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Patent Privateering

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Abstract

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Keywords: intellectual property; patent; patent privateering; patent litigation; patent.

JEL: K11; K41; O31; O34.

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Patent Privateering*

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Abstract

We study operating companies' delegation of patent enforcement to patent assertion entities, a practice called "patent privateering." Using a privateer may allow an operating company to generate higher patent revenues, increase rivals' costs with "stealth" attacks, and limit the legal responsibilities to bear litigation costs. Using data on European patent transfers and patent infringement litigation in five large European jurisdictions in 2010-2020, we show that patent privateering is more likely to occur for patents with relatively lower economic value, for standard essential patents, and when the target of patent assertion is a competitor of the operating company.

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1 Introduction

How companies appropriate the returns from their inventions is a key question in strategy and is increasingly important as intangible assets generated by innovation investments have become a major component of companies' value in developed economies (Corrado et al., 2022). Patents can play a key role in firms' appropriation strategies by granting the right to exclude others from making, using, and selling an invention. As a result of the increasing importance of intangible assets, patent monetization through litigation, sales, and licensing has become an important source of revenues for inventors (Osenga, 2014).

In this paper we study inventors' delegation of patent monetization to Patent Assertion Entities (PAEs), a practice often labeled as "patent privateering." PAEs' business model is typically based on generating revenues from enforcement of patents they purchase from inventors, and have recently emerged as major actors in the market for patents and in patent assertion (Cohen et al., 2019). Although the terms of patent sales are usually confidential, a common assumption is that PAEs and inventors are independent entities that merely participate in a market transaction. But they can also cooperate more closely, establishing patent privateering relationships. This practice resembles maritime privateering, an historic method of waging war through state-sponsored piracy. In maritime privateering, a government (the sponsor) delegated war by authorizing a pirate (the privateer) to attack and seize the assets of the state's adversaries (Ewing, 2012). Similarly, an operating company can ask privateers to buy patents from third parties and then attack competitors or delegate patent monetization to a privateer with an agreement to share patent enforcement revenues and payment schedules that incentivize the PAE to attack the sponsor's competitors. In this paper, we focus on this second mechanism. By hiding its identity with transfers to a PAE, a sponsor company can therefore benefit from "stealth" attacks to rivals directly (from the revenues generated by the patent) and indirectly (from damaging competitors) (Sokol, 2017). We study the diffusion of this practice in Europe and empirically analyze the decision of an operating company to delegate patent assertion to a privateer.

Patent privateering has recently received attention in public debates. For example, Google, Blackberry, Earthlink, and Red Hat urged antitrust agencies to carefully study this practice in a 2013 comment to the US Federal Trade Commission and the US Department of Justice,[1] and a 2016 report by the Joint Research Centre of the European Commission discussed the use of patent privateers (Thumm and Gabison, 2016). Quantifying the diffusion of this practice is difficult because patent transfers terms are usually kept secret, but the anecdotes reported by numerous sources suggest the use of privateers is widespread. For example, according to Lemus and Temnyalov (2017) companies such as Alcatel-Lucent, British Telecom, Digimarc, Ericsson, Kodak, Micron Technology, Microsoft, Motorola, Nike, Nokia, Philips, Sony, and Xerox have cooperated with privateers.

To provide statistical evidence on the use of privateering, we combine data on patent characteristics, transfers, and litigation for patent infringement, and analyze the characteristics of the patents involved in privateering, the relationship between privateering and the occurrence of litigation, and the association between operating companies' delegation of lawsuits to privateers and some key patent and company characteristics. A fundamental challenge for this analysis is the identification of patent privateering transfers because this practice fundamentally relies on secret agreements. We address this challenge by combining a list of privateering relationships used by Kesan et al. (2019) to study this practice in the US with a new list that we compile by exploiting the dependence of some PAEs on a single operating company for the construction of their patent portfolios as a way to identify likely privateering links. In our analysis of the delegation decision, we focus on three factors: patent economic value, essentiality for a technology standard, and competition between the original patent owner and the target of litigation.

Our empirical analysis focuses on the ICT sector, as most of the PAEs' business in Europe is concentrated in this technology area (Thumm and Gabison, 2016). Our data reveal a large use of privateering in this context. Privateering transactions represent about

[1] https://docs.google.com/file/d/0BwxyRPFduTN2VTE4TXlNcW9MR2s/edit?resourcekey=0-vbxluKWVkIiDQyOHYdlfUA (accessed October 14, 2021).

65% of the patents transferred to and about 38% of those that are acquired and litigated by PAEs. We compare patents transferred to privateers to other ICT patents and find that, not surprisingly, privateering is associated with a higher probability of litigation. Moreover, the probability a patent is litigated for the first time immediately jumps after the transfer to a privateer. Interestingly, privateering patents appear to be of significantly lower quality or value and less litigated than other patents purchased by PAEs, consistent with the idea that privateering transfers are fundamentally different from other PAEs' patent acquisitions and are likely involved in more targeted assertion activities. The second part of our analysis shows that operating companies are more likely to transfer a patent to a privateer to assert patents of lower economic value, standard essential patents (SEPs), and against competitors. We finally show that the use of a privateer is negatively correlated with the occurrence of a counter-suit for patent infringement.

This study contributes to several streams of the literature on the use of patents to appropriate the returns to innovation investments (Teece, 1986; Levin et al., 1987; Cohen et al., 2000; Somaya, 2012). Prior work on the use of *patent enforcement* to force alleged infringers to stop using an invention or to pay royalties analyzes the characteristics of patent litigation cases and how the decision to assert patents correlates with patent and firm attributes (e.g. Lanjouw and Lerner, 1998; Lanjouw and Schankerman, 2001; Cremers et al., 2017). We focus on the delegation of litigation and analyze its drivers. Our results show that in an important setting such as European ICT the delegation of assertion is widespread, and litigation outsourcing is associated with some key patent characteristics and the degree of rivalry between inventor and target of a lawsuit. Our findings also shed light on firms' use of the *market for patents* to generate revenues (Serrano, 2010; Ciaramella et al., 2017; Gaessler and Harhoff, 2018). Extant research analyzes how the existence of a market for technology facilitates the division of labor in innovation activity, the reallocation of innovations to firms that are more efficient in commercializing an invention, and how the market for patents can generate welfare gains by exploiting comparative advantages in patent enforcement (Arora

et al., 2001; Gans and Stern, 2003; Galasso et al., 2013). We provide evidence that companies use the market for patents for "stealth" attacks against competitors and to enforce patents with relatively lower value. This work is also related to the literature that focuses on *patent assertion entities* (Reitzig et al., 2007; Cohen et al., 2019; Feng and Jaravel, 2020; Fischer and Henkel, 2012; Orsatti and Sterzi, 2023). This literature generally assumes inventors benefit from the revenues generated by selling their patents to a PAE, which then retains all the rights on a transferred patent. But privateering relationship involve a higher degree of cooperation between the parties. Lemus and Temnyalov (2017) develop a theoretical model of privateering to study the effects of outsourcing patent monetization and Kesan et al. (2019) analyze the characteristics of US patents transferred to privateers by relying on a publicly available list of operating-company-privateer links. We propose a general and simple way to identify likely privateering transfers, provide evidence on the diffusion of privateering in another setting, and show that privateering transfers are systematically different from other transfers to PAEs. Finally, our findings are relevant for the literature on *standard essential patents*. To facilitate standard adoption, many owners of patented technology included into technical standards promise to license their patents under fair, reasonable, and non-discriminatory (FRAND) terms or to cap the royalties demanded for their SEPs portfolios (Lerner and Tirole, 2015; Baron and Spulber, 2018; Bekkers et al., 2023). Our results suggest that privateering might be used to assert these patents more aggressively.

2 Background

Appropriating the value of their innovations is a key challenge for firms (Teece, 1986). By providing protection against copying, patents are one of the tools inventors can use to protect the returns of their research and development (R&D) investments. Owners of patents can directly enforce them against imitators of the products they commercialize or the new processes they invent, but can also profit from selling or licensing the patent rights. The market for patents has indeed become an important source of revenues for inventors (Osenga,

2014). PAEs have emerged as important actors in this market. These firms typically acquire patents from inventors to generate revenues from licensing and assertion activities.

Inventors can profit from selling patents they do not practice to PAEs (Steensma et al., 2016). But they can also benefit from establishing "patent privateering" arrangements with PAEs. Although multiple versions of the privateering practice exist, the key difference between patent privateering and the typical market transactions between inventors and PAEs is that patent privateering transactions are structured to align the incentives of the PAE towards generating direct or indirect benefits for the sponsor through licensing and assertion activities, whereas in the typical inventor-PAE market transaction the inventors neither receive any additional compensation nor have any influence on how the patent is used after the sale. In patent privateering transactions, PAEs and inventors typically share the earnings generated by the transferred patents (Kesan et al., 2019). Moreover, privateering agreements often include payment schedules that incentivize the PAE to assert the patents against the inventor's competitors.[2] Privateers may also be instructed to assert the patents only against a list of target companies selected by the inventor (Ewing, 2012). In another version of this practice, the PAE is just a shell or patent holding company that appears to be an independent entity but is actually owned by the operating company (Thumm and Gabison, 2016). Importantly, the terms of the transfers are typically kept secret, so third parties do not know whether a change in patent ownership represents a simple patent sale or a privateering agreement.

Using a privateer to delegate patent enforcement has multiple advantages for an operating company related to differences in patent assertion capabilities, lack of transparency on patent ownership and reasons for a patent transfer, and legal responsibilities to bear litigation costs (Ewing, 2012; Popofsky and Laufert, 2013; Sipe, 2015; Lemus and Temnyalov, 2017; Kesan et al., 2019; Sterzi et al., 2021). First, a PAE may generate revenues from a patent more effectively than an operating company. A PAE may have an expertise in iden-

[2] https://www.huffpost.com/entry/as-congress-contemplates_b_3000110 (accessed June 29, 2023.)

tifying targets, negotiating licensing deals and settlements, and litigating in court that an operating company may lack. Delegating patent monetization to a PAE may therefore generate larger revenues. Moreover, a PAE has advantages in negotiations that derive from its lack of production activities (Chien, 2008). In industries such as telecommunications equipment or semiconductors, products are often composed of multiple patented complementary components and a single firm rarely owns all the relevant patents. In these situations, firms usually accumulate large patent portfolios for defensive purposes and because they own many patents that are necessary for producing each other's products, competitors typically negotiate cross-licensing agreements or avoid attacking each other, as a lawsuit would probably trigger a dangerous counter-suit (Shapiro, 2001; Hall and Ziedonis, 2001; Ziedonis, 2004). A PAE does not need obtain any licenses from other firms and is not at risk of being countersued for patent infringement by its targets because it does not produce any goods or services. It can therefore demand higher royalties and initiate lawsuits without the risk of retaliation.

Second, by masking its identity with the transfer to a PAE, an operating company may also indirectly benefit from increasing rivals' costs with a "stealth" attack. These indirect benefits may be substantially larger than the direct benefits from patent revenues. Higher royalties or larger litigation expenses may put a target firm at a disadvantage in the competition with the PAE's sponsor in the product market. Furthermore, privateering might be used to refuse to license to competitors patents that are fundamental to operate in the market, therefore creating a monopoly position for the privateer's sponsor.

Third, PAEs' business model is based on generating revenues from patents. Therefore, it does not suffer any reputation costs associated with patent assertion, and may actually benefit from a "reputation for toughness" in negotiations and litigation. Conversely, aggressive patent licensing negotiations and assertion by an operating company may have negative reputational consequences, especially when customers, allies, shareholder, or public authorities are skeptical about this type of behavior. This is particularly important when collaboration with other firms is key such as in cooperative standard-setting, where an aggressive patent

assertion strategy may decrease the chances a company's technology is included in an industry standard. By hiding behind a privateer, an operating company can monetize its patents without bearing these reputation costs.

Fourth, inventors might use privateers to evade licensing obligations they have previously undertaken. This is a particularly salient issue for SEPs, i.e. patents that would be infringed by any implementation of a technical standard. Standard adoption can lead to the exclusion of alternative technologies from the market. To reduce the holdup concerns that may be generated by the inclusion of patented technology into an industry standard, the policies of many standard setting organizations (SSOs) encourage or require participants to license their SEPs on FRAND terms (Lemley, 2002; Baron and Spulber, 2018; Bekkers et al., 2023). In other contexts, companies commit to liberal licensing policies to induce adoption of their technology as a *de facto* standard (Popofsky and Laufert, 2013). Until recently, it was unclear whether a FRAND commitment would travel with the patent, so an inventor that wanted to increase its licensing revenues from a SEP could transfer the patent to a privateer, which later demanded higher royalties (Scott Morton and Shapiro, 2013). In Europe, two recent court decisions (Huawei v. ZTE in 2015, and Unwired Planet v. Samsung in 2016) resolved this uncertainty by clarifying that FRAND commitments indeed travel with a SEP in the case of a transfer. However, the flexibility of the notion of FRAND terms still leaves margins for engaging in this type of behavior. It is typically up to SEP owners and prospective licensees to negotiate licensing agreements, and FRAND terms may very along a continuum. Privateers have thus the flexibility to request royalties that are higher than those the inventor would have requested but still fall within the boundaries of FRAND commitments. Lack of publicly available information on the terms entered voluntarily by other parties that could provide relevant benchmarks also creates opportunities for demanding higher royalties. A related reason to use a privateer is to evade no-stacking or royalty cap pledges, i.e. promises not to demand more than a given royalty rate for their entire portfolio of SEPs (Scott Morton and Shapiro, 2013). Splitting the portfolio by transferring part of it to privateers can enable the

portfolio owners to jointly obtain higher total royalties even if all of them individually honor the original promise, because now multiple independent companies can demand licensing fees up to the cap.

Finally, an operating company may use a privateer to evade litigation responsibilities. This explanation applies mostly to litigation cases in Europe where, to limit frivolous litigation, the losing party is typically required to pay reasonable attorney fees and litigation costs to the winning party. By delegating litigation to formally independent entities with little financial resources, operating companies can exploit the European laws that grant reductions in these costs to firms unable to afford them, thereby limiting the financial consequences of losing a case (Sterzi et al., 2021).

The costs of using a privateer include sharing the revenues generated by the patent with another party, the partial loss of control as a consequence of transferring the ownership of the patent, and the potential reputation damages that may hit a company caught doing business with an aggressive PAE exploiting the lack of transparency in the market for patents. Not surprisingly, operating companies often deny the existence of privateering agreements with PAEs.

Although it is difficult to assess the diffusion of this practice because of the confidentiality of most patent sales, multiple cases of privateering have been documented. For example, in 2011 the PAE Mosaid entered in a privateering agreement with Microsoft and Nokia (Popofsky and Laufert, 2013). In this deal, Nokia transferred about 2,000 patents (of which roughly 1,200 declared essential for wireless communication technology standards) to Mosaid for a nominal price. The PAE agreed to monetize these patents and transfer two-third of the royalties to Nokia and Microsoft. The agreement also contained a set of provisions and milestones to incentivize Mosaid to enforce the patents, but prevented the PAE from asserting certain patents against implementers of Microsoft's software for mobile devices. Any change in ownership of those patents would also have to be approved by Nokia.[3]

[3]See also https://www.wsj.com/articles/SB10001424053111904716604576544441441198816, https://www.cbc.ca/news/business/mosaid-secures-nokia-patent-deal-1.1102570, https:

In another famous example, Ericsson transferred to Unwired Planet (a subsidiary of Panoptis Holdings) about 2,000 patents and applications in 2013. Some of these patents were related to telecommunication standards and were later litigated. The publicly available terms of this deal clearly describe a revenue sharing agreement and reserve some rights to Ericsson in case of a Unwired Planet change of control.[4]

From a welfare perspective, the impact of patent privateering is unclear. By increasing the ability to monetize patents, this practice might increase the incentives to invest in R&D, with positive consequences for innovation. On the other hand, privateering might exacerbate hold-up problems in technology development, increase the cost of technology adoption and cumulative innovation, and have anti-competitive impacts that eventually reduce total welfare. In this paper we do not attempt to estimate the overall effects of privateering. Instead, we provide evidence on the diffusion of privateering in Europe, a context for which we do not have any systematic studies on this practice yet, and study when operating companies are more likely to delegate litigation to a privateer instead of directly filing an infringement lawsuit focusing on some key patent and company characteristics.

3 Patent Privateering in Europe

3.1 Data

To assess the presence of patent privateering in Europe, we combine data from two main sources. First, we identify all EPO patents acquired or filed by PAEs by relying on the Bu-

//www.reuters.com/article/mosaid-idINL4E7K121Z20110901, https://www.zdnet.com/article/microsoft-weighs-in-on-mosaid-nokia-patent-deal/, https://techcrunch.com/2011/09/01/mosaid-acquires-2000-nokia-patents-will-handle-licensing-litigation-for-a-cut/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAIzM5I1eiFF6oiC0eqphqjXcdrNR3szYRuQMSP0Vj8Wj2cMelRi87_mKn3h5x-89LtFf7Ea4cJ1PPmePMHMNelztr7Tg6v5bbuK85LIRQFy7OG5Xvvb9fhqGC0d1VY1ANAq4yLjyFB1iMvvuu7yRwUNzm9IsTD0Qxh6SKdAHcLnN, and https://www.ipdigit.eu/2013/06/beware-privateers-patrol-these-patent-waters/ (accessed March 7 2023).

[4]See https://www.sec.gov/Archives/edgar/data/1082506/000119312513012058/d466328dex102.htm, https://www.iam-media.com/article/unwired-planet-sell-patent-business-30-million-buyer-increases-its-stockpile-of-ericsson-assets, https://www.juve-patent.com/cases/game-over-in-unwired-planet-and-huawei-dispute-in-germany/, and https://www.ipdigit.eu/2013/06/beware-privateers-patrol-these-patent-waters/ (accessed March 7 2023).

reau van Dijk's Orbis Intellectual Property Database (ORBIS IP), a commercial database that provides economic and administrative data for more than 360 million companies and information on approximately 115 million patents worldwide, including publication, ownership, technology area, transfer, and opposition information. Second, we retrieve data on all patent infringement cases filed in five large European jurisdictions (Germany, France, Italy, U.K., and the Netherlands) for the 2010-2020 period from Clarivate Darts IP, a database that provides information on intellectual property litigation cases worldwide and is used on a daily basis by leading law firms, corporate counsels, and courts. The five selected countries account for 81.9% of the patent infringement actions filed in Europe since 2010. If we focus only on actions filed by PAEs, the percentage rises to 97.3%.

3.1.1 Patent transfers to PAEs

We use ORBIS-IP to identify all EPO patents and their current owner as of February 2021, and, for transacted patents, the entity selling the patent to the current owner. We then rely on a list of PAE names (parent companies and subsidiaries; updated in July 2021) provided by Clarivate Darts IP and Allied Security Trust (AST) to identify PAEs among patent owners. Reconstructing patent ownership history, especially for European patents, is challenging due to two main reasons: first, the EPO does not register patent reassignments after the grant date; second, national patent offices have different rules for registering ownership changes. ORBIS IP addresses these issues by collecting data from various sources and applying ownership changes to the entire patent family when a national patent office records an ownership transfer for a family member.[5]

3.1.2 Patent litigation

We also collect data on infringement cases filed in five large European jurisdictions by operating companies or PAEs in the years 2010-2020 that involve an EPO patent. The information

[5]To verify the quality of the data, we sampled 30 patents acquired by PAEs and found only two discrepancies. Additionally, we examined a known and significant patent portfolio acquisition by the PAE Interdigital from Technicolor, confirming that most patents previously assigned to Technicolor were re-assigned to Interdigital in our data.

about the type of plaintiff is provided directly by Clarivate Darts IP. They define PAEs as independent organizations owning or benefiting from patent rights, but not selling or manufacturing goods or services, and having an active assertion or litigation role as plaintiffs in patent cases. For each infringement action we also collect information about date and patent numbers.

3.1.3 Other data sources

We retrieve additional information on patent and firm characteristics from the OECD Patent Quality Indicators Database (Squicciarini et al., 2013) and Orbis for EPO patents and applications filed after 1994.[6] We use the former source for data on patents' technological field, filing date and days of grant lag from the filing date, patent scope (measured as the number of 4-digit IPC subclasses), number of claims, backward citations to patent and non-patent literature, forward citations within a five-year window from the publication date, generality and originality indexes, and patent family size (measured as the number of patent offices at which an invention has been protected). We refer the reader to Squicciarini et al. (2013) for details on these variables. We use the latter source for data on firms' NACE industry codes and business descriptions, and for information on which patents have been declared essential to a technology standard.

3.1.4 Identification of patent privateering cases

The identification of patent privateering cases is a fundamental challenge for our analysis. The terms of the patent transfers are typically kept secret and the mere fact that a PAE acquires a patent from an operating company does not automatically mean the PAE behaves as a privateer. Acquiring patents is often a core part of PAEs' business and a PAE could simply purchase a patent no longer useful to an operating company, without any patent privateering agreement between the two parties. A possible approach might be to also exploit information on litigation that follows the PAE's purchase, as in Lemus and Temnyalov (2017).

[6] We exclude a few patents that have an extremely high number of renewals, as these are likely mistakes in the data.

However, in our analysis we want to shed light on the characteristics of litigation cases that are associated with privateering transactions, so we do not follow this approach.

To identify transactions that *likely* involve a privateering agreement, we adopt the following strategy. First, we follow Kesan et al. (2019) and rely on the FOSS Patents blog. This blog lists a number of likely patent privateer relationships between PAEs and operating companies involving patents that protect technology relevant for smartphones, tablet computers, or the technologies they incorporate, and for which it is possible to verify the nature of the transactions with publicly available sources such as press releases, public statements, media reports, or court filings.[7] We thus consider as patent privateering cases all the transactions where the last vendor of a patent and the PAE are listed in the FOSS blog as a case of privateering. We identify 755 transacted patents with this criterion, representing about 10% of all patent that are transferred to PAEs in our data.[8]

Using this source has three main limitations. First, the list might be under-inclusive, because it is focused on high-profile cases in a specific technology area for which there is some evidence of privateering and does not include recent transactions as it was compiled in 2015. Second, there might be a personal bias in the transaction classifications. Third, we do not know the specific terms of all the patent transactions between the firms identified by the FOSS blog and some of the patents transferred between these parties might not be part of privateering agreements.

It is very difficult to overcome the third limitation mentioned above, as the terms of most patent transfers are kept secret. To overcome the first two limitations, we complement this information using an additional and more general criterion. The key idea is to identify PAEs that mostly depend on a single operating company for assembling their patent portfolio. First, inspecting the publicly available information on high-profile patent privateering cases, we noted that these transactions often involve the transfer of large patent portfolios. Second,

[7] http://www.fosspatents.com/2015/05/privateering-lets-name-and-shame.html (accessed June 28, 2022.)

[8] The same patent can be counted twice if it is acquired by two PAEs simultaneously. This happens for only 84 patents that are acquired by PAEs in our data.

an operating company and a PAE might establish a long term relationship in which the sponsor continues feeding the privateer with more patents over the years, leading to a greater importance of the patents from the sponsor company for the composition of the PAE's portfolio.[9] Third, the high dependence of a PAE on an operating company may indicate that the PAE is actually a shell or patent holding company owned by the operating company. We therefore consider a PAE acting as a privateer for an operating company also when the latter contributes substantially to the PAE patent portfolio. More formally, we consider as a case of patent privateering a relationship between an operating company A and a PAE B when at least 50% of the patent portfolio of B consists of patents acquired from A. We classify 4,340 patents as involved in a privateering transaction with this second criterion, representing about 57% of all patents acquired by PAEs.

This additional approach is more general than the first one as it is not focused on high-profile cases in a specific industry and it is not limited to the pre-2015 period, but has limitations. First, we do not know the actual terms of the transactions, so we might classify as privateering transactions some PAEs' purchases that are not characterized by privateering agreements. Second, we might miss some actual privateering transactions that account for a small share of the PAE's portfolio.

To assess the quality of our approach to measure patent privateering, we begin by analyzing the overlap between the privateering cases identified using the dependence of the PAE's patent portfolio with the privateering cases identified using information from the FOSS blog. The results are in Table 1. Interestingly (and reassuringly for the quality of our approach) about 95% (715 out of 755) of the patent involved in privateering transactions identified by the FOSS blog criterion are classified as privateering transactions also by our method based on the PAE's dependence on the operating company. As expected, the latter method also classifies as privateering transactions many patent transactions between firms not listed in

[9]For example, the agreement between Ericsson and Unwired Planet was reported to contain a commitment by Ericsson to continue transferring patents to Unwired Planet in the future. https://www.huffpost.com/entry/as-congress-contemplates_b_3000110 (accessed June 29, 2023).

the FOSS blog. Using only data on patents litigated in the 2010-2020 period, we also find that all the patent privateering cases identified by the FOSS blog criterion (11 patents) are classified as privateering transactions also by our second method. These results are robust to using a 75% threshold for the PAE's portfolio dependency on the operating company.

Table 1: Comparison of FOSS blog and PAE's dependency on operating company to identify patent privateering cases

	FOSS Blog		
Ratio $\geq$ 50%	No	Yes	Total
No	3,254	40	3,294
Yes	3,625	715	4,340
Total	6,879	755	7,634

Notes. The data for this table contain EPO patents acquired by PAEs.

We then inspect the largest privateering relationships identified with our measurement approach. Table 2 shows the ten largest operating-company-PAE pairs in terms of privateering transactions, which represent about 92% of the privateering transactions in our data. We discussed the likelihood that these transactions represent true privateering transactions with some intellectual property experts from the ICT industry. Although they could not guarantee that any of these transactions truly represent a privateering agreement, some of them confirmed that some of these operating-company-PAE transfers are likely to hide a privateering relationships.

We also collected information on these relationships from public sources. We did not find any additional information about patent transfers from Philips to Pendrell. We did not find any evidence of any privateering agreements between Nortel and the Rockstar Consortium, Kodak and Global Oled Technology, and Alcatel-Lucent and Provenance Asset Group. The Rockstar Consortium is a non-practicing entity backed by Apple, Microsoft, BlackBerry, Ericsson, and Sony that was formed to acquire the patents of the bankrupt telecommunications company Nortel. Therefore, Nortel cannot be the sponsor in a privateering agreement.[10] Global OLED Technology is a subsidiary of the Korean conglomerate

[10]See https://www.zdnet.com/home-and-office/networking/google-settles-with-rockstar-con

LG Group that manages patents purchased from Kodak when the latter shifted its technology focus.[11] Provenance Asset Group was formed in 2017 to manage a patent portfolio originating from Nokia and its subsidiaries, including Alcatel-Lucent (acquired by Nokia in 2016), covering technologies such as telecommunications, gaming, semiconductors, software, Wi-Fi, and Internet-of-Things. Immediately after the patent purchase from Alcatel-Lucent, Provenance's CEO declared that they would share their revenues with those selling patent assets to the firm. However, the terms of the transactions with Alcatel-Lucent were not disclosed. Moreover, public statements say that Provenance sells licenses that allow a client to assert a patent against specific companies for defensive purposes. Although there might be a revenue sharing agreement with the seller of a patent, Provenance's seems different from the business model of the typical PAE or of a privateer.[12]

The information we collected about the transactions between Bosch and IPCom, and Micron Technology and Round Rock Research is inconclusive. IPCom has litigated a number of patent families relevant for mobile communications that it purchased from Bosch and Ewing (2012) mentions this case as a possible privateering effort. IPCom's former managing director Bernhard Frohwitter previously represented Bosch and the current managing director Pio Suh declared in an interview that their goal "[...] was to compensate for the investments made by Robert Bosch in research and development in the mobile communications sector." On the other hand, Frohwitter rejected the idea that he was part of any "scheme" and we were not able to find any information on the terms of the patent transfers.[13] The non-practicing entity Round Rock Research purchased about 4,000 patents on various

sortium-over-nortel-patents/ or https://techcrunch.com/2013/10/31/apple-microsoft-backed-rockstar-consortium-sues-google-samsung-over-7-nortel-patents/ (accessed March 7, 2023).

[11] See https://www.oled-info.com/kodak-completes-sale-their-oled-unit-lg, https://en.wikipedia.org/wiki/Global_OLED_Technology_LLC, or https://www.reuters.com/article/us-kodak-idUSTRE5B32UD20091204 (accessed March 7, 2023).

[12] See https://www.prweb.com/releases/2017/11/prweb14861899.htm and https://www.iam-media.com/article/new-licensing-vehicle-will-be-offering-slice-of-12000-former-nokia-patents-just-100000 (accessed March 7, 2023).

[13] See https://www.law.com/almID/1202424954133/ (accessed March 7, 2023) and https://www.juve-patent.com/people-and-business/how-ipcom-kept-the-mobile-phone-industry-on-tenterhooks-for-13-years/ (accessed March 8, 2023).

technologies such as chipmaking, photo imaging, telecommunications and search engines, and radio-frequency identification from Micron Technology. The PAE later asserted some of these patents against SanDisk, a competitor of Micron. SanDisk alleged that Micron could not enforce itself its patents because of FRAND commitments made to the SSO JEDEC, so it conspired with Round Rock Research to transfer and monetize the patents. Although Round Rock Research's founder revealed that Micron approached him to do the deal, we were not able to find information on the terms of the agreement.[14]

The remaining transactions include some of the most famous examples of privateering agreements. For these deals we found evidence of revenue sharing agreements typical of privateering transfers. Two of them are those that we discuss in Section 2. In 2012, Nokia also transferred a portfolio of about 500 patents and applications (including more than 100 patent families declared essential to telecommunication standards) to Form Holdings (formerly known as Vringo). Also this deal included a revenue sharing agreement. Moreover, the agreement contained a clause that reduced the PAE's incentives to transfer the patents and would result in substantial payments if the PAE would not withdrawn an action against a third party after a notice from Nokia.[15] In 2018, Interdigital acquired substantially all of Technicolor's patent portfolio for an estimated total deal value of about $475 million, including an upfront payment of $150 million and 42.5% of the future royalties from Interdigital's licensing activities in the Consumer Electronics field.[16]

[14]See https://www.essentialpatentblog.com/2014/03/sandisk-sues-pae-round-rock-for-antitrust-breach-of-contract-claims-involving-former-micron-patents/, https://www.essentialpatentblog.com/wp-content/uploads/sites/64/2014/03/2014-03-19-SanDisk-Complaint.pdf, http://www.ip.finance/2010/06/more-news-on-micron-patent-what-is.html, and https://www.iam-media.com/article/it-was-microns-idea-create-npe-monetise-its-patents-round-rock-founder-reveals (accessed March 8 2023).

[15]See https://www.sec.gov/Archives/edgar/data/1410428/000114420412043832/v320786_8k.htm, https://www.sec.gov/Archives/edgar/data/1410428/000114420416099228/v439052_ex99-1.htm, and https://thenextweb.com/news/mobile-tech-firm-vringo-to-sell-31-2m-worth-of-stock-to-buy-ip-from-nokia-and-more (accessed March 8 2023).

[16]See https://www.technicolor.com/news/technicolor-agrees-sell-interdigital-its-patent-licensing-business, https://www.globenewswire.com/news-release/2018/07/31/1544295/0/en/InterDigital-Completes-Acquisition-of-Technicolor-Patent-Licensing-Business.html, https://ipwatchdog.com/2018/03/12/interdigital-acquires-technicolor-patent-portfolio/id=94401/ or https://www.reuters.com/article/us-technicolor-sa-interdigital-us-acquis-idUSKCN1GD61O (accessed March 7 2023).

Overall, there is evidence of revenue sharing agreements typical of privateering transfers only for 4 of the 10 largest operating-company-PAE pairs in our data, but these pairs represent almost 70% of the patents transacted by the companies in Table 2. Since it is rare to find reliable information on the terms of patent transfers (especially for transfers that may be perceived as controversial such as privateering agreements), we find reassuring that the large majority of the patents classified by our measurement strategy as being involved in privateering deals are transferred between firms for which there is clear evidence of a revenue sharing agreement. Nevertheless, we acknowledge our approach to identify privateering transactions is highly imperfect and our classification of the transactions should only be considered as a proxy for the existence of such deals, rather than a certain classification.

Table 2: Largest identified privateering relationship

Operating company (seller)	PAE (buyer)	Number of transacted patents
Technicolor	Interdigital	2007
Alcatel Lucent	Provenance Asset Group	772
Ericsson	Panoptis Holdings	515
Nokia	Mosaid Technologies	197
Nortel	Rockstar Consortium	147
Kodak	Global Oled Technology	145
Robert Bosch	Ipcom	87
Koninklijke Philips	Pendrell	72
Nokia	Form Holdings	60
Micron Technology, Inc.	Round Rock Research	35

Notes. This table shows the ten largest operating-company-PAE pairs in terms of privateering transactions in our data.

3.2 Comparison of privateering patents and other ICT patents

Prior research shows that in Europe PAEs typically acquire and assert ICT patents (Thumm and Gabison, 2016). Our data confirm these findings. Of the 6,570 patents transferred to PAEs in the 2010-2020 period, 92% are in ICT fields, and 94% of the 86 patents acquired by PAEs that are litigated in the same period are ICT patents. We thus restrict the analysis in the rest of the paper to ICT patents. Privateering represents a substantial share of the PAEs' activity in this area. Privateering transactions represent about 65% of the ICT patents transferred to PAEs, and patents transferred to privateers account for about 38% of ICT

patents acquired and litigated by PAEs.[17]

In Table 3 we compare patents transferred to privateers with other ICT patents. We construct three comparison groups: patents that are not transferred, patents transferred to PAEs that are not involved in privateering transactions, and patents transferred to other types of entities. The table reports the means for patent characteristics for these groups and the t-statistics from tests of the difference between the means for privateering patents and patents in the other groups. To be clear, the "control" patents are not meant to represent the counterfactual in absence of privateering, but are comparison groups of patents in the same broad technology area as the privateering patents.

Patents transferred to privateers appear to be different from those that are not transferred and those that are purchased by entities that are not PAEs, but the differences are generally not dramatic. Patents transferred to privateers are more likely to be litigated. This is not surprising, as one of the main reasons to transfer patents to privateers is to assert them more aggressively. Patents transferred to privateers are also "older" in terms of filing and grant dates, and more likely to be granted within our sample period, especially compared with those that are not sold. This may be due to the fact that parties prefer to transfer a patent after the resolution on the uncertainty on the scope of patent protection has been resolved. Interestingly, patents transferred to privateers also have larger patent families and are more likely to be SEPs, suggesting they have a greater private value than those in the these first two comparison groups.

The comparison between patents transferred to PAEs with privateering transactions and other patents transferred to PAEs reveals that these two groups are fundamentally different. In particular, patents transferred to PAEs with other types of transactions appear to be more valuable patents characterized by features typically correlated with a higher probability of litigation (Lanjouw and Schankerman, 2001; Allison et al., 2004): they have larger families

[17]ICT includes the following WIPO 35 subclasses: Electrical machinery, apparatus, energy; Audio-visual technology; Telecommunications; Digital communications; Basic communication processes; Computer technology; IT methods for management; Semiconductors. About 95% of the patents involved in privateering transactions in our data are in these subclasses.

and scope; are more original, general, and likely to SEPs; receive and make more citations; have more claims; and spent more time in examination. This is not surprising, as PAEs may want to construct patent portfolios of relatively high quality to widely assert them, whereas patentees may use privateering agreements for targeted enforcement of relatively lower quality patents (Fischer and Leidinger, 2014). Consistent with these ideas, Table 3 indeed shows that patents purchased by PAEs in non-privateering transactions are more likely to be litigated.

Table 3: Comparison of patents transferred to privateers with other ICT patents

	(1) Privateering	(2) Not transferred	(3) T-stat (2)-(1)	(4) Transferred not to PAE	(5) T-stat (4)-(1)	(6) Transferred to PAE	(7) T-stat (6)-(1)
Litigated	0.01	0.00	-22.65	0.00	-6.92	0.02	4.34
Granted	0.74	0.42	-41.2	0.71	-4.68	0.72	-1.97
SEP	0.04	0.03	-6.77	0.04	-2.25	0.11	10.38
Family size	6.05	4.66	-32.14	5.24	-15.33	6.85	9.38
Patent scope	1.70	1.71	0.24	1.75	2.98	2.03	11.43
Fwd cites	0.95	0.72	-6.61	0.94	-0.12	2.19	14.91
Bwd cites, pat.	3.67	4.80	12.81	5.07	23.54	5.15	11.54
Bwd cites, NPL	1.32	0.97	-9.03	1.02	-6.09	1.37	0.87
Filing year	2,006.01	2,008.26	21.79	2,007.10	12.3	2,003.87	-16.5
Grant year*	2,011.50	2,012.73	11.14	2,012.72	12.09	2,011.27	-1.5
Grant lag*	2,484.87	2,093.80	-20.67	2,372.85	-5.15	2,852.32	9.47
Claims*	13.47	14.21	4.46	13.51	0.27	15.88	8.55
Originality*	0.68	0.68	0.5	0.69	3.6	0.70	5.35
Generality*	0.30	0.31	0.89	0.32	2.54	0.35	4.98
N	4,085	793,547		65,245		2,550	

Notes. This table compares patents transferred to privateers with other ICT patents. Columns (1), (2), (4), and (6) report means. Columns (3), (5), and (7) report t-statistics for tests of differences in means. *Excluding observations with missing values.

3.3 Patent privateering and litigation

To shed light on the use of privateering transactions to assert patents, we now focus on the relationship between transfers to privateers and litigation. We analyze this association in a regression framework, using our sample of granted EPO patents in ICT.[18] We estimate a set of simple linear probability models based on the equation

[18] We focus on granted patents because a patent must be granted by the patent office to be litigated.

$$Lit_i = \beta_0 + \beta_1 Privateer_i + X_i\gamma + \varepsilon_i \quad (1)$$

where Lit_i is a binary variable equal to one if patent i is litigated at least once in the period 2010-2020, $Privateer_i$ is an indicator equal to one for patents transferred to privateers, X_i is a vector of control variables, β_0 is a constant, and ε_i is the error term. We multiply Lit_i by 100 for an easier interpretation of the coefficients, so a one-unit change in β_1 can be interpreted as a one-percentage-point change in the probability of litigation associated with privateering patents.

In all models, the vector X_i contains a set of grant year effects that control for differences in time at risk of litigation. Depending on the specification, it can also contain variables that control for systematic differences in patent characteristics that may be correlated with both privateering and litigation. One set of control variables includes patent characteristics that are fixed at the grant date. These include filing year effects, technology field effects, patent scope, number of backward citations to patent and non-patent documents, number of claims, and patent originality. We set originality to zero for patents with missing values and add a dummy variable equal to one for these patents. We also control for patent characteristics that are not fixed at the grant date, such as a SEP indicator, the number of forward citations received by the patent during the first 5 years since publication, and the patent family size. Although this latter set of variables may contain "bad controls" that could be affected by transfers to privateers, any impacts of privateering on these variables are likely to be small, as the vast majority of the transfers to privateers usually happen after the end of the five-year window from publication we use for forward citations, and patent treaties generally limit the ability of patent applicants to file foreign patent applications many years after the priority date. Anyway, the goal of these regressions is not to estimate the effect of privateering on litigation, but rather to test whether privateering is associated with litigation after we control for a large set of patent characteristics. To be clear, we think there are even more serious threats to a causal interpretation of our estimates than the impacts of the inclusion

of those "bad controls" that we do not address in this empirical exercise. As we explain above, transfers may happen because the original patent owner wants to enforce the patent through a privateer. This would lead to a reserve causality issue in our estimates, so we prefer to interpret our results as purely descriptive.

We then analyze the relationship between the timing of transfers to privateers and the timing of litigation as this can also help understand patent enforcement strategies that involve the use of privateers. We therefore proceed by estimating another set of linear probability models, constructing a panel dataset with observations at the patent-year level and exploiting information on the timing of transfers and litigation. These models are based on the equation

$$Lit_{it} = \beta_0 + \beta_1 PostPrivateer_{it} + \beta_2 Privateer_i + X_{it}\gamma + \varepsilon_{it} \tag{2}$$

where i indexes patents and t indexes calendar years. $Privateer_i$ is a time-invariant dummy variable equal to one for the patents transferred to privateers during the period 2010-2020 and $PostPrivateer_{it}$ is an indicator that switches once from 0 to 1 in the year of the transfer to a privateer. Lit_{it} is a binary variable equal to one in the first year patent i is ever litigated, and patents exit the estimation sample after the first litigation case. The coefficient β_1 can thus be interpreted as the percentage-point change in the litigation hazard associated with the transfer to a privateer. The vector of control variables X_{it} contains a set of age (defined as calendar year minus grant year) by calendar year effects to control for the baseline probability of litigation at different stages of the patent life cycles, allowing it to differ in different calendar years. We also estimate models that control for the same patent characteristics we use in the models based on Equation 1. As we do not have information on the exact timing of declarations of standard essentiality, forward citations, and family members' filings, we treat SEP status, forward citations and patent family size as time-invariant patent characteristics, estimating models with and without them to check whether their inclusion affects the results.

We estimate models based on Equation 2 only on patents granted between 2010 and 2020 to observe their entire assertion history since the grant date, and drop a small number of

patents transferred to privateers before 2010 to focus on transfers that happen during our sample period. As also these estimates may be affected by reverse causality (see above), we do not interpret them as representing the impact of privateering on litigation. Nevertheless, they may reveal an interesting association that improves our understanding of companies' patent assertion strategies.

To better understand the trends in litigation and their association with transfers to privateers, we also modify Equation 2 by substituting $PostPrivateer_{it}$ with a set of leads and lags of the privateering transfer indicator, estimating linear probability models based on

$$Lit_{it} = \beta_0 + \sum_{\tau=-5}^{5} \beta_\tau \mathbb{1}[t - T_i = \tau] + \beta_2 Privateer_i + X_{it}\gamma + \varepsilon_{it} \tag{3}$$

where T_i is the year patent i is transferred to a privateer and τ represents the year relative to T_i, so the β_τ's measure the percentage-point difference in the hazard of litigation between patents transferred to privateers and those that are not before (if $\tau < 0$) and after (if $\tau \geq 0$) the transfer. We use a single indicator if $\tau \leq -5$ and a single indicator if $\tau \geq 5$, and omit the $\tau = -1$ dummy to avoid collinearity between the β_τ's indicators and the $Privateer_i$ dummy.

3.3.1 Patent privateering and litigation: results

Table 4 displays the results of the linear probability models based on Equation 1. Model 1 includes only the indicator equal to one for patents transferred to privateers and the grant year effects as explanatory variables. Model 2 adds the control variables for patent characteristics that are fixed at the patent grant date, and model 3 also controls for SEP status, patent family size, and forward citations. In all models, patents transferred to privateers are about 0.8 percentage points more likely to be litigated. This represents an increase in the probability of litigation of roughly 600% from the mean probability of litigation in the estimation sample. As a robustness check, we estimate similar logistic regressions. The coefficient of the privateering indicator is statistically significant at conventional levels also in these models, with marginal effects indicating an increase of 0.47-0.77 percentage-points in the probability of litigation associated with the privateering indicator.

Table 4: Linear probability models of litigation

Outcome	Litigation × 100		
Model	Baseline	Controls fixed at grant	All controls
	(1)	(2)	(3)
Privateering	0.87***	0.82***	0.82***
	(0.18)	(0.18)	(0.18)
Grant year effects	✓	✓	✓
Control variables fixed at grant		✓	✓
Other control variables			✓
Observations	372,309	372,306	372,306
R-squared	0.00	0.00	0.01
Mean of outcome	0.14	0.14	0.14

Notes. The unit of observation is the patent. The sample contains granted EPO patents in ICT. All models are estimated with OLS regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Table 5 displays the results of the linear probability models of first litigation based on Equation 2. In model 1, we use as explanatory variables only the post-privateer-transfer dummy, the time invariant indicator for patents transferred to privateers, and the age-by-year and the grant year effects. We add the control variables for patent characteristics that are fixed at the patent grant date in model 2, and use the full set of control variables in model 3. Across all models, the transfer to a privateer is followed by an increase in the hazard of litigation of about 0.15 percentage points, a 750% increase from the mean probability of litigation in the estimation sample.

Table 5: Linear probability models of first litigation

Outcome	First litigation × 100		
Model	Baseline	Controls fixed at grant	All controls
	(1)	(2)	(3)
Post-privateering	0.16***	0.15***	0.15***
	(0.05)	(0.05)	(0.05)
Privateering	-0.02***	-0.02***	-0.02***
	(0.00)	(0.00)	(0.00)
Age-by-calendar-year effects	✓	✓	✓
Grant year effects	✓	✓	✓
Control variables fixed at grant		✓	✓
Other control variables			✓
Observations	1,263,131	1,263,125	1,263,125
R-squared	0.00	0.00	0.00
Mean of outcome	0.02	0.02	0.02

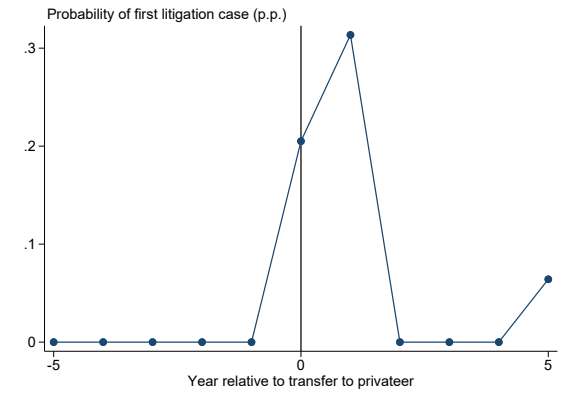
Notes. The unit of observation is the patent-year. The sample contains EPO patents in ICT granted between 2010 and 2020, excluding patents transferred to privateers before 2010. All models are estimated with OLS regressions. Robust standard errors in parentheses, clustered by patent. *** p<0.01, ** p<0.05, * p<0.10

In Figure 1, we plot the β_τ's and their 95% confidence intervals from three versions of Equation 5 that include, along with the time-relative-to-privateer-transfer indicators, the same control variables included in the three models in Table 5. In panel A, we also plot the mean probability of first litigation for the patents transferred to privateers in each year relative to their transfer. In all panels, we use a single group if $\tau \leq -5$ and a single group if $\tau \geq 5$. The increase in the hazard of litigation with the transfer to a privateer is already clear in panel A: before the transfer, there is no litigation activity for those patents, and there is a big spike immediately in the year of transfer to a privateer. This is already indicative of a strong association between the transfer and litigation. The other panels confirm this finding with regression estimates. There are multiple explanations for this finding. One is that the privateering transfer has an effect on litigation because a PAE has stronger incentives to monetize the patent. But we prefer to avoid a causal interpretation. A transfer to a privateer may already imply that the original patent owner has identified a target for a lawsuit and the privateer "attacks" immediately after the official change in ownership. Furthermore, privateers (and PAEs in general) often notify the patent office of the patent

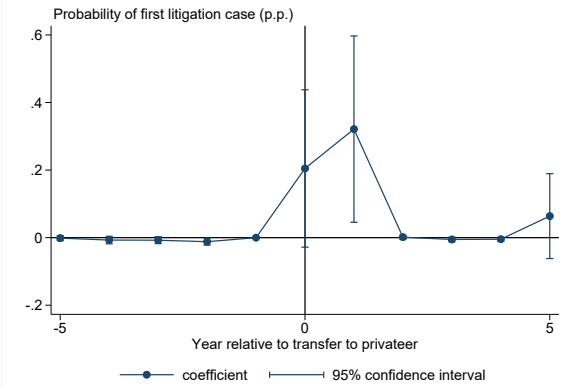
ownership change only immediately before going to court to show that they are the owners (Sterzi, 2021), so the timing of transfers in our data may not be exogenous. Interestingly, the increase in the hazard of litigation after the transfer to a privateer is only temporary, and we find no big difference between patents transferred to privateers and control patents starting in the time period $\tau = 2$.

Figure 1: Probability of first litigation around transaction to privateer

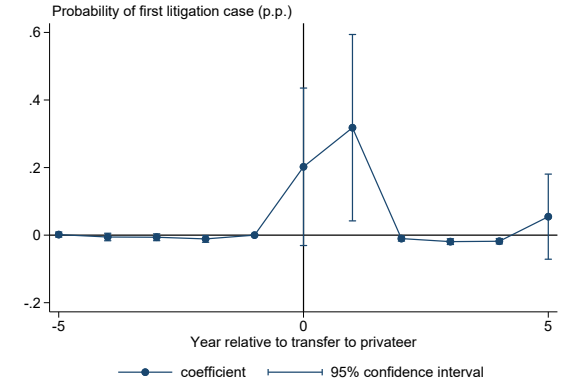
(A) Means



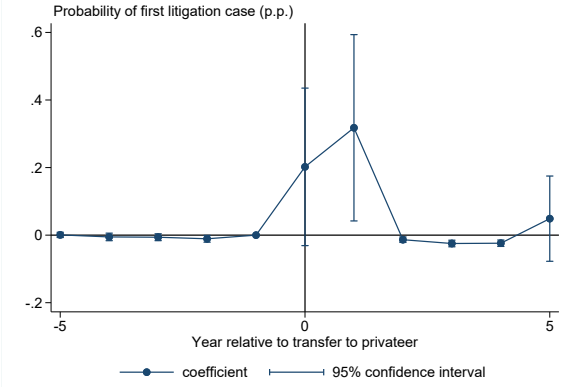
(B) LPM, baseline



(C) LPM, controls fixed at grant



(D) LPM, all controls



Notes. To produce this figure, we use the sample of EPO patents in ICT granted between 2010 and 2020, excluding patents transferred to privateers before 2010. In this sample, the unit of observation is the patent-year and patents exit the sample after the first litigation case. Panel A uses data only on patents transferred to privateers. Panels B, C, and D plot the β_τ's (solid line) and 95% confidence intervals (shaded area) from OLS regressions based on Equation 3.

4 Empirical analysis of the decision to use a privateer

In the analysis above, we show that the use of privateers is associated with an increase in the probability of litigation. In this section we focus on a related question: when is an operating company more likely to delegate litigation to a privateer instead of directly filing an infringement lawsuit?

4.1 Samples

As our interest is in the decision to delegate litigation of an operating company, in this part of the analysis we focus on litigation cases that involve ICT patents where the plaintiff is either an operating company or a PAE that is enforcing a patent that we classify as a privateering transfer. We therefore exclude from the analysis all infringement actions filed by PAEs that assert patents that we do not classify as transferred with a privateering agreement (238 cases) and cases where both a PAE and an operating company act as plaintiffs (65 cases). We use our litigation data to construct two main estimation samples. The first sample is a cross-section where an observation represents a litigation case. This litigation-case level sample contains 841 cases. The second sample is a cross-section at the litigation-case-patent level that contains 1,086 observations. Using this second sample allows us to include in the analysis more precise information on the characteristics of the patents asserted in a lawsuit.

4.2 Variables

In the analysis that uses the *litigation-case sample* our outcome variable (*Privateering*) is an indicator variable equal to one if at least one of the plaintiffs of the case is enforcing a patent that we flagged as a privateering case. We have 22 such cases (about 3% of our sample).

To analyze the delegation decision, we focus on some key patent or target company characteristics. Our key explanatory variables are a dummy variable for cases that involve at least one *SEP*, the largest international patent *family size* of the patents litigated in the case as a proxy for the economic importance of the most valuable patent enforced, and

two measures of competition between the operating companies that are asserting (directly or indirectly) the patents in the case and the alleged infringers. To compute the latter variables, we identify all defendant-operating-company pairs in the case (where an operating company is the operating company that directly asserts the patent or transferred the asserted patent to a PAE that acts as a privateer). Then, we use information on the NACE industry codes (taken from Orbis) of the companies in the pair and their business descriptions to define two variables. The first is an indicator equal to one if the companies in the pair are in the same industry, i.e. they have the *same NACE* core code. The second is a *business description similarity* for the companies in the pair. To compute it, we first process the business descriptions with the BERT algorithm, and then calculate the cosine similarity between the processed descriptions. For each case, we take the maximum of these competition variables, therefore measuring for each case whether there is a defendant in the same industry of one of the operating companies involved in the case and the similarity of the most similar operating-company-defendant pair in the case.

To control for systematic differences that may be associated with different assertion strategies, we also include in the analysis a number of control variables. These include the *country* and the *year* of the litigation case to control for systematic differences across jurisdiction and time, and the numbers of *plaintiffs*, *defendants*, and *patents* involved in the case to capture different dimensions of case "size" or importance. To control for differences related to the size of the patent portfolios of the parties involved, we also control for the *patent stocks of the operating companies and the defendants* in the case in the year of case filing, using information on the largest operating company and the largest defendant involved in the case, and taking natural logarithms (after adding one to include also observations for companies without patents).[19]

Table A1 reports summary statistics for this sample. Most cases involve only one defen-

[19]We compute the patent stocks assigning EPO patents to years using the filing date, using all patents filed by firms starting in 1990, and assuming a 15% patent depreciation rate and an 8% pre-sample growth rate of patents (Hall, 1990; Hall et al., 2005).

dant, one plaintiff, and one patent: the medians of these variables (and the unreported third quartiles) are equal to 1, and the means are just slightly higher than 1. About 8% of the cases involve at least a company pair in the same NACE industry. There is a SEP among the patents asserted in 16% of the cases. On average, the patent with the largest family size in each case has a relatively large international patent family (almost 10 family members). The operating companies that directly or indirectly initiate patent assertions have, on average, much higher patent stocks than the defendants. The (unreported) distribution of cases by country shows that almost 80% of these cases are filed in Germany, and 12% in France.

We add information at the patent level to construct our second analysis sample. To construct this sample, for each litigated patent in a case we collect information on patent scope (i.e. number of 4-digit IPC subclasses), grant lag (days between filing and grant), number of backward citations to patents and non-patent documents, number of claims, forward citations in a 5-year window from patent publication, originality (imputing a zero when this variable is not defined, and defining a dummy equal to one for those observations), and the age of the patent at the time of litigation filing (where age is computed as the number of years between filing year and litigation year). We also use the information at the case level (described above) on number of plaintiffs, defendants, and patents, as well as the patent stocks of plaintiffs and defendants. Similarly, we use the variables *same NACE* and *business description similarity* at the case level also in this sample. However, we use more detailed information at the patent level on *SEP*, *family size*, and on our outcome, the *Privateering* dummy, using only information on the focal patent to define these variables in this sample.

Table A2 reports summary statistics for this sample. As most litigation cases involve only one patent, the summary statistics for the variables that we have in both analysis samples are similar.

4.3 Specification

Our empirical analysis of the litigation data focuses on the association between the use of privateers to litigate patents and a number of key patent and case characteristics. Using the *litigation-case sample*, we estimate linear probability models based on the equation

$$Privateering_i = \beta_0 + \beta_1 Competition_i + \beta_2 SEP_i + \beta_3 MaxFamilySize_i + X_i\gamma + \varepsilon_i. \quad (4)$$

$Privateering_i$, SEP_i, and $MaxFamilySize_i$ are define above, $Competition_i$ is either the *same NACE* indicator or the *business description similarity* based on the text of business descriptions, X_i is a vector of control variables for the characteristics of case i, and ε_i is the error term. We multiply $Privateering_i$ by 100 for an easier interpretation of the coefficients β_1, β_2, and β_3 as percentage point changes.

Using the *litigation-case-patent sample*, we estimate similar linear probability models based on the equation

$$Privateering_{ip} = \beta_0 + \beta_1 Competition_i + \beta_2 SEP_p + \beta_3 FamilySize_p + X_{ip}\gamma + \varepsilon_{ip}. \quad (5)$$

$Privateering_{ip}$, SEP_p, and $FamilySize_p$ are define above, $Competition_i$ is again either the *same NACE* indicator or *business description similarity*, X_{ip} is a vector of control variables for the characteristics of case i and patent p, and ε_{ip} is the error term, which we cluster at the litigation case level. Also for these regressions we multiply the outcome by 100 for an easier interpretation of the coefficients.

4.4 Results

We show the results of the linear probability models based on Equation 4 in Table 6. Models 1 and 2 use the same NACE indicator as a measure of competition, while models 3 and 4 use the business description similarity, which we standardize before running our regressions, so an increase of one unit in this variable represents a one-standard-deviation increase in

description similarity. Models 1 and 3 use only our key case characteristics as explanatory variables. Models 2 and 4 include also the control variables.

The first two models show that the probability of using a privateer is more than 8 percentage points higher when defendant and operating company that wants to assert the patent are in the same industry. This represents an increase of more than 300% from the mean probability of privateer use in the estimation sample. We obtain similar results in models 3 and 4, where a one-standard-deviation increase in business description similarity is associated with an increase in the probability of using a privateer of more than 2 percentage points. All models also show that there is also a strong association between use of a privateer and litigation of a SEP: the magnitude of the coefficient of the SEP indicator slightly changes depending on the specification, but all models estimate an increase in privateer use of about 6 percentage points when the litigation case involves a SEP. Finally, the table shows a negative correlation between the size of the international patent family of litigated patents and the use of privateers. This is consistent with the idea that companies use privateers when they want to assert patents with relatively low economic importance.

Table 6: Linear probability models of privateering

Outcome	Privateering × 100			
Model	Baseline	Controls	Baseline	Controls
	(1)	(2)	(3)	(4)
Same NACE	8.85**	8.22**		
	(3.78)	(3.79)		
Business description similarity			2.51***	2.13***
			(0.95)	(0.79)
SEP case	6.30***	6.57***	5.67***	6.40***
	(2.15)	(2.16)	(2.08)	(2.17)
Max family size	-0.13**	-0.26***	-0.20***	-0.35***
	(0.06)	(0.09)	(0.07)	(0.11)
Control variables		✓		✓
Observations	746	746	650	650
R-squared	0.05	0.13	0.05	0.13
Mean of outcome	2.55	2.55	2.92	2.92

Notes. The unit of observation is the litigation case. All models are estimated with OLS regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Table 7 shows the results of similar regression models estimated using the litigation-case-patent level sample and based on Equation 5. The results are consistent with those above. The competition measures have similar coefficients, although their relationship with privateer use is estimated less precisely. The coefficients of the variables that we now measure at patent level within case (SEP and family size) are now even larger in magnitude, a result that is probably due to better measurement of patent characteristics for the (few) cases that involve multiple patents.

Table 7: Linear probability models of privateering

Outcome	Privateering × 100			
Model	Baseline	Controls	Baseline	Controls
	(1)	(2)	(3)	(4)
Same NACE	7.56**	7.38*		
	(3.73)	(4.10)		
Business description similarity			2.97**	2.36**
			(1.16)	(1.09)
SEP	9.97***	9.42***	8.91***	9.11***
	(3.62)	(3.33)	(3.23)	(3.49)
Family size	-0.28***	-0.50***	-0.37***	-0.64***
	(0.09)	(0.18)	(0.10)	(0.22)
Control variables		✓		✓
Observations	980	968	855	848
R-squared	0.07	0.21	0.07	0.22
Mean of outcome	3.27	3.31	3.74	3.77

Notes. The unit of observation is the litigation-case-patent. All models are estimated with OLS regressions. Robust standard errors in parentheses, clustered by litigation case. *** p<0.01, ** p<0.05, * p<0.10

In unreported analysis, we also add to the two samples observations that use information on 68 cases where both PAEs and PEs appear together as plaintiffs, treating these cases as cases of direct litigation of the operating company. The results are similar. Moreover, we estimate similar logit models, finding similar results.[20]

[20] In logit models with country and year fixed effects a significant number of observations would be excluded because some of these effects perfectly predict the use of a privateer. So we estimate simpler models that instead of those effects include a dummy for Germany and two dummies for the 2014-2016 and the 2017-2020 periods.

4.5 Retaliation

An operating company might want to delegate patent litigation to a PAE to "hide" its identity and decrease the probability of being counter-sued. Does this strategy work? To shed light on this question, in this section we estimate the association between using a privateer for litigation and retaliation by the defendants of the infringement case. To do that, we estimate models similar to those in Table 6, but use the privateering dummy as an explanatory variable. The outcome of these models is an indicator equal to one if one of the defendants files an infringement case against the original patent owner(s) (for privateering case) or the plaintiff(s) (when the patent owner does not delegate litigation) in the years following the focal litigation case. We use the same litigation-case sample used above.

The results are in Table 8 and show that delegation to a privateer is associated with a large decrease in the probability of a counter-suit. Unreported analysis that uses a sample at the litigation-case-firm-pair level or that use a different definition of the outcome, including also the year of the focal litigation case to capture counter-suits, produces similar results.

Overall, these models suggest that delegating patent litigation to a PAE is associated with a lower probability of being counter-sued. However, this analysis has important limitations. First, we do not have data on lawsuits in other countries. Second, our estimates do not take into account the fact that some patent owners may start using privateers when they change business model, e.g. when they start relying more on monetization and less on producing goods and services (and are therefore less likely to be counter-sued for infringement). Third, the transactions that we classified as privateering cases might actually include many case of simple transfers to PAEs that do not involve any privateering agreements. These case might drive our results.

Table 8: Linear probability models of counter-suit

Outcome	Countersuit × 100			
Model	Baseline	Controls	Baseline	Controls
	(1)	(2)	(3)	(4)
Privateering	-7.72***	-9.72***	-8.99***	-10.69***
	(1.84)	(3.07)	(1.90)	(3.35)
Same NACE	✓	✓		
Business description similarity			✓	✓
SEP	✓	✓	✓	✓
Family size	✓	✓	✓	✓
Other control variables		✓		✓
Observations	739	739	644	644
R-squared	0.01	0.20	0.01	0.22
Mean of outcome	5.28	5.28	6.06	6.06

Notes. The unit of observation is the litigation-case-patent. All models are estimated with OLS regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

5 Conclusion

This paper studies operating companies' delegation of patent enforcement to PAEs, also known as patent privateering. Although several anecdotes suggest this practice is widespread, the confidentiality of patent transfer agreements has limited researchers' ability to quantify and analyze this practice. By combining a list of operating-company-PAE privateering agreements and a new, simple approach to identify likely privateering agreements, we analyze the diffusion of this practice in the European ICT technology area and study the drivers of the use of a privateer for patent enforcement.

We find that patent privateering is widespread in our empirical setting, systematically different from other transfers to PAEs, and enforcement through a privateer is more likely to occur when the economic private value of the patent is relatively low, the patent has been declared essential for a technical standard, and the target of the patent infringement lawsuit is a competitor of the original patent owner. Our results suggest that patent privateering can be a strategic and anti-competitive tool employed by some operating companies. The sponsor's benefits in fact may be not limited to the licensing fees that can be obtained through

the PAE's assertion activity, but can also derive from the changed competitive environment brought by the patent privateer's activity.

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Online Appendix

Table A1: Litigation-case level sample

Variable	N	Mean	SD	Min	Median	Max
Privateering	841	0.03	0.16	0.00	0.00	1.00
Same NACE	746	0.08	0.28	0.00	0.00	1.00
Max business description similarity	650	0.35	0.13	0.06	0.33	0.81
SEP case	841	0.16	0.36	0.00	0.00	1.00
Max family size	841	9.73	5.17	1.00	9.00	28.00
Year	841	2015.06	3.02	2010.00	2015.00	2020.00
Defendants	841	1.35	0.87	1.00	1.00	10.00
Plaintiffs	841	1.07	0.48	1.00	1.00	7.00
Patents	841	1.29	1.10	1.00	1.00	16.00
Max patent stock, operating companies	841	915.09	1913.18	0.00	120.84	8999.78
Max patent stock, defendants	841	429.05	790.83	0.00	2.70	5473.70

Notes. The unit of observation is the litigation-case.

Table A2: Litigation-case-patent level sample

Variable	N	Mean	SD	Min	Median	Max
Privateering	1086	0.03	0.18	0.00	0.00	1.00
Same NACE	980	0.09	0.29	0.00	0.00	1.00
Max business description similarity	855	0.36	0.13	0.06	0.35	0.81
SEP	1086	0.17	0.38	0.00	0.00	1.00
Family size	1086	9.47	4.98	1.00	8.00	28.00
Year	1086	2014.67	3.02	2010.00	2015.00	2020.00
Filing year	1086	2001.08	5.46	1982.00	2001.00	2016.00
Patent scope	1086	2.29	1.42	1.00	2.00	9.00
Grant lag	1069	2398.22	1153.70	335.00	2246.00	6553.00
Backward patent citations	1086	5.99	5.65	0.00	4.00	40.00
Backward non-patent lit. citations	1086	1.93	4.54	0.00	0.00	72.00
Claims	1085	16.21	12.49	0.00	14.00	147.00
Forward citations (5 years)	1086	4.44	10.57	0.00	1.00	104.00
Originality	1086	0.68	0.23	0.00	0.76	0.95
Originality, missing value dummy	1086	0.04	0.19	0.00	0.00	1.00
Defendants	1086	1.35	0.86	1.00	1.00	10.00
Plaintiffs	1086	1.24	1.07	1.00	1.00	7.00
Patents	1086	2.22	2.88	1.00	1.00	16.00
Age	1086	13.59	4.64	2.00	14.00	31.00
Max patent stock, operating companies	1086	1024.90	1922.06	0.00	165.93	8999.78
Max patent stock, defendants	1086	490.86	855.39	0.00	3.44	5473.70

Notes. The unit of observation is the litigation-case-patent.

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