Assertion+Entity%29&up_entity=NPE+%28Small+Company%29&up_entity=NPE+%28Individual%29) (last visited May 22, 2018). Moreover,

opinion in *Alice v. CLS Bank*.<sup>84</sup> PAEs that purchased patents in years past may now be looking to unload assets that, in today's litigation environment, are insufficiently profitable.

We also observe that different types of sellers tend to list different types of packages. Not surprisingly, we see that individuals sell the smallest packages, while operating technology companies sell the largest. We also see variation in pricing across different types of sellers. Patents sold by individuals and PAEs sell at disproportionately high prices, which may support our suspicions about the reasons for their respective decline and rise in the market. Individuals with all but the most promising packages may be deterred by the cost of entering the market, while PAEs may be looking to re-sell patents that, while relatively less valuable today, were nonetheless carefully vetted for high value in years past and retain much of that value.<sup>85</sup> Interestingly, packages offered by universities sold for the lowest prices of any group. While this may reflect the fact that universities are non-profit institutions that (ideally) engage in technology transfer with more than sheer profitability in mind, it may also reflect

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NPE-owned patents have been both instituted and (at least partially) cancelled by the PTAB at higher rates than patents owned by operating tech companies. *See id.*

84. *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S. Ct. 2347 (2014). The Court's decision in *Alice* substantially (and retroactively) narrowed the scope of patentability for software-implemented algorithms, an outcome that left many existing software-related patents vulnerable to attack. *See* Robert R. Sachs, *AliceStorm Update for Q1 2017*, BILSKIBLOG (Apr. 6, 2017), <http://www.bilskiblog.com/blog/2017/04/alicestorm-update-for-q1-2017.html> (reporting that, post-*Alice*, sixty-seven percent of patentable subject matter decisions issued by U.S. courts – 317 out of 473 total decisions through March 2017 – at least partially invalidated the patent(s)-at-issue). This development disproportionately impacts PAEs because PAEs assert software patents more often than other patentees. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-13-465, INTELLECTUAL PROPERTY: ASSESSING FACTORS THAT AFFECT PATENT INFRINGEMENT LITIGATION COULD HELP IMPROVE PATENT QUALITY 22 (Aug. 2013), <http://1.usa.gov/1gatCRr> ("Specifically, about 84 percent of [PAE] lawsuits from 2007 to 2011 involved software-related patents, while about 35 percent of operating company lawsuits did . . . . By defendant, software-related patents were used to sue 93 percent of the defendants in [PAE] suits and 46 percent of the defendants in operating company suits . . . .").

85. At least one study found that patents acquired by PAEs were of higher quality, at least as measured by forward citations, than patents acquired by other purchasers. *See* Timo Fischer & Joachim Henkel, *Patent Trolls on Markets for Technology – An Empirical Analysis of NPEs' Patent Acquisitions*, 41 RES. POL'Y 1519, 1526 (2012) ("NPEs acquire patents that, on average, lie in denser technology fields, received more forward citations, have more claims, are older, and lie in more crowded technology fields than patents acquired by practicing firms.").

that university patents are of relatively low quality<sup>86</sup> or that universities are less effective than other entities at managing their patent portfolios.<sup>87</sup>

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86. Some studies have linked increased patenting by universities with a decrease in overall university patent quality. See Rebecca Henderson et al., *Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting, 1965–1988*, 80 REV. ECON. & STAT. 119 (1998) (finding that university patent quality, as measured by citation analysis, declined dramatically following enactment of the Bayh-Dole Act); Christos Kolympiris & Peter G. Klein, *The Effects of Academic Incubators on University Innovation*, 11 STRATEGIC ENTREPRENEURSHIP J. 145 (2017) (finding that the quality of university patents is negatively correlated with the establishment of a university-affiliated startup incubator). However, other studies have called these findings into question. See Bhaven N. Sampat et al., *Changes in University Patent Quality After the Bayh-Dole Act: A Re-Examination*, 21 INT’L J. INDUS. ORG. 1371, 1388 (2003) (explaining that Henderson et al.’s findings may reflect “truncation bias” due to their citation data covering an insufficiently long period of time).

87. For example, multiple studies have found that universities tend to lose money on their patent holdings, see Brian J. Love, *Do University Patents Pay Off? Evidence from a Survey of University Inventors in Computer Science and Electrical Engineering*, 16 YALE J.L. & TECH. 285, 313 (2014) (estimating based on a survey of university professors of electrical engineering and computer science at highly ranked U.S. universities that these universities collectively lost money pursuing “high tech” patents); WALTER D. VALDIVIA, UNIVERSITY START-UPS: CRITICAL FOR IMPROVING TECHNOLOGY TRANSFER 9 (Nov. 2013), [https://www.brookings.edu/wp-content/uploads/2016/06/Valdivia\\_Tech-Transfer\\_v29\\_No-Embargo.pdf](https://www.brookings.edu/wp-content/uploads/2016/06/Valdivia_Tech-Transfer_v29_No-Embargo.pdf) (estimating that 130 of 155 surveyed universities lost money on their patent programs in 2012).

**Table 8: Sales Data by Seller Entity Type**

	<b>Individ. Inven- tor</b>	<b>PAE</b>	<b>Uni- ver- sity</b>	<b>Def. Ag- gre- gator</b>	<b>Oper- ating Co.</b>	<b>Total</b>
<b>Num. (% of Total) Packages Sold</b>	71 (13%)	80 (15%)	14 (3%)	11 (2%)	353 (66%)	537 (100%)
<b>Avg. (Me- dian) Total Assets/Pack- age</b>	6.2 (2)	10.3 (5)	12.7 (9)	4.8 (3)	25.3 (11)	15.0 (5)
<b>Avg. (Me- dian) U.S. As- sets/Package</b>	3.0 (2)	6.4 (5)	11.1 (9)	2.6 (3)	17.7 (11)	9.2 (3)
<b>Avg. (Me- dian) Est. Sales Price \$/Asset</b>	\$196 (\$163)	\$158 (\$130)	\$111 (\$94)	\$122 (\$106)	\$134 (\$93)	\$135 (\$98)
<b>Avg. (Me- dian) Est. Sales Price \$/U.S. Asset</b>	\$244 (\$211)	\$236 (\$184)	\$128 (\$96)	\$149 (\$98)	\$197 (\$163)	\$195 (\$150)

While sellers come in many shapes and sizes, buyers are a more uniform group. As with listed packages, the majority of purchased packages are acquired by product-producing technology companies. As shown below in Figure 5, operating companies (acting in their own capacity) make up the largest subset of buyers. Collectively, they buy about forty percent of packages that sell. Defensive aggregators purchase an additional twenty percent of brokered patents on behalf of their operating company members. Virtually all of the remaining packages – about forty percent of those that are sold – are purchased by PAEs.

**Figure 5: Buyers by Entity Type**<sup>88</sup>

While we saw a good deal of variation in price and package size among sellers, we see far less variation among types of buyers. PAEs and defensive aggregators, in particular, paid similar per-asset prices for packages of similar sizes. On average, the two groups of buyers have virtually identical statistics. By comparison, operating companies bought somewhat larger packages for somewhat lower per-asset prices.

Turning to litigation data, we see that purchased patents are frequently litigated when purchased by PAEs but very rarely litigated when acquired by operating companies. One third of patent packages purchased by PAEs included at least one U.S. patent that was asserted<sup>89</sup> after the sale's completion. By contrast, only about three percent of packages purchased by operating companies and defensive aggregators<sup>90</sup> included a later-asserted patent. Overall,

88. The "other" category includes five individuals, two universities, one law firm, and nine buyers that we were unable to identify.

89. In the charts that follow we report statistics for packages including at least one asset that was either enforced in a patent infringement case filed in a U.S. court or challenged in a petition filed with the PTAB. We include patents that were challenged in a PTAB petition, but not litigated in federal court, in our statistics because it is our experience that such challenges often follow a threat of assertion made out of court. That said, this decision does not have a significant impact on our results. Only four packages (out of the seventy-eight total litigated or challenged) included an asset that had been challenged before PTAB but not an asset that was asserted in court.

90. We observed that a total of two packages purchased by defensive aggregators were later litigated in U.S. court. However, these packages were not in fact litigated

PAEs purchased eighty-three percent of packages that were asserted at least once in U.S. court post-sale. Moreover, PAEs filed suit more quickly, waiting on average only about five months before filing suit. Patents purchased by operating companies and defensive aggregators were asserted much later, on average well over a year after purchase.

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by the aggregators themselves. Rather, these packages were purchased, licensed to the aggregators' members, and then re-sold to PAEs that asserted them later.



**Table 9: Sales and Assertion Data by Buyer Entity Type**

	PAE	Def. Aggregator	Operating Co.	Other <sup>91</sup>	Total
<b>Num. (% of Total) Packages Purchased</b>	198 (37%)	98 (18%)	225 (42%)	16 (3%)	537 (100%)
<b>Avg. (Median) Total Assets/Package</b>	17.2 (7.0)	16.3 (6.0)	23.7 (10.0)	-	15.0 (5.0)
<b>Avg. (Median) U.S. Assets/Package</b>	12.6 (7.0)	13.0 (6.0)	14.9 (10.0)	-	9.2 (3.0)
<b>Avg. (Median) Est. Sales Price/Asset Purchased</b>	\$158 (\$110)	\$161 (\$120)	\$128 (\$90)	-	\$135 (\$98)
<b>Avg. (Median) Est. Sales Price/U.S. Asset Purchased</b>	\$215 (\$163)	\$235 (\$204)	\$187 (\$163)	-	\$195 (\$150)
<b>Num. Packages Litigated or Challenged Post-Purchase</b>	65	2 <sup>92</sup>	9	2	78
<b>% of Total Num. Packages Litigated or Challenged</b>	83%	3%	12%	3%	100%
<b>% of Num. Packages Purchased by Entity Type</b>	33%	2%	4%	12.5%	14.5%
<b>Avg. (Median) Num. Days from Sale to First Suit or Challenge</b>	153.2 (100.0)	388.5 (388.5)	443.7 (359.0)	-	186.9 (106.0)

91. As in Figure 5, *supra*, the “other” category includes individuals, universities, a law firm, and a few buyers that we were unable to identify. Because these groups are individually very small, and collectively very heterogeneous, we have omitted their statistics from Table 9.

92. *See supra* note 90. Both packages were actually enforced by PAEs to which the patents were subsequently re-sold.

	PAE	Def. Ag- gregator	Operat- ing Co.	Other	Total
<b>Num. (% of Total) Suits and Challenges Filed Post-Purchase</b>	934 (84.5%)	110 (10.0%)	39 (3.5%)	22 (2.0%)	1105 (100%)

To learn more about parties' motivations for buying and selling, we also took a closer look at various subsets of buyers and sellers, including those that are most active in the market, operating companies that have not yet gone public, PAEs, and universities. Table 10 below shows the top ten most frequent buyers and sellers in the brokered market. The two groups make for an interesting comparison. The top sellers are, by and large, established incumbents. AT&T, IBM, Xerox, and Alcatel Lucent have each been in business for well over a century, and Panasonic isn't too far behind.<sup>93</sup> Though responsible for some of the most important innovations of the twentieth century,<sup>94</sup> these firms have since largely moved away from manufacturing and today make a good deal of their revenue from selling patent rights instead of products.<sup>95</sup>

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93. AT&T's predecessors date back to 1875. *A Brief History: Origins*, AT&T, <https://www.corp.att.com/history/history1.html> (last visited May 22, 2018). IBM was founded in 1911. *IBM Is Founded*, IBM, <http://www-03.ibm.com/ibm/history/ibm100/us/en/icons/founded/> (last visited May 22, 2018). Xerox's predecessor was founded in 1906. *Always Moving. Making History for More Than 100 Years*, XEROX, <https://www.xerox.com/about-xerox/history-timeline/1950-decade/enus.html> (last visited May 22, 2018). And both Alcatel and Lucent have predecessors that date back to the nineteenth century. *Alcatel-Lucent History*, NOKIA, [https://www.nokia.com/en\\_int/about-us/who-we-are/our-history](https://www.nokia.com/en_int/about-us/who-we-are/our-history) (last visited May 22, 2018).

94. For example, scientists and engineers working at Bell Labs, which was established by AT&T and later spun off to Lucent, played a central role in the invention of many revolutionary technologies, including the transistor and laser. See, e.g., JOHN GERTNER, *THE IDEA FACTORY: BELL LABS AND THE GREAT AGE OF AMERICAN INNOVATION* 255 (2012). Xerox's Palo Alto Research Center ("PARC") also played a crucial role in the development of many personal computing technologies, including laser printing, the graphical user interface, and the mouse. See, e.g., MICHAEL HILTZIK, *DEALERS OF LIGHTNING: XEROX PARC AND THE DAWN OF THE COMPUTER AGE* (1999).

95. For example, IBM sold its personal computer division to Lenovo in 2005, as well as its x86 server division in 2014. Stephen Shankland, *IBM Sells Its x86 Server Business to Lenovo for \$2.3 Billion*, CNET (Jan. 23, 2014, 2:33 AM), <https://www.cnet.com/news/ibm-sells-its-x86-server-business-to-lenovo-for-2-3-billion/>. IBM's revenues also fell every year during the period of our study. *How IBM Makes Money? Understanding IBM Business Model*, REVENUE & PROFITS, <http://revenuesandprofits.com/how-ibm-makes-money/> (last visited May 22, 2018). Similarly, Xerox recently split into two separate companies after "annual revenue and net income decline[d] every year going back to at least 2011, dropping roughly \$2.5 billion in total revenues from 2011–2015." Todd Clausen, *Xerox Completes Split into 2 Companies*, USA TODAY (Jan. 3, 2017 1:00 PM), <http://www.usatoday.com/story/money/nation-now/2017/01/03/xerox-conduent-split-complete/96110370/>. Alcatel-Lucent merged with Nokia in 2016. Dominic Chopping, *Nokia, Alcatel-Lucent Set to Put Merger to*

The group of top buyers is a bit more diverse. It is made up of three defensive aggregators, three PAEs, and four frequent targets of patent assertion.<sup>96</sup> Though different in many respects, these buyers all share an acute interest in the litigation value of the patents they purchased: the PAEs for purposes of revenue generation and the others for risk mitigation. Compared to sellers, operating companies on this side of the ledger are much younger and much more heavily invested in producing goods and services (relative to licensing).

**Table 10: Top 10 Sellers and Buyers**

Rank <sup>97</sup>	Sellers	Rank	Buyers
1.	AT&T	1.	RPX Corp.
2.	PARC (Xerox)	2.	Intellectual Ventures
3.	Panasonic Corp.	3.	Allied Security Trust
4.	Verizon Communications, Inc.	4.	Google, Inc.
5.	Cypress Semi. Corp.	5.	Knapp Investment Co.
6.	Alcatel Lucent	5.	Rakuten, Inc.
6.	IBM	7.	Apple, Inc.
8.	Allied Security Trust	7.	LinkedIn Corp.
8.	Hewlett Packard Enter.	9.	Intellectual Discovery Co., Ltd.
8.	Huawei Tech. Co. Ltd.	9.	Open Innovation Network, LLC
8.	Intel Corp.		

To learn more about the market activity of larger and smaller companies, we compared the activities of public and private operating companies. As

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*Work*, WALL ST. J. (Jan. 4, 2016, 7:06 AM), <https://www.wsj.com/articles/nokia-alcatel-lucent-set-to-put-merger-to-work-1451896364>.

96. As shown in Table 6, Apple and Google were collectively sued more than 400 times for patent infringement during the period 2012 to 2016. RPX reports that, during the same period, Rakuten (or one of its subsidiaries) was sued for patent infringement fifty-five times and LinkedIn thirty-six times. RPX INSIGHT, <https://insight.rpx-corp.com/> (last visited Feb. 23, 2018). For a unique look into the defensive calculations behind LinkedIn's patent purchases during this period, see Sara Harrington, Pierre Keeley, Kent Richardson & Erik Oliver, *How and Why LinkedIn Learned to Love Patents*, INTELL. ASSET MGMT., Mar./Apr. 2017, at 26, 26 ("In 2012 LinkedIn found itself a potential target for corporate patent asserters. It had revenue reaching nearly \$1 billion, with growth of 86%, yet owned only 22 patents. However, this changed fundamentally from 2012 to mid-2016, when LinkedIn grew its organic portfolio from 36 to over 1,000 patent assets and purchased more than 900, dramatically reducing its risk profile.").

97. The rankings reported in this table are based on the total number of packages sold or purchased, respectively.

shown below in Table 11, both groups sold a similar number of packages during the period of our study and made a similar proportion of their sales to other types of market participants. However, public companies purchased about three times as many packages as privately-owned firms. On one hand, this data is consistent with the traditional narrative that patents help early stage companies transfer technology to larger firms that are better positioned to bring a product to market. Indeed, we see more than twice as many packages moving from private to public companies as we see moving in the opposite direction.<sup>98</sup> However, we otherwise see little evidence that the brokered market directly facilitates technology transfer.

Instead, we suspect that the differences we see in buying activity are largely explained by the relative likelihood that public and private firms will be sued for patent infringement. Private companies tend to be younger and smaller and, thus, generally make less attractive targets for patent suits. Consequently, they have less incentive to build a defensive portfolio or preemptively acquire patents that might otherwise wind up in the hands of a competitor or PAE. Additionally, it is our anecdotal experience that private companies selling patents are disproportionately likely to be doing so because they are in extreme financial straits, if not already in the process of winding down their operations. Companies in that situation, again, make poor targets for patent infringement suits.

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98. This finding stands somewhat in contrast to Chien's finding that transfers of software patents tend to go from older, larger, and higher-earning (public) companies to younger, newer, lower-earning (public) companies. See Chien, *supra* note 11, at 1707.

**Table 11: Private vs. Public Operating Companies**

	<b>Public Operating Companies</b>	<b>Private Operating Companies</b>
<b>Num. Packages Sold</b>	194	159
<b>Num. (%) Sold to Pub. Op. Cos.</b>	82 (42%)	42 (26%)
<b>Num. (%) Sold to Priv. Op. Cos.</b>	17 (9%)	21 (13%)
<b>Num. (%) Sold to Def. Aggregators</b>	27 (14%)	37 (23%)
<b>Num. (%) Sold to PAEs</b>	67 (35%)	53 (33%)
<b>Num. Packages Purchased</b>	169	56
<b>Num. (%) Purchased from Pub. Op. Cos.</b>	82 (49%)	17 (30%)
<b>Num. (%) Purchased from Priv. Op. Cos.</b>	42 (25%)	21 (38%)
<b>Num. (%) Purchased from Def. Aggregators</b>	6 (4%)	1 (2%)
<b>Num. (%) Purchased from PAEs</b>	18 (11%)	8 (14%)

Turning next to a closer examination of deals involving PAEs, we see that operating companies are not just the largest source overall of offered patents but also the largest source of assets purchased by PAEs. In addition, we observe that packages listed by publicly traded operating companies – the subset of patentees that should possess the most experience with patent assertion – are the source of about one third of packages that PAEs purchased on the brokered market during the period of our study. Privately held companies and individuals, the two groups that we would expect to benefit the most from PAEs' expertise in patent assertion,<sup>99</sup> sold fewer packages to PAEs, accounting for about twenty-seven and eighteen percent respectively of PAEs' purchases.

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99. One potential benefit of PAEs is that they serve as enforcement specialists. See Christopher A. Cotropia et al., *Unpacking Patent Assertion Entities (PAEs)*, 99 MINN. L. REV. 649, 653 (2014) (noting that “[d]efenders of PAEs have offered several purported benefits” including that “PAEs are claimed to be specialists in patent enforcement who are skilled in evaluating allegations of infringement and hiring and supervising law firms to keep costs down”); Axel Haus & Steffen Juranek, *Non-Practicing Entities: Enforcement Specialists?* (May 20, 2016) (working paper) (available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2424407](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2424407)) (providing a theoretical model and empirical support for this view of PAEs).

**Table 12: PAE Purchases**

<b>Num. Packages Purchased</b>	<b>198</b>
Num. (%) Purchased from Pub. Op. Cos.	67 (34%)
Num. (%) Purchased from Priv. Op. Cos.	53 (27%)
Num. (%) Purchased from Def. Aggregators	3 (2%)
Num. (%) Purchased from PAEs	27 (14%)
Num. (%) Purchased from Individuals	35 (18%)
Num. (%) Purchased from Universities	9 (5%)

Finally, we observe that a small but significant percentage of PAE patents were purchased from universities. As shown below in Table 13, sales to PAEs constitute the overwhelming majority of all packages sold by universities.<sup>100</sup> Based on the listing prices of packages transferred from universities to PAEs, we estimate that universities earned a total of about \$13 million from brokered sales of 115 assets to PAEs during the five years covered by our study. Interestingly, these sales took place despite a public stance among universities that “universities would better serve the public interest by . . . requiring their licensees to operate under a business model that encourages commercialization and does not rely primarily on threats of infringement litigation to generate revenue.”<sup>101</sup> These transactions, and the substantial monetary reward associated with them, may help explain why universities so strenuously opposed patent

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100. See Yarden Katz, *Universities Have Turned over Hundreds of Patents to Patent Trolls*, MEDIUM (Oct. 13, 2016), <https://medium.com/@yardenkatz/universities-have-turned-over-hundreds-of-patents-to-patent-trolls-99d5cdec1d8a#.315c8xj7c> (reporting that “nearly 500 of IV’s patents originally belonged to universities, including state schools”).

101. IN THE PUBLIC INTEREST: NINE POINTS TO CONSIDER IN LICENSING UNIVERSITY TECHNOLOGY 8 (Mar. 6, 2007), <http://news.stanford.edu/news/2007/march7/gifs/whitepaper.pdf>.

reform legislation in recent years.<sup>102</sup> They may also support ongoing efforts to encourage individual universities to pledge not to sell patents to PAEs.<sup>103</sup>

**Table 13: University Patent Sales**

	Packages	Assets
<b>Num. Sold</b>	14 <sup>104</sup>	178
<b>Num. (%) Sold to Pub. Op. Cos.</b>	2 (14%)	11 (6%)
<b>Num. (%) Sold to Priv. Op. Cos.</b>	0 (0%)	0 (0%)
<b>Num. (%) Sold to Def. Aggregators</b>	2 (14%)	37 (21%)
<b>Num. (%) Sold to PAEs</b>	9 (64%)	115 (65%)

### C. Technology

Finally, we examine how transactions differ across various technologies. Table 14 below presents our data broken down into four broad technology categories. We first observe that the vast majority of packages relate to computing and telecommunications. Together, patents covering software and hardware

102. See, e.g., Timothy B. Lee, *Patent Trolls Have a Surprising Ally: Universities*, WASH. POST: THE SWITCH (Nov. 30, 2013), <http://www.washingtonpost.com/blogs/the-switch/wp/2013/11/30/patent-trolls-have-a-surprising-ally-universities/> (noting that several university groups publicly expressed opposition to a patent reform bill “target[ing] patent trolls” that passed in the House in 2013).

103. See Elliot Harmon, *Tell Your University: Don’t Sell Patents to Trolls*, ELECTRIC FRONTIER FOUND. (Aug. 17, 2016), <https://www.eff.org/deeplinks/2016/08/tell-your-university-dont-sell-patents-trolls> (introducing a campaign to encourage universities to agree to a “Public Interest Patent Pledge” stating that they would “take appropriate steps to research the past practices of potential buyers or licensees and favor parties whose business practices are designed to benefit society through commercialization and invention” and “strive to ensure that any company we sell or license patents to does not have a history of litigation that resembles patent trolling”).

104. One additional package containing fifteen total assets was transferred back to its faculty inventor. During this time, universities also tried unsuccessfully to sell many more assets on an ad hoc basis. For example, in 2014 Penn State held an online patent auction that netted just one sale. See Goldie Blumenstyk, *Penn State’s Patent Auction Produces More Lessons Than Revenue*, CHRON. HIGHER EDUC. (May 1, 2014), <https://www.chronicle.com/blogs/bottomline/penn-states-patent-auction-produces-more-lessons-than-revenue/> (“[T]he university got just one bid on [a] single pair of patents out of 53 batches” and that bidder “offered the minimum bid, \$10,000.”).

for computers and mobile devices make up about eighty-eight percent of brokered listings and ninety-five percent of brokered sales.

This of course means that we saw very few packages related to pharmaceuticals, biotech, or medical devices. Though surprising at first glance, this finding actually meshes well with what we know about the biopharma industry, as well as with many of the observations described above. For one, while complex consumer electronics often incorporate tens of thousands of patented technologies,<sup>105</sup> medical treatments are typically protected by no more than a handful of patents.<sup>106</sup> Thus, we would expect there to be relatively few patents worth transacting in those fields. In addition, PAEs virtually never enforce patents on drugs, diagnostics, or other medical technologies,<sup>107</sup> and thus there is little risk for operating companies in this field to mitigate through proactive purchases. Though there is a great deal of technology transfer in these industries,<sup>108</sup> it does not appear to occur through the brokered market. In our experience, it happens instead primarily through mergers and acquisitions, in which entire startups (including their patent rights) are transferred to established firms.<sup>109</sup>

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105. RPX once estimated that approximately 250,000 patents cover some aspect of a smartphone. RPX Corp., Registration Statement (Form S-1) (Sept. 2, 2011) (available at <http://www.sec.gov/Archives/edgar/data/1509432/000119312511240287/ds1.htm>). Another study put the total (including design patents) at close to 315,000. JOEL R. REIDENBERG ET AL., PATENTS AND SMALL PARTICIPANTS IN THE SMARTPHONE INDUSTRY 6 (Jan. 15, 2015), [http://www.wipo.int/export/sites/www/ip-competition/en/studies/clip\\_smartphone\\_patent.pdf](http://www.wipo.int/export/sites/www/ip-competition/en/studies/clip_smartphone_patent.pdf).

106. See Lisa Larrimore Ouellette, *How Many Patents Does It Take to Make a Drug? Follow-On Pharmaceutical Patents and University Licensing*, 17 MICH. TELECOMM. & TECH. L. REV. 299, 316–17 (2010) (reporting that pharmaceuticals are typically protected by just two to four patents per drug).

107. See *2016 Annual Patent Dispute Report*, UNIFIED PATENTS (Jan. 1, 2017), <https://www.unifiedpatents.com/news/2016/12/28/2016-annual-patent-dispute-report> (reporting that just 39 of the 2630 total cases filed by PAEs in 2016 asserted patents covering “medical” technology, defined as “[t]echnologies relating to pharmaceuticals, medical devices, and any other health-related technologies”).

108. See Chien, *supra* note 11, at 1701–02 (finding that approximately one to two percent of biotech patents changed hands each year between 2012 and 2015); Serrano, *supra* note 11, at 693 (reporting that sixteen percent of patents covering “drugs and medical” technology were transferred during their term of protection, the highest rate observed among technology classifications).

109. See John M. Golden, *Biotechnology, Technology Policy, and Patentability: Natural Products and Invention in the American System*, 50 EMORY L.J. 101, 167 (2001) (“[T]he American biotechnology industry . . . operates according to a ‘mayfly’ or ‘small company’ model that explicitly seeks to unleash hundreds of small, lean (with regard to capital resources), and largely similar firms to engage, for the duration of their frequently short lives, in a voracious search for ways of converting bioscience into marketable technology.”); Jonathan M. Barnett, *Cultivating the Genetic Commons: Imperfect Patent Protection and the Network Model of Innovation*, 37 SAN DIEGO L. REV. 987, 1010 (2000) (“Since . . . 1980, biotechnological product development generally



Table 14: Sales Data by Technology

	Soft-ware	Hard-ware	Communica-tions	Other <sup>110</sup>	Total
<b>Num. Packages Observed (% of Total Packages Observed)</b>	1,185 (45%)	652 (25%)	447 (17%)	321 (12%)	2,605 (100%)
<b>Avg. (Median) Total Assets/Package</b>	11.0 (4)	19.9 (7)	18.3 (8)	14.8 (4)	15.0 (5)
<b>Avg. (Median) U.S. Assets/Package</b>	6.9 (2)	13.3 (5)	10.3 (4)	8.3 (2)	9.2 (3)
<b>Avg. (Median) Asking \$K Price/Asset</b>	\$240 (\$167)	\$171 (\$125)	\$204 (\$149)	\$161 (\$108)	\$208 (\$150)
<b>Avg. (Median) Asking \$K Price/U.S. Asset</b>	\$324 (\$250)	\$271 (\$172)	\$297 (\$227)	\$240 (\$163)	\$297 (\$231)
<b>Num. Packages Sold (% of Total Packages Sold)</b>	277 (52%)	114 (21%)	121 (23%)	25 (5%)	537 (100%)
<b>Avg. (Median) Total Assets/Package</b>	13.5 (5)	30.2 (11)	22.9 (10)	21.0 (14)	19.5 (8)
<b>Avg. (Median) U.S. Assets/Package</b>	8.6 (4)	22.6 (8)	15.5 (7)	13.9 (3)	13.4 (5)
<b>Avg. (Median) Est. Sales Price/Asset Sold</b>	\$161 (\$130)	\$104 (\$91)	\$161 (\$125)	\$105 (\$59)	\$146 (\$108)
<b>Avg. (Median) Est. Sales Price/U.S. Asset Sold</b>	\$215 (\$163)	\$183 (\$108)	\$210 (\$163)	\$218 (\$179)	\$208 (\$163)
<b>Num. Packages Litigated or Challenged Post-Purchase</b>	45	12	16	5	78

has taken place through collaborative networks that . . . match up a small biotechnology firm, which primarily attends to basic research and early product development, and a large pharmaceutical firm, which primarily attends to clinical testing, marketing, and distribution.”).

110. The “other” category includes patents covering medical, pharmaceutical, and other miscellaneous technologies.

	Soft-ware	Hard-ware	Communica-tions	Other	Total
<b>% of Total Packages Litigated or Challenged</b>	57.7%	15.4%	20.5%	6.4%	100%
<b>% of Total Num. Sold in Each Tech Category</b>	16.2%	10.5%	13.2%	20%	14.5%
<b>Num. (%) of Suits and Challenges Filed Post-Purchase</b>	728 (65.9%)	67 (6.1%)	231 (20.9%)	79 (7.1%)	1,105 (100%)

Looking closer at the technology categories for which we did see a large number of packages, software stands out as the most interesting. During the period of our study, more software packages were offered for sale than the combined total of packages including hardware- and communications-related assets. Software packages were also listed with higher per-asset prices, about fifteen percent above the overall average. Moreover, these prices do not seem to have been viewed as unduly high by purchasers because software packages sold at higher rates than all other packages and ultimately made up more than half of all packages sold during the period of our study. Post-purchase, software patents were asserted most often, too, accounting for almost sixty percent of litigated packages.

What makes these findings even more interesting is that they span a period when several legal developments called into question the patentability of software and erected additional hurdles to the enforcement of issued software patents. Special administrative procedures for challenging issued "covered business method" patents became available in September 2012.<sup>111</sup> To date, more than 500 of these challenges have been initiated against software patents asserted in court.<sup>112</sup> In addition, perhaps no development in the last decade has affected the patent system more than the revival of limitations on patentable subject matter. In the wake of the Supreme Court's June 2014 opinion in *Alice*

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111. For an overview of procedural rules applicable in "covered business method" reviews, see *Transitional Program for Covered Business Method Patents*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/patents-application-process/appealing-patent-decisions/trials/transitional-program-covered-business> (last visited May 22, 2018).

112. See LEX MACHINA, <https://lexmachina.com> (statistics collected on Feb. 21, 2017). Since the creation of CBM review, more than 500 petitions for review have been filed. *Id.* Approximately eighty-six percent of petitions litigated to an institution decision on the merits were instituted by the PTAB. *Id.* About eighty-seven percent of instituted petitions litigated to a final decision on the merits resulted in the cancellation of all instituted claims. *Id.*

*v. CLS Bank*, which significantly curtailed the scope of patentable subject matter for software-enabled invention,<sup>113</sup> many made dire predictions about the case's impact on the value of high-tech patents.<sup>114</sup>

However, as shown below in Table 15, the market for software patents hardly cratered in 2012 or 2014.<sup>115</sup> To be sure, we observe that per-asset prices for software patents fell between 2012 and 2015. Median per-asset asking prices fell more than twenty-five percent over this period. However, we also observe that prices rebounded in 2016. In addition, the size and number of software patent packages increased markedly during the period of our study.

In our view, these trends likely reflect the introduction – and subsequent dissipation – of uncertainty in the market for software patents over the last five years. As uncertainty about the patentability and enforceability of software assets grew, sellers responded by lowering asking prices and buyers responded by buying larger packages, perhaps in hopes that at least one asset in the package would eventually prove valuable. Over time, prices began to recover as case law on software patentability continued to develop and as PTAB practice became more predictable.

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113. *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2358–59 (2014).

114. See, e.g., Kelly Mackin, *How Alice Is Undermining the American Economy*, LAW360 (Mar. 29, 2016, 10:30 AM), <https://www.law360.com/articles/773025/how-alice-is-undermining-the-american-economy> (estimating that the *Alice* decision resulted in “\$24 billion in direct economic damage” to patent owners and possibly as much as “\$40 billion or even \$60 billion”).

115. *Accord* Chien, *supra* note 11, at 1700 (finding that “[r]ather than declining, the absolute number of software patent transfers has actually increased, from around 5,900 patents per year in 2012 to 8,900 patents per year in 2015, a 68% rise”).

Table 15: Software Patents by Year

	2012	2013	2014	2015	2016
<b>Num. Software Packages (% of Annual Total Packages) Observed</b>	90 (45%)	209 (55%)	316 (48%)	292 (41%)	278 (42%)
<b>Avg. (Median) Total Assets/Package</b>	9.0 (4)	8.0 (3)	12.0 (4)	9.8 (4)	14.1 (5)
<b>Avg. (Median) U.S. Assets/Package</b>	4.5 (2)	4.3 (1)	8.1 (2)	6.5 (2)	8.6 (3)
<b>Avg. (Median) Asking Price/Asset</b>	\$297 (\$241)	\$292 (\$250)	\$220 (\$163)	\$207 (\$150)	\$228 (\$167)
<b>Avg. (Median) Asking Price/U.S. Asset</b>	\$359 (\$319)	\$393 (\$325)	\$310 (\$250)	\$304 (\$200)	\$285 (\$250)
<b>Num. Software Packages (% of Annual Total Packages) from Listing Year that Sold<sup>116</sup></b>	35 (47%)	74 (59%)	86 (48%)	59 (50%)	22 (59%)
<b>Avg. (Median) Total Assets/Package</b>	7.6 (4)	8.4 (3)	17.9 (7)	13.7 (8)	22.9 (11.5)
<b>Avg. (Median) U.S. Assets/Package</b>	3.7 (2)	5.9 (2)	11.7 (4.5)	9.8 (5)	10.7 (4.5)
<b>Avg. (Median) Est. Sales Price/Asset Sold</b>	\$221 (\$163)	\$192 (\$163)	\$132 (\$81)	\$129 (\$88)	\$121 (\$74)
<b>Avg. (Median) Est. Sales Price/U.S. Asset Sold</b>	\$248 (\$211)	\$255 (\$217)	\$198 (\$163)	\$162 (\$127)	\$184 (\$176)
<b>Num. Software Packages (% of Annual Total Packages) from Listing Year Litigated or Challenged Post-Purchase<sup>117</sup></b>	4 (57%)	12 (67%)	10 (42%)	17 (68%)	2 (50%)

116. See *supra* note 72.117. As with all annual sales figures reported *supra*, these statistics reflect observable assertions (initiated before December 31, 2016) of patents that were *listed for sale* in the indicated year, not all observable assertions *that took place* during the indicated year (regardless of when the asserted patent was listed). Thus, for example, the data in

We see further evidence for this interpretation when we isolate deals involving U.S. patent assets assigned to PTO Tech Center 3600. TC 3600 specializes in examining “business method” applications and includes three work units devoted to examining applications covering “electronic commerce.”<sup>118</sup> As shown below in Table 16, we see a much steeper decline in prices for these assets. While the overall average asking price for software patents fell about twenty percent between 2012 and 2016, average per-asset asking prices for business method patents dropped almost forty percent. In fact, during this timeframe business method patents transitioned from among the most valuable software patents on the market to among the least valuable.

Again, these findings are consistent with the market responding to available information about changes to the patent system. As several commentators have concluded, the impact of *Alice* has in large measure been limited to “business method” patents and has not significantly impacted most other types of “software” patents.<sup>119</sup>

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the adjacent column is meant to communicate that four software packages listed in 2012 were subsequently purchased and asserted (before December 31, 2016). And, these four software packages represent fifty-seven percent of the seven total packages listed in 2012 that were subsequently purchased and asserted.

118. U.S. patent examiners are divided into nine “technology centers,” each subdivided into a number of “work units” that, in turn, are further subdivided into “art units.” See *Patent Technology Centers Management*, *supra* note 44. Though titled “Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review,” Technology Center 3600 is the primary tech center for applications covering business methods. See *TC 3600 Management Roster*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/patent/contact-patents/tc-3600-management-roster> (last visited May 22, 2018); Robert R. Sachs, *Two Years After Alice: A Survey of the Impact of a “Minor Case” (Part 2)*, BILSKIBLOG (June 20, 2016), <http://www.bilskiblog.com/blog/2016/06/two-years-after-alice-a-survey-of-the-impact-of-a-minor-case-part-2.html> (reporting that applications examined by TC 3600 have been rejected on patentable subject matter grounds more often than those examined by any other technology center). Within TC 3600, work units 3620, 3680, and 3690 specialize in business method patents related to “electronic commerce” and include art units devoted to “Coupons,” “Electronic Shopping,” “Accounting,” and “Finance/Banking/Insurance.” *TC 3600 Management Roster*, *supra*.

119. See Mark Summerfield, *How the Fate of Software and Business Method Patents Has Turned on USPTO Directors and the Courts*, PATENTOLOGY (Jan. 8, 2017, 3:53 PM), <http://blog.patentology.com.au/2017/01/how-fate-of-software-and-business.html> (comparing PTO data on applications examined in tech centers 3600 and 2100 and concluding that “in established fields of software technology . . . neither US court decisions nor changes in management have resulted in any identifiable deviation in US patent grant rates” despite the fact that “the US Supreme Court decision in *Alice* looks to have eliminated about 75% of new business method patents”); Sachs, *supra* note 118 (showing that patentable subject matter rejections are largely isolated to Tech Center 3600).

Table 16: Business Method Patent Sales by Year

	2012	2013	2014	2015	2016
<b>Num. Bus. Method Packages (% of Annual Total Packages) Observed</b>	32 (16%)	73 (19%)	140 (21%)	102 (14%)	140 (21%)
<b>Avg. (Median) Total Assets/Package</b>	19.4 (11)	27.6 (6)	23.6 (8)	20.4 (11)	27.3 (14)
<b>Avg. (Median) U.S. Assets/Package</b>	11.3 (7.5)	18.6 (4)	18.7 (6)	14.6 (7)	17.5 (8)
<b>Avg. (Median) Asking Price/Asset</b>	\$317 (\$288)	\$236 (\$167)	\$171 (\$121)	\$174 (\$112)	\$186 (\$138)
<b>Avg. (Median) Asking Price/U.S. Asset</b>	\$389 (\$325)	\$312 (\$245)	\$254 (\$167)	\$241 (\$167)	\$247 (\$200)
<b>Num. Bus. Method Packages (% of Annual Total Packages) from Listing Year that Sold<sup>120</sup></b>	16 (22%)	30 (23%)	47 (26%)	18 (15%)	7 (19%)
<b>Avg. (Median) Total Assets/Package</b>	15.1 (5.5)	34.9 (11)	32.1 (10)	32.1 (24)	34.0 (15)
<b>Avg. (Median) U.S. Assets/Package</b>	10.7 (5)	25.5 (7)	23.4 (8)	23.1 (19)	25.0 (11)
<b>Avg. (Median) Est. Sales Price/Asset Sold</b>	\$240 (\$228)	\$159 (\$120)	\$109 (\$81)	\$89 (\$81)	\$134 (\$69)
<b>Avg. (Median) Est. Sales Price/U.S. Asset Sold</b>	\$276 (\$219)	\$185 (\$153)	\$187 (\$163)	\$118 (\$108)	\$173 (\$99)

120. See *supra* note 72.

## V. ANALYSIS

Synthesizing the findings reported above, we draw three broad conclusions from our data regarding what the brokered market can tell us about how to value patented technology, what operating companies can do to respond to the patent “troll” problem, and what the market can tell us about the future of the patent system.

First, our data strongly suggests that the brokered market for patents is primarily, and perhaps almost exclusively, a market for the transfer of potential legal liability, not a market for the transfer of technology. Over ninety-nine percent of the packages that we observed were made up exclusively of patent assets. None of these packages included copyrights, trademarks, or trade secrets, let alone other forms of technological knowhow like software, prototypes, or technical documentation. In addition, our findings suggest that buyers tend to value just a few assets per package, particularly assets that are the subject of an EOU suggesting that they are infringed by a large, profitable tech company. Moreover, a large percentage of patents that are sold (about fifty-seven percent of packages) winds up in the hands of PAEs and defensive aggregators, neither of which commercialize technology. And, finally, the overwhelming majority of patents offered and purchased on the brokered market cover computing and telecommunications technologies, which generally can be (and often are) transferred without significant patent protection.<sup>121</sup>

One important consequence of this conclusion is that prevailing prices in the brokered market may be of limited use for purposes of calculating damages in patent suits. While courts and commentators alike have called for the increased use of evidence derived from the market for “real world” patent transactions,<sup>122</sup> we are not convinced that data from the brokered market is a panacea for concerns about damages calculations. If we are correct that prices in the brokered market largely reflect buyers’ and sellers’ estimates of the litigation value of available assets, then brokered market data falls prey to the same “circularity” concerns that a long list of commentators has raised against undue reliance on prior license agreements.<sup>123</sup> True technology transfer, it would appear, remains hidden from public view even more so than the brokered market for “bare” patent transactions.

Yet another consequence of the market’s basis in liability, not technology, is that the market itself represents another heretofore largely hidden source of

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121. A 2008 survey of entrepreneurs found that only twenty-four percent of software startups owned patent assets and that “first-mover advantage,” not patent protection, was ranked the most “important” means to “capture competitive advantage” in the software industry. Stuart J. H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1277, 1289–90 (2009).

122. The Supreme Court, for example, has referred to prior licenses of the patent-in-suit as the “best measure of damages.” *Clark v. Wooster*, 119 U.S. 322, 326 (1886).

123. *See, e.g., Masur, supra* note 6, at 122.

indirect costs and benefits from patent monetization. While lawsuits and damages awards are publicly accessible, most patent assertions never make it to court.<sup>124</sup> The brokered market, thus, offers a window into the costs of potential patent assertions that were nipped in the bud with a defensive acquisition. During the five years covered by our study, we estimate that operating companies and defensive aggregators spent hundreds of millions of dollars purchasing patents for the primary purpose of reducing their exposure to patent assertion. At the same time, our data also reveals that a large number of assets, worth billions of dollars in the eyes of brokers and their clients,<sup>125</sup> were never sold. While defending a patent suit is undoubtedly expensive, bringing one is not cheap either.<sup>126</sup> To at least some extent, these unsold assets represent potential value that cannot be realized due to the high transaction costs involved in transferring patent rights. At the same time, then, they likewise represent potential risk to operating companies that could reemerge if the costs or returns to enforcement shift in the future.

Second, we find that operating companies, particularly large publicly traded firms, are the most active sellers and buyers in the brokered market. Perhaps most importantly, we see that operating companies are the source of about sixty percent of packages acquired by PAEs. This observation suggests to us that PAEs are, in significant part, a collective action problem among operating tech companies. While the tech industry on the whole decries patent monetization as a net drag on innovation, in some situations tech companies face strong financial incentives to sell their own assets to PAEs for assertion against their competitors. Were operating companies better able to achieve and enforce *ex ante* agreements not to sell to PAEs, it seems likely that the level of PAE activity would significantly decline. Without access to a stream of assets from large tech companies, fewer PAEs would be able to subsist on a diet of patents sourced from individual inventors and failed startups. Thus, our data may suggest that self-help solutions that facilitate the "mutual disarmament" of patent assets among operating companies may be more promising than previously recognized. Existing initiatives, like the License on Transfer ("LOT")

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124. See Mark A. Lemley, Kent Richardson & Erik Oliver, *The Patent Enforcement Iceberg* (Dec. 18, 2017) (working paper) (available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3087573](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3087573)) (reporting that, among respondents in a survey of technology companies, about two-thirds of patent licensing demands eventually resulted in litigation).

125. The cumulative asking price for all unsold assets that we observed is approximately \$4 billion.

126. According to the AIPLA's most recent survey of its membership, the median cost of litigating a patent suit with less than \$1 million at stake through the end of discovery is \$250,000. AIPLA, 2017 REPORT OF THE ECONOMIC SURVEY I-118 (2017) (on file with authors).



Network<sup>127</sup> and the Open Innovation Network (“OIN”),<sup>128</sup> provide a useful blueprint for ex ante coordination among operating companies.

Third, we find less market fluctuation over time than many might expect. During the period covered by our study, the U.S. patent system saw a number of major changes, some of which elicited near-apocalyptic predictions.<sup>129</sup> Despite this, we saw no drastic swings in the market.<sup>130</sup> While overall prices do appear to have fallen significantly since 2012, software patents continue to sell for substantial sums of money, and the market appears to have correctly assessed (before many commentators) that the impact of *Alice* would be largely contained to business method patents. Though the data that we present is purely descriptive, our observations suggest to us that the brokered market reflects a cool-headed assessment of the profitability of patent monetization (at least when viewed in the aggregate) and, thus, has at least some promise for use as a metric for predicting and gauging the impact of changes in law and procedure.

However, we also acknowledge that our data is limited in a number of respects and that our findings and conclusions should be considered with those limitations in mind. As discussed above, our data does not cover all patent transfers but only those that followed quasi-public solicitations made by patent brokers. Moreover, while our study is the most comprehensive analysis of which we are aware, we nonetheless fail to capture the entire brokered market, and thus we cannot rule out the possibility that our observations are biased as a result. In addition, our data on market prices is, by necessity, a work of approximation. Asking prices were often interpreted from general ranges provided by sellers and sometimes were not provided at all. Also, as discussed

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127. See *How LOT Works*, LOTNETWORK, <http://lotnet.com/how-lot-works/> (last visited May 22, 2018) (“Upon becoming a member of LOT Network, when another member sells or transfers a patent to a patent troll or PAE, you are automatically granted immunity against PAE lawsuits for the life of that patent.”).

128. See *About OIN*, OPEN INNOVATION NETWORK, <http://www.openinventionnetwork.com/about-us/> (last visited May 22, 2018) (“The Open Invention Network is a shared defensive patent pool with the mission to protect Linux.”).

129. See, e.g., Richard Baker, *America Invents Act Cost the US Economy over \$1 Trillion*, PATENTLY-O (June 8, 2015), <http://patentlyo.com/patent/2015/06/america-invents-trillion.html>; Paul Morinville, *How the U.S. Is Killing Innovation and Why It Matters for Entrepreneurs*, IPWATCHDOG (Oct. 24, 2015), <http://www.ipwatchdog.com/2015/10/24/how-the-u-s-is-killing-innovation-and-why-it-matters-for-entrepreneurs/id=62679/>.

130. Mark Lemley recently made a similar observation about the patent system as a whole. Mark A. Lemley, *The Surprising Resilience of the Patent System*, 95 TEX. L. REV. 1, 2 (2016) (“Despite the undeniable significance of these changes in both directions, something curious has happened to the fundamental characteristics of the patent ecosystem during this period: very little. Whether we look at the number of patent applications filed, the number of patents issued, the number of lawsuits filed, the patentee win rate in those lawsuits, or the market for patent licenses, the data show very little evidence that patent owners and challengers are behaving differently because of changes in the law.”).

above, the sales prices we report are approximations derived from a combination of the asking prices that we observed and a (smaller) benchmark analysis of true sales prices. Thus, we likewise caution that our pricing-related statistics are best viewed in the aggregate and, particularly for smaller populations, may be significantly biased by individual packages offered at unrealistically high prices. Finally, we note that our data suffers from truncation biases caused by the "pipeline" of sales activity that we observed. Because packages listed in a given year often sell the next year (or even later), the sale statistics that we report are necessarily incomplete. In early years (particularly 2012) we were unable to observe sales of patents that were listed before our data collection began, particularly in 2011. Similarly, for many patents listed in recent years (particularly 2016), it is not possible to observe their eventual sale.

## VI. CONCLUSION

Despite these limitations, we believe our study to be the most in-depth analysis performed to date of the secondary market for patents, and our data to be the most comprehensive collection possible given the fractured and confidential nature of today's market. Overall, our study includes data on almost 39,000 patent assets listed on the quasi-public "brokered" patent market between 2012 and 2016. Using this data, we provide statistics on the size and composition of the brokered market, including the types of buyers and sellers who participate in the market, the types of patents listed and sold on the market, and how market conditions have changed over time.

Our findings suggest that the brokered market is a market allowing patent owners to address potential legal liability and, thus, may not be well suited for use in valuing technology. We also observe that PAEs play a sizeable role in the market and most often acquire patents from operating technology companies. Thus, our findings suggest that a significant part of the brokered market can be viewed as an extension of patent enforcement campaigns that, to date, are largely observable only when they enter federal court. Our data also suggests that operating companies concerned about PAE activity may be well advised to invest more heavily in the creation of third party organizations that facilitate mutual patent disarmament among groups of technology firms. Finally, though we do observe a significant decrease in patent sales prices over the course of our study, the market (even for software patents) hardly cratered in response to the introduction of administrative patent challenges in 2012 or the Supreme Court's 2014 opinion in *Alice v. CLS Bank*. To the contrary, the market actually grew in 2016. The brokered market's behavior during this tumultuous time in patent law suggests to us that it may well have utility in predicting the impact of future changes to patent law and procedure, at least as they relate to shifts in the balance of power between plaintiffs and defendants in patent litigation.

