



# Revisiting the consequences of loans secured by patents on technological firms' intellectual property and innovation strategies

Cécile Ayerbe<sup>a,\*</sup>, Jamal Azzam<sup>b</sup>, Selma Boussetta<sup>c</sup>, Julien Pénin<sup>d</sup>

<sup>a</sup> Université Côte d'Azur, CNRS, GREDEG, 250 rue Albert Einstein - CS 10269, 06905 Sophia Antipolis Cedex, France

<sup>b</sup> Université Toulouse 1 Capitole, TSM Research (UMR 5303 CNRS), Université Toulouse 1 Capitole/Toulouse School of Management, 2, rue du Doyen Gabriel Marty, 31042 Toulouse Cedex 9, France

<sup>c</sup> Université de Bordeaux, BSE, Avenue Léon Duguit, 33608 Pessac Cedex, France

<sup>d</sup> Université de Strasbourg, Université de Lorraine, CNRS, BETA, F- 67000 Strasbourg, 61, avenue de la Forêt Noire, 67085 Strasbourg Cedex, France

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## ABSTRACT

This article analyzes the impact of loans secured by patents (LSPs) on the intellectual property and innovation strategy of technological firms that benefit from them. The literature mostly emphasizes that LSPs, by reducing the risk taken by lenders in case of borrowers' default, facilitate the financing of technological firms. However, it remains silent on the impact of LSPs on the behavior and strategy of borrowers. With regard to this second point, our research suggests that LSPs are not neutral. In particular, we provide evidence that LSPs might induce technological firms to deviate from innovative activities toward more short-term strategies based on the monetization and litigation of their patents. We also show that financing groups might attempt to encourage this strategic change. Our research is based, first, on empirical insights provided by a qualitative analysis of publicly known LSPs offered by an international investment group and their consequences for four borrowers. Second, we propose a theoretical model that formally explores how LSPs might impact borrowers' strategies. Even though the welfare implications of these findings are difficult to evaluate, this research has likely important economic and managerial implications with regard to intellectual property management, the financing of innovation and the organization of the innovation process.

## 1. Introduction

The financing of risky innovative activity is a central issue in our modern knowledge economies. The entrepreneurial finance landscape is experiencing important changes, with the emergence of new forms of financing, mainly based on debt ventures, that are complementary to the more traditional ones such as business angels and venture capital (Wright et al., 2016). Given the growing importance of these new forms of financing, understanding their implications for innovative activities is a key challenge. Their interactions with intellectual property, and patents in particular, might be particularly interesting. Indeed, since financing institutions are usually reluctant to invest in projects that are too uncertain, it has been shown that patents can help technological firms attract funding more easily. In particular, as summarized by Hall (2019), patents can 1) improve the expected rentability of technological firms by reinforcing their technology appropriability; 2) provide an

external signal about the quality of the project; and 3) increase the salvage value of the firm when it fails. In this last possibility, loans secured by patents (LSPs) play a central role as a funding mechanism that avoids the dilution of borrowers' equity.

As explained by Fischer and Ringler (2014, p. 635), “in general, a loan is a financing relationship in which a lender cedes a borrower a specific amount of money for a limited period of time and, in turn, receives interest payments. In order to reduce their risk in the financing relationship, lenders usually request, among other contractual clauses, that the loan be secured by collateral... Most importantly, if the borrower fails to pay the principal and interest, the lender can seek relief in the collateral”. In the case of LSPs, the collateral is made off borrowers' patents. The economics and management literature shows that LSPs have the potential to mitigate risks associated with loans and therefore to facilitate access to financing for technological firms (Hochberg et al., 2018; Mann, 2018). This point is perfectly summarized by Hall (2019, p. 659): “one obvious reason that an

\* Corresponding author.

E-mail addresses: [Cecile.AYERBE@univ-cotedazur.fr](mailto:Cecile.AYERBE@univ-cotedazur.fr) (C. Ayerbe), [jamal-eddine.azzam@tsm-education.fr](mailto:jamal-eddine.azzam@tsm-education.fr) (J. Azzam), [selma.boussetta@u-bordeaux.fr](mailto:selma.boussetta@u-bordeaux.fr) (S. Boussetta), [penin@unistra.fr](mailto:penin@unistra.fr) (J. Pénin).

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investor might prefer a patented idea to a similar unpatented idea is the possibility to limit losses in case of failure". However, the literature usually neglects the impact of LSPs on borrowers' strategies, thus making the implicit assumption that LSPs do not significantly modify the intellectual property management and innovation strategy of technological firms. More generally, this reflects the fact that the literature has mostly focused on the lender's side, analyzing their expectations and rights, and has largely underinvestigated the impact on borrowers.

In regard to this situation, this article aims to deepen our understanding of the consequences of LSPs by focusing on the borrower's side. We seek to understand whether LSPs, in addition to easing access to financing, might modify borrowers' patent and innovation strategies. In particular, we analyze the possibilities that LSPs induce technology companies to prefer short-term strategies based on the litigation and monetization of their patents instead of long-term strategies based on internal innovation development. In addition to this focus on borrowers, we study how lenders might use LSPs to encourage this strategic change. Analyzing this issue is highly relevant since LSPs and patent monetization strategies are rarely explored together.

Our research is based on a mixed methodology. First, we conduct an empirical qualitative analysis of publicly known LSPs offered by an international investment group, as well as the consequences of these LSPs on four technology companies that have benefited from them. Second, we propose a theoretical model that analyzes the relationship between LSPs and the strategy adopted by borrowers. Our empirical insights suggest that 1) LSPs can be explicitly designed to influence borrowers' strategies and 2) borrowers' patent and innovation strategies change after obtaining the LSP. According to a diverse set of indicators (licensing revenues, patent litigations, board composition, semantic analysis of firms' communication, etc.), borrowers appear to be moving away from industrial and innovation product development activities toward more short-term ones based on immediate patent monetization and litigation. These empirical findings are in line with the theoretical predictions of our analytical model.

This research, which combines the literature on finance, innovation and intellectual property, might have important management and policy implications. It illustrates the growing interplay between finance and intellectual property, especially for technological firms that operate in markets for technology (Arora et al., 2001). Particularly, it shows how the financing of innovative activities might not be neutral with regard to the innovation strategy of technological firms. It also shows how some investment companies might be tempted to use LSPs to promote business models that are based on patent monetization. Even though the welfare implications of our findings are difficult to evaluate (and are not studied in this paper), it is likely that if the strategies emphasized in this research were to be adopted at a large scale by financial groups, the impact on the innovation process could be significant.

The remainder of this paper is organized as follows. In the next section, we review the recent literature on LSPs (Section 2.1) and examine the patenting strategies of technological firms and non-practicing entities (Section 2.2). Section 3 describes the empirical design and strategy. Section 4 presents and discusses our main empirical results. Section 5 proposes a theoretical model that formalizes the empirical findings. Section 6 concludes.

## 2. Theoretical background

### 2.1. Loans secured by patents

#### 2.1.1. Importance of the phenomenon

The practice of using the collateral value of intellectual property (IP) to secure financing is not a recent phenomenon. For instance, in the late 1880s, Thomas Edison used his patent on incandescent electric light as collateral to finance the creation of his company (Baldwin, 1995; Jacobs, 2011). However, various studies indicate that this practice has significantly increased in recent decades. Fischer and Ringle (2014) found

that 245,074 patents were used as collateral in 33,293 distinct security agreements between 1983 and 2006 and that approximately, on average, one out of every 8.5 patents granted is collateralized. Hochberg et al. (2018) showed that among 1519 start-ups with patents, 36 % received venture debt. Marco et al. (2015) analyzed USPTO patent assignment data between 1970 and 2014. They found that the number of patents pledged as collateral to secure debt significantly increased in the past three decades, both in absolute terms and relative to the stock of patents-in-force, and that approximately 90,000 patents per year were pledged as collateral in 2009, 2010, and 2013. In another study, Mann (2018) reported that 38 % of US patenting firms in 2013 had previously pledged patents as collateral. Recent estimations indicate that the number of patents recorded by the USPTO as having ties to a "security interest" or "security agreement" doubled between 2016 and 2019 (Financial Times, JUNE 18, 2020<sup>1</sup>).

#### 2.1.2. LSPs and the funding of innovative firms

The economic importance of the phenomenon has attracted academic attention and led to the emergence of a still modest but growing literature, which has mostly studied the link between LSPs and the financing of innovation. Indeed, the financing of technological firms operating in high-tech industries is a problematic issue due to the multiple uncertainties characterizing them (Hall and Lerner, 2010). In addition to technological and commercial uncertainties, funders often face opportunistic behavioral risk. Information asymmetry frictions between technological firms and funders might lead classical funders such as banks to reduce their debt financing. In this case, the use of funded firms' assets as collateral has the potential to mitigate these opportunistic risks (Stiglitz and Weiss, 1981; Holmstrom and Tirole, 1997; Fischer and Ringle, 2014; Hall, 2019). However, the effectiveness of such a strategy is based on the possibility for lenders to liquidate the collateralized assets by reselling them to other actors (Williamson, 1988). For this reason, traditional lenders such as banks have a strong preference for tangible collateral (such as real estate, plants or machines), which is more readily marketable than intangible assets such as patents (Fischer and Ringle, 2014). This preference is problematic, especially for financing startups since many of them do not hold tangible assets and rely mainly on intangible assets. The consequence is a possible underutilization of patents as collateral by traditional actors and a call for a revision of this likely suboptimal situation.

Nevertheless, various factors favor the acceptance of patents as collateral by lenders (Hochberg et al., 2018; Mann, 2018; Zhang et al., 2021). First, patents are recognized as an increasingly important element of firms' assets, especially for those operating in high-tech industries (Teece, 1986, 2006; Pitkethly, 2001; Blind et al., 2006). As explained by Baldwin (1995, p. 1704), "as the value of IP has risen, so has the value of having IP available for financing purpose". Second, legal evolution favored lenders and their control rights on collateralized patents. When patents are included as collateral in the debt agreement, lenders can record the security interest in the patent office to establish secured-lender status and make sure that they are first in line to be paid if patents are liquidated and, by doing so, recover their debt (Mann, 2018; Hochberg et al., 2018; Ma et al., 2022). Third, the development of markets for technology facilitated the trade of patents between firms, thus increasing the redeployability of collateralized patents in case of default (Fischer and Ringle, 2014; Hochberg et al., 2018). Last but not least, the rise of LSPs also benefited from the development of the venture capital (VC) sector. Indeed, VC acts as a "certification agent" to less informed investors by signaling the quality of potential borrowers and by providing the latter with strategic advice to help them grow and be able to repay their loans (de Rassenfosse and Fischer, 2016). VC and LSPs therefore seem to be complementary since debt helps avoid equity

<sup>1</sup> <https://www.ft.com/content/0b0e09b0-9362-11ea-899a-f62a20d54625> (Consulted online January 24, 2023).

dilution for both investors and entrepreneurs (Ibrahim, 2010; Hesse and Lutz, 2016).

### 2.1.3. A focus mostly on lenders

The literature treats the phenomenon of LSPs in an unbalanced way since much of the emphasis tends to be placed on lenders, their lending decisions and their rights in cases of default. For instance, in one of the most influential studies on LSPs to date, Fischer and Ringle (2014) investigated how lenders consider the “full potential of patents as collateral”. They distinguished between two basic components of a patent that determine its liquidation value: technological value (i.e., selling the collateralized patent to an industrial company operating in the same field to use the underlying technology to profit from innovation by offering a product or service) and exclusive legal value (i.e., selling the collateralized patent to a non-practicing entity looking for generating royalties by enforcing the exclusion right against potential infringers). The results show that although the technological value of a patent is positively related to the likelihood of accepting that patent as collateral, lenders tend to neglect the exclusion right value. This might lead to underexploiting the full liquidation value of patents (thus leading to a possible underutilization of patents as collateral, as mentioned in the previous subsection). In another study, de Rassenfosse and Fischer (2016) analyzed the decision criteria used by venture debt lenders in the United States and found a strong preference for start-ups holding patents. Furthermore, they show that the effect of offering patents as collateral on financing startups is as strong as the effect of offering tangible assets as collateral.

In line with these findings, Hochberg et al. (2018) focused on lenders' expectations of the collateral salvage value and found that these expectations depend on two interrelated factors: (1) the trading conditions in the secondary market for collateral assets and (2) whether the assets pledged are firm-specific or redeployable. Furthermore, Caviggioli et al. (2020) showed that more valuable patents (i.e., younger patents with higher technical merit and a wider technological scope) have a higher likelihood of being used as loan collateral than relatively less valuable patents. They also found that lender characteristics positively affect the likelihood of a pledge: in comparison to traditional ‘Banks’, “Specialty finance companies” exhibit a higher aptitude to identify “good borrowers” and to develop patent-backed security agreements thanks to their ability to evaluate the potential of the pledged technological assets. In another study, Zhang et al. (2021) investigated the influence of prior art cited by patents (to measure the degree of novelty of a patent) on acceptance decisions by lenders. Using data on U.S. firms operating in the semiconductor industry, they found an inverted U-shape relationship between the degree of novelty of a patent and the likelihood that it will be used as loan collateral, thus suggesting that lenders are less likely to accept patents as collateral if they perceive higher uncertainties in terms of inventions' potential commercial values (patents linked to too recent inventions) or in terms of technological obsolescence (patents linked to too old inventions) (Zhang et al., 2021).

In contrast to this already abundant literature, a relatively small body of literature has focused on LSPs from the perspective of borrowers. Yang et al. (2021) explored the effect of firm attributes (age, patent scale and technological competitiveness) on patent pledges by studying a panel of Chinese startups from 2006 to 2015. They found an inverted U-shaped relationship between the borrower's age and the probability of contracting LSPs. In another recent study, Ma et al. (2022) found that in the case of bankruptcy, innovative firms tend to sell off core (technologically critical and valuable) rather than peripheral patents. Regarding the impact of LSPs on funded firms, existing works have highlighted various positive outcomes. In their study, Hochberg et al. (2018) showed that start-ups can use this funding channel to lengthen the venture capital cycle. Similarly, Mann (2018) found that the use of patents as collateral facilitates both financing and investment for innovative firms. More interestingly, he showed that the increase in investment also led to a subsequent increase in innovation productivity

measured by the number of new patent applications filed. In line with this result, others found that high-tech startups that benefit from LSPs witness an increase in employment and innovation performance measured by patent quantity and quality (Appel et al., 2019).

## 2.2. Technology firms' patenting strategies and non-practicing entities

### 2.2.1. Licensing or not licensing: the “Profiting From Innovation” framework

For at least two decades, patenting licensing practices have attracted abundant attention in the literature (Arora et al., 2001, 2004; Arora and Gambardella, 2010). Some authors have insisted on the importance of licensing for large industrial companies, which must “Unlock the hidden value of patents” and not leave their “Remnants in the attic” (Rivette and Kline, 2000). However, the literature has mostly highlighted the importance of licensing practices for technological firms (start-ups, sometimes also called “fabless firms” because they have no manufacturing activity), which are specialized upstream in the production of knowledge and technology. Thanks to the development of markets for technology, technological firms can specialize in the production of new knowledge, protect it with patents and directly license it to downstream manufacturing firms (Arora and Merges, 2004).

An important trade-off faced by technological firms early in their development is whether they should opt for a manufacturing strategy or a licensing strategy. In the first case, the objective of the firm is to develop its technology to transform it into a manufacturing product that it can then sell in the market. In the second case, the firm develops its technology only up to a certain point and then licenses it to an existing manufacturing firm.<sup>2</sup> In this strategic decision, financial constraints and access to complementary assets are key variables (Teece, 1986). First, the existence of a tight financial constraint obviously mitigates the possibility of technological firms engaging in long-term costly manufacturing investments, thus pushing them toward licensing. Second, according to Teece's seminal “Profiting From Innovation” framework, without access to complementary assets, technological firms, even those protected by strong patents, will find it very difficult to appropriate the entire value of their technology. However, complementary assets are usually difficult to develop or acquire rapidly since they are often the outcome of long-term specific investments (a specific production capacity or trademark) and/or long-term ongoing relationships that create mutual trust (for instance, with suppliers or distributors).

The “Profiting From Innovation” framework (Teece, 1986, 2006) predicts that when technological firms are able to invest in complementary assets and have strong patents, then they can opt for a manufacturing business model and hope to appropriate a significant share of the value of their technology. In contrast, provided that they hold strong and monetizable patents, they can license their technology to a manufacturing firm and will therefore have to share the value of their invention. These predictions are in line with Gans and Stern (2003), who find that technology startups lacking complementary assets are more likely to ally with incumbents as soon as complementary assets are costly to acquire. It is also in line with Shane (2001), who finds that specialized complementary assets increase the likelihood that technology is developed internally. Similarly, Arora and Ceccagnoli (2006) find that more effective patent protection increases the probability of licensing for firms that lack specialized complementary assets but not for firms that possess them.

### 2.2.2. Licensing and non-practicing entities

When a technological firm embarks on a licensing strategy, it faces significant transaction costs. The business of licensing requires specific financial and legal skills, which technology companies seldom possess.

<sup>2</sup> It is important to highlight that firms can switch their strategies from licensing to manufacturing and vice versa (Leiponen and Delcamp, 2019).

As a result, the rise of licensing practices has been accompanied by the emergence of intermediary players, patent brokers, also often called NPEs (for non-practicing entities), whose role is to help reduce transaction costs to encourage the completion of mutually beneficial technology transactions between technology and manufacturing firms (Benassi and Di Minin, 2009; Dushnitsky and Klueter, 2011; Hagi and Yoffie, 2013; Abrams et al., 2019).

These market intermediaries are consulting firms composed of experts in IP evaluation, transaction and litigation and specialized in technology transfer, and more specifically in IP transfers. In a context in which information about inventions is far from perfect, uncertainty about the financial value of inventions is high and knowledge transactions are complex, patent brokers help identify promising technologies and design the legal contracts and financial terms to transfer them to the firms that want them the most. Specialized in IP litigation, they also remove the burden of IP litigation from R&D companies, and they provide a credible threat of litigation in case manufacturing firms would like to free ride on technological firms (McDonough, 2006; Shrestha, 2010). These NPEs thus position themselves in a complementary way to technological firms since they help them promote their technology and to complete licensing deals.

However, technological firms that, despite the support of brokers, would not succeed in licensing their technology may be tempted to embrace another type of NPEs, namely, patent trolls. Present in the innovation landscape for two decades, patent trolls are, at first glance, very similar to patent brokers since they do not conduct manufacturing activity and are involved in the business of patent monetization.<sup>3</sup> However, their business models are very different. Unlike pure brokers, patent trolls are not interested in ex ante licensing. Instead, they use the weapon of patent litigation and hold-up to force manufacturing companies to pay disproportionate financial compensation (Reitzig et al., 2010).

The notion of hold-up is essential to grasp trolls' strategies. A firm is trapped in a hold-up position when after having made significant sunk investments, it faces a threat of injunction from a patent holder (Lemley and Shapiro, 2006). Since the manufacturing firm has already invested and since the investment is sunk, the firm can hardly stop its activity, which places it in a very uncomfortable and unbalanced position to negotiate patent licenses. The aim of patent trolls is therefore to provoke hold-up situations to artificially increase the value of their patents. Hold-up situations are favored by the low quality of patent information, which makes freedom to operate analysis too expansive and largely inefficient (Menell and Meurer, 2013; Pénin and Neicu, 2018). This allows patent trolls to capture a share of the value much higher than the intrinsic value of the technology they own (Lemley and Shapiro, 2006; Shapiro, 2010).

Patent brokers and patent trolls depict two very different kinds of NPEs. They are both involved in licensing and patent monetization activities but in very different ways. Brokers are actively seeking to enter into licensing agreements. Trolls are seeking to provoke hold-up and litigations. Brokers do not hide; trolls do. In other words, it is not monetizing its patents that makes patent brokers and patent trolls different but the way they do so. In practice, this makes the distinction between patent trolls and patent brokers very difficult.

<sup>3</sup> Even though the business models of trolls are quite heterogeneous (Pohlmann and Opitz, 2013; Leiponen and Delcamp, 2019), recent literature emphasizes many characteristics of patent trolls: they have a targeted patent buyout strategy (Fischer and Henkel, 2012), i.e., they focus on sectors in which the likelihood of counterfeiting is high, such as electronics, telecommunications or software. Within these sectors, they buy patents with broad scope and coverage (Fischer and Henkel, 2012). When suing manufacturing firms, trolls target companies with important liquidity and/or those that are likely to encounter difficulties in defending themselves legally (Cohen et al., 2019).

### 2.2.3. The uncertain welfare implications of patent monetization and NPEs

Since the activities of licensing and patent monetization of NPEs are booming in many sectors, it is essential to pay attention to their welfare implications. To do so, it is necessary to distinguish between licensing activities performed by technological firms, eventually assisted by patent brokers, and those performed by pure patent trolls. In a simple theoretical model, Pénin (2012) showed that technological firms and patent brokers, in their pure form, are market makers and thus welfare enhancers, while patent trolls, in their pure form, imply a net loss of welfare. However, in practice, this theoretical result is of little value because it is hardly possible to distinguish between pure trolls and others. Therefore, to date, to the best of our knowledge, there is no clear evidence on the welfare implication of patent monetization and NPEs, taken as a single block.

NPE's advocates focus on the good properties of brokers and tend to neglect the harmful effects of patent trolls. They argue that NPEs sustain the emergence and growth of technological firms specialized in knowledge production by making markets for technology more flexible and liquid and by providing credible threats of litigation in case of infringement (McDonough, 2006; Maglioca, 2006; Golden, 2007; Shrestha, 2010). NPEs allow vertical specialization between small and large companies along the innovation value chain (Arora et al., 2001). They would also contribute to "policing" large corporations and force them to more carefully respect the patents held by small firms and independent inventors (Fischer and Henkel, 2012). In other words, NPEs would be white knights that provide capital, expertise and bargaining power to litigate and force manufacturing firms to offer better financial compensation to technological firms and independent inventors (Shrestha, 2010).<sup>4</sup>

On the other hand, NPEs' detractors highlight the exorbitant costs associated with patent litigations (Smeets, 2014; Tucker, 2014; Cohen et al., 2016). The results from large-sample evidence suggest that NPEs act opportunistically by targeting firms that have a reduced ability to defend themselves, which is hardly compatible with the white knight argument (Cohen et al., 2019). A report by the White House (White House patent report, June 4: Executive Office of the President, 2013) showed that disputes caused by NPEs tripled between 2011 and 2013, from 29 % of all patent litigation in the United States to 62 %. Additionally, in 2012, NPEs sued approximately 100,000 companies in the United States. Furthermore, Bessen et al. (2011) have shown that over the period 2007–2010, US manufacturers spent more than \$83 billion, or the equivalent of more than a quarter of US annual R&D spending, on deals against NPEs. Some authors do not hesitate therefore to speak of an innovation tax imposed by NPEs. Beyond litigation costs, survey evidence indicates that litigation by NPEs majorly influences small firms' decisions, such as delaying hiring new employees (Chien, 2014). Analyzing the impact of NPE litigation on incremental innovations, Tucker (2014) found that sales declined by one-third during the period of litigation and that this decline was not the result of a suppression of demand by customers. Similarly, Smeets (2014) found that in the case of small firms, R&D intensity decreased (4.7 % to 2.6 %) after litigation with NPEs, and Cohen et al. (2016) found that firms on average reduced their R&D investment by >25 % after settling with NPEs.

<sup>4</sup> However, some authors warn that this argument largely depends on the bargaining power between NPEs and technological firms. Indeed, the benefits for technological firms may be low if their bargaining power vis-à-vis NPEs is limited. In this case, as argued by Haus and Juranek (2018) "the trade surplus will mainly be captured by NPEs, and the effect on innovation incentives will be low". In line with this warning, empirical evidence provides little support for the idea that there is a revenue flow from NPEs to technological firms. Bessen et al. (2011) and Bessen and Meurer (2014) estimated that only 5 to 10 % of damages paid to NPEs are transferred to original inventors. Other studies did not find any indication of a significant increased effect of NPEs on innovation by small innovators (Fischer and Ringle, 2014; Cohen et al., 2019).

To summarize, our research bridges two streams of literature, namely, LSPs and NPEs. In the next sections, we explore whether and how LSPs might alter the patent strategies of technology borrowers who benefit from them and, eventually, turn them toward NPEs and patent monetization. This intuition is guided by findings in entrepreneurial finance showing that the financing mode (venture capital, for instance) is not neutral and directly influences the strategic behaviors of funded companies (de Rassenfossé and Fischer, 2016; Wright et al., 2016).

### 3. Empirical design

#### 3.1. Research setting

Our empirical research relies on a single case study of the “revealing” type in the sense that it explores new and undocumented phenomena (Yin, 2009). A single case is recognized for its potential to richly present the existence of a phenomenon and for its persuasive power (Siggelkow, 2007, p. 20). Our research setting is an investment company “INVESTOR” specialized in LSPs as well as four technological firms that benefited from these LSPs.<sup>5</sup>

Created in the late 1990s, “INVESTOR” is a leading investment firm that manages more than \$45 billion assets for almost 2000 clients, which are both private investors and institutions. With >850 employees and several offices, “INVESTOR” conducts worldwide investment activities such as credit and real estate, private equity, and permanent capital investment strategies in various sectors such as transportation, energy and healthcare. Subsequently, convinced by the importance of the company’s intellectual property, “INVESTOR” started to support risky innovative activities, acquire several patent portfolios and gain expertise in patent monetization and licensing operations. “INVESTOR” first funded NPEs such as IPCOM and Marathon Patent Group, either through equity investment or LSPs. Then, it used similar funding sources with practicing entities and created its own subsidiaries in charge of patent monetization. Currently, “INVESTOR” develops sophisticated financing mechanisms involving interest repayment clauses based on patent licensing income or even patent licensing income sharing in some cases. In the event of default or inability to reimburse, the ownership of patents used as collateral is systematically transferred from the borrower to “INVESTOR”, which becomes the sole owner and beneficiary of intellectual property rights. This LSP strategy has enabled “INVESTOR” to control approximately two thousand patents and has reinforced its patent acquisition strategy. “INVESTOR” orchestrates its own patent monetization and litigation activities thanks to its patent portfolio built from patent acquisitions and LSP recovery. These monetization activities are mostly carried out via entities controlled by “INVESTOR”. They target well-known large companies such as Apple, HTC, Intel and ZTE. By 2020, numerous patent lawsuits involving “INVESTOR” and its affiliated entities had been identified.<sup>6</sup>

Our empirical analysis focuses on technological firms that have contracted LSPs with “INVESTOR”. We searched “INVESTOR”’s annual reports as well as the WWW as a first source. We found fourteen financial agreements involving “INVESTOR”. After analyzing the activity of each company when signing the financing agreement, we identified eight technological firms that we considered not to be NPEs at the time of the loan. Then, we eliminated the firms that were not exclusively funded by LSPs and that were not publicly traded.<sup>7</sup> We ended up with four technological firms that benefited from LSPs from “INVESTOR”: Firm A and

Firm B obtained LSPs in 2013, and Firm C and Firm D obtained LSPs in 2014. Table 1 provides information on these four firms and LSP deals.

#### 3.2. Data collection and methodology

For each firm, we collected information about strategic choices, resource allocation and financial results from their annual reports as well as many publicly available sources, such as public complaints for patent infringement, press releases and press articles published by specialized media. We also consulted the websites of these firms (analyzed longitudinally using [archive.org](https://archive.org)) and the content of their communication public supports. Finally, we used the RPX<sup>8</sup> database to collect information about patent litigations over the period 2011–2016. This database contains systematic and verified data on patent litigation since 1977 (Bessen et al., 2011; Cohen et al., 2016; Joshi and Hemmatian, 2018). Finally, we analyzed the terms of the LSP contracts passed between “INVESTOR” and the four technological firms. In total, nearly one hundred documents were referenced and analyzed (see Table 2).

In addition to these publicly available data, we conducted interviews with experts in the field. Due to the sensitivity and confidentiality associated with intellectual property issues, especially when legal litigations are concerned, it was not possible to conduct interviews with insiders such as top managers at “INVESTOR” or at the funded firms. As an alternative, we interviewed three outside observers, all experts in patent monetization and IP financing, including one former board member of one of the studied technological firms. These informants were guaranteed anonymity and confidentiality.

The wide range of archival and publicly available data allowed an in-depth analysis in the form of *ex ante* and *ex post* comparisons of the activity of the four technological firms. To observe eventual strategic changes toward patent monetization and litigation activities, we used a set of criteria in line with our theoretical understanding and with the literature on NPEs (Reitzig et al., 2010; Fischer and Henkel, 2012; Leiponen and Delcamp, 2019). These criteria are (i) evolution of product and service operations and revenues; (ii) evolution of revenues from patent monetization; (iii) legal aggressiveness (as measured by the number of lawsuits); (iv) evolution of R&D expenses; (v) evolution of IP expenses; and (vi) evolution of financial performance (as measured by the return on equity (ROE) and the return on assets (ROA)). In addition to these standard criteria, we used two original metrics: the evolution of funded firms’ communication and the evolution of the composition of their board of directors.

First, regarding firms’ communication, we performed a content analysis of annual reports. Content analysis in social sciences assumes that agents’ attention can be captured by the words they use (Fiske and Taylor, 1982; Sapir, 1944; Whorf, 1956). Many organizational scholars promote text content analysis (annual reports, letters to shareholders, etc.) to capture the attention of top managers, as a “word provides an indicator of the direction of attention, and the frequency of the words’ used an indicator of the intensity of attention” (Abrahamson and Hambrick, 1997, p.519). Firms’ annual reports are available in a standardized form, thus making them a valuable and comparable source of information over time. We used computer-aided text analysis (CATA) (namely, the open-source software Iramuteq) to analyze these reports and to measure the frequency of words. Particularly, we investigated the section entitled “Business and strategy” to understand the evolution of the key strategic orientations of each company. We proceeded in two steps. First, two of the authors independently coded the CATA results to create a dictionary of themes grouping words that are homogeneous in

<sup>5</sup> We have changed the names of the firms and adopted neutral pseudonyms in order to avoid any positive or negative connotation.

<sup>6</sup> More than 170.

<sup>7</sup> Publicly traded companies must file an annual report with detailed information about their products and business practices, as well as audited financial statements. This makes it possible to obtain relevant and comparable information about their strategic choices, resource allocation and financial results.

<sup>8</sup> RPX Corporation (Rational Patent eXchange) is a private provider of risk management services for patent-related issues. See <https://insight.rpxcorp.com>.

**Table 1**  
General information on the four firms and LSP deals<sup>a</sup>.

Disguised name	Sector	Information on LSPs			
		Year	Deal types	Amounts (in Millions \$ US)	Number of collateralized patents
Firm A	Data storage solutions	2013	Loans secured by patents	10	More than 900
Firm B	Cloud computing and semiconductors	2013	Loans secured by patents and patent monetization agreement	17	More than 80
Firm C	Electronics	2014	Loans secured by patents.	5	NC
Firm D	IT security and protection	2014	Loans secured by patents and patent monetization agreement	5,4	10

<sup>a</sup> To strengthen the anonymity of the firms, we slightly modified the figures.

**Table 2**  
Overview of empirical material.

Types and sources	Number of documents
Annual reports and financial documents of funded companies.	41
Press articles (generalist and specialized outlets: IAM Media, Financial Times, etc.).	64
Press releases	16
“INVESTOR” documentation (public presentation and articles by the fund’s managers)	2
Official credit agreement documents	6
Documents of complaints and lawsuits related to patent infringement and anticompetitive conduct	5
Specialized database on patent litigation ( <a href="http://www.rpx.com">http://www.rpx.com</a> )	1
LSPs contracts	4
Interviews with experts	3

terms of meaning.<sup>9</sup> Three categories of themes were created: one related to IP in general (named “IP management”), one related to the licensing and financial use of IP (named “IP monetization”) and one related to “industrial activities”.<sup>10</sup> Second, after coding for each ‘firm/year’, the coded themes were compared, discussed and adjusted until intercoder agreement was reached, indicating high intercoder reliability (Weber, 1990).

Second, the analysis of board composition was inspired by the literature on corporate governance and strategic management, which shows the influence of board members’ profiles on firms’ strategic choices and orientations (Fama and Jensen, 1983; Hillman and Dalziel, 2003; Mizuchi, 1983; Pfeffer and Salancik, 1978). For instance, boards with “scientists and industrials” directors (members with scientific education and/or experience in R&D and new product development) are shown to support innovation and R&D investment (Zona et al., 2013), while the presence of public pension fund managers on the board has been shown to be associated with orientation toward short-term choices such as mergers and acquisitions (Hoskisson et al., 2002). In our analysis, data on board composition were collected from the company’s annual report or/and firm’s website. For each company, we collected and coded data about each board member by considering various profiles: financial (directors with background and expertise in finance), legal (directors with background and expertise in IP and licensing) and industrial (directors with background and expertise in industry, technology, and business development).

<sup>9</sup> To create this dictionary, neutral words (“moreover”, “and”, etc.) were eliminated. We also aggregated words with the same roots (such as innovate, innovation, and innovator).

<sup>10</sup> More precisely, the words included in each category are as follows: First category: patent, protection, and intellectual property. Second category: counterfeit, enforce, defend, INVESTOR, infringe, law, monetization, license, litigation, legal, royalty, jury, and verdict. Third category: customer, design, development, engineer, industry, innovation, invention, manufacture, partner, product, research, and technology.

This multidimensional analysis based on a combination of very different criteria allows a granular understanding of the strategic orientation for each company. By analyzing their evolution before and after contracting LSPs with “INVESTOR”, we track strategic changes and observe an eventual switch toward patent monetization and litigation activities.

## 4. Results

### 4.1. Investigating the terms of LSP contracts

On their main lines, LSPs granted by “INVESTOR” follow the standard principles and rules of this type of contract. For instance, “INVESTOR” obviously claims the ownership of pledged patents in case of default. Similarly, “INVESTOR” reduces the ability of funded firms to use collateral patents for their strategic development (for example, for their M&A deals or their patent-based collaboration that requires cross-licensing). The following quotation illustrates this:

*“The Company shall not make any Disposition of any Patents (other than assignment to a special purpose entity as and when required pursuant to this Agreement) without the prior written consent of the Majority Investors other than the entry into settlement agreements or non-exclusive licensing arrangements with respect to the Patents in furtherance of Monetization Activities”*

(excerpt from Firm ‘D’ document).

However, in addition to these standard terms, we have identified specific terms that introduce more constraints on the behavior of funded firms and that might not be neutral as to their strategy and behavior (these terms are summarized in Table 3). For instance, some of the contracts entail an IP monetization partnership between the funding and the funded firms in which the technological firm brings its patents, while “INVESTOR” handles all the management operations with its expertise in patent monetization. This is illustrated in the following quotation:

*“Firm ‘A’ entered into a series of definitive agreements which collectively set forth the terms and conditions pursuant to which the Company agreed to enter into a secured credit facility .... And transfer certain of its patents and patent rights to a newly formed limited partnership (the ‘Partnership’), of which the Company will be a limited partner and ‘INVESTOR’ will be the general partner... ‘INVESTOR’ will be the general partner of the Partnership and will generally have the right and power to manage, control and conduct the business and affairs of the Partnership... The purpose of the Partnership is to enforce, license or sell the Patent Rights held by the Partnership”*

(Excerpt from Firm ‘A’ document).

A direct consequence of such IP monetization partnerships might obviously be to increase the expected profitability of short-term patent monetization strategies of funded firms. These IP partnerships are often coupled with an ownership option in the form of a warrant, which allows “INVESTOR” to buy stocks in the funded firms at a prefixed price.

“INVESTOR” may also condition the release of funds on the

**Table 3**

An overview of the terms incorporated in LSPs.

	Collateralized patents	Warrant	Revenue-sharing agreement	IP monetization partnership	Milestoning of the release of funds	Restrictions on investment and liquidity	Reimbursement from monetization revenue
Firm 'A'	Yes	No	No	Yes	Yes	Yes	Yes (obligation)
Firm 'B'	Yes	Yes	No	No	Yes	Yes	Yes (option)
Firm 'C'	Yes	No	Yes	No	No	No	Yes (obligation)
Firm 'D'	Yes	No	Yes	No	No	No	Yes (obligation)

achievement of certain IP monetization milestones by the funded companies. Thus, a first part (that is, a tranche of the credit) is released under signature, while the remaining tranches are unlocked only once specific milestones are reached. Interestingly, in some cases, the milestones are directly related to licensing performance, which obviously directly incentivizes the borrower to engage in a licensing strategy (if it wants to unlock the next tranches, the borrower must increase its licensing turnover). The following quotation illustrates this point:

*“The term loans are available in an initial \$10 million tranche with a second tranche in the amount of \$7 million becoming available upon achievement of certain performance milestones relating to intellectual property matters...Pursuant to the Warrants, (i) 293,760 shares subject to the Warrants will become exercisable upon the achievement of the IP Monetization Milestones and (ii) the remaining 293,760 shares subject to the Warrants will become exercisable upon the Company's receipt of an IP Milestone Term Loan”* (Excerpt from Firm 'B' document).<sup>11</sup>

Similarly, “INVESTOR” may impose some restrictive clauses concerning investment decisions and/or liquidity management (for instance, maintaining a specific amount of liquidity monthly), as illustrated in the following excerpt from an LSP agreement:

*“The Company, Firm 'A' Inc., a wholly owned subsidiary of the Company (“Firm 'A' Texas”), and the Partnership are also subject to certain customary negative covenants, including, but not limited to, limitations on dispositions, changes in the nature of business, mergers or acquisitions, distributions, investments and transactions with affiliates [...] The Company is also subject to certain financial covenants, including (i) a requirement to maintain a minimum of \$2,600,000 of unrestricted cash at each month end.”*

(Excerpt from Firm 'A' document).

Moreover, “INVESTOR” may require that the loan repayment be made through patent monetization revenue or even a minimum of the royalties to be generated according to a specific schedule, as indicated below:

*“Any Monetization Revenues (as defined in the Agreement) received from the Patents will first be applied 100% to the payment of accrued and unpaid interest on, and then to repay outstanding principal of, the Notes. After the Notes are paid off in full, the Monetization Revenues received from the Patents will be allocated amongst the Revenue Participants and the Company in accordance with certain predetermined percentages (based on aggregate amounts received by the Revenue Participants) ranging from 100% to the Revenue Participants (such percentage to be allocated to the Revenue Participants until they have received \$5,000,000) to ultimately 20% to the Revenue Participants”*

(Excerpt from Firm 'C' document).

When the deal also involves an IP monetization partnership, the revenue is expected to be used first for loan reimbursement and then for

distribution between the funded company and “INVESTOR”:

*“The purpose of the Partnership is to enforce, license or sell the Patent Rights held by the Partnership...Upon each Monetization Event, the General Partner of the Partnership is to determine whether there is net cash flow available for distribution. If so, the Partnership will distribute those funds to the partners as follows: (i) first, to fully pay off and satisfy the Firm A' obligations under the loan agreement; and (ii) thereafter, 30% to 'INVESTOR' and 70% to 'Firm A', unless the Firm A' has exercised the Monetization Call Option discussed below, in which case, the net cash flow will be distributed 100% to 'Firm A'.”*

(Excerpt from Firm 'A' document).

From the lender perspective, a likely desired consequence of all these contractual terms is the diversion of technological firms from long-term industrial projects and their reorientation toward short-term patent monetization activities. IP partnerships lead to an increase in the expected profitability associated with direct patent monetization. Similarly, milestones increase the short-term profitability imperative, while liquidity restrictions reduce investment ability, thus limiting borrowers' incentives and ability to conduct long-run industrial projects. This was confirmed by one interviewee who stressed the existence of two types of LSP: first, “loans to own”, which aim at a rapid assertion of patents, and second, “loans to develop”, which aim at the long-term development of young technological firms. The interviewee also confirmed the reputation of INVESTOR as implementing “loans to own” LSPs:

*“INVESTOR is known as having an aggressive behavior, its business model is clearly dedicated to patent assertion and is oriented toward 'loan to own'... The terms used in their agreements are classical, but their implementation reflects a form of aggressiveness or pressure exerted on the financed companies. For example, commitments to important revenue objectives over a very specific period can push funded companies to pursue litigation quickly and aggressively, with a significant risk of losing patents in the short term. In addition, limitations on investments may reflect the aggressiveness of the lender and a lack of confidence in the ability of the managers of the financed company to properly manage value-creating projects”*

(Excerpt from interview with expert in patent-based lending and in patent assertion and monetization).

This focus on the type of loan regarding the lender's profile is also mentioned by another expert:

*“the implications for the borrowers depend on who offers the loan. INVESTOR is well-known as the white wolf, but the litigation finance claims for such behaviors”*

(Excerpt from an interview with an expert in patent licensing).

#### 4.2. The impact of LSPs on borrowers' strategies

To understand the LSPs' impact on borrowers' strategies, we relied on a set of various indicators that are believed to capture borrowers' strategic orientations (4.2.1), borrowers' strategic allocation of resources

<sup>11</sup> To strengthen the anonymity of the analyzed companies, we have slightly modified the amounts and figures.

(4.2.2) and borrowers' performance (4.2.3). Fig. 1 depicts the process through which LSPs might transform borrowers' strategies and economic performance.

#### 4.2.1. Strategic orientation

As discussed in Section 3.2, we capture borrowers' strategic intent by the words they use in their communication documents and by the composition of their board of directors. The results of the annual reports content analysis of the four funded firms are reported in Table 4. Board compositions are reported in Table 5. Taken together, these two criteria suggest that funded companies have increased their attention toward patent licensing and monetization after having obtained LSPs from "INVESTOR".

The increased frequency of words referring to IP and IP monetization, such as license, enforcement, and royalty, for instance, although not always homogenous across firms, tends to indicate the growing attention of borrowers' top management toward IP management in general and IP monetization in particular. Vocabulary related to IP monetization is often almost nonexistent before the financial agreement with INVESTOR and augments significantly after. For instance, in the case of firm 'A', the evolution of relative word count indicates that patent management and monetization activities become more important than 'Industrial' ones. In the case of firm 'C', it indicates a decreased attention to 'Industrial' activities and an increased importance of 'patent management' and 'patent monetization' activities. The following excerpts from firms B and C's annual reports illustrate this change:

*"Key aspects of our growth strategy include...Actively pursue patent monetization opportunities: we intend to vigorously defend our patent portfolio and related IPR, including when necessary, through pursuit of enforcement actions seeking injunctive relief or monetary damages, and aggressively pursue monetization avenues for these rights, including licensing, royalty or other revenue-producing arrangements"*

(Firm 'B' 2016 annual report).

*"Our strategy is to...vigorously defend and monetize our patents through licensing agreements and, where necessary, enforcement actions against those actors using our patented inventions in their products..."*

(Firm 'C' 2014–2015 annual report).

In line with these results, our analysis of the board composition reveals considerable changes, sometimes right after borrowers passed LSPs with "INVESTOR". Once "INVESTOR" enters the scene, seats on the boards of funded firms tend to increasingly be held by directors skilled in finance, IP and licensing instead of 'innovative directors' (those with a background and expertise in technology, business development and industry). This change is observed in all firms except firm C. It likely indicates a firm's reorientation toward patent monetization at the expense of innovation and product development since implementing such a strategy is easier in the presence of board members with related expertise.

These changes in the board are likely to have fundamental implications, as its composition is at the cornerstone of a firm's strategic decisions. Furthermore, a switch toward patent monetization requires specific competences, as emphasized by one of our interviewees:

*"As a board, we urged the CEO to create two separate divisions much like church and state because of concerns that R&D and sales operations would be constrained (disrupted or blocked) by legal strategies. Therefore, we had to separate the two and, in the board of directors, we became very disciplined because we had a part where we talked about products and customers and the part where we talked about legal strategy. We have become organized to deal with two different subjects with a specific agenda"*

(Excerpt from an interview with a former board member of one of the studied technological firms).

#### 4.2.2. Resource allocation

As could be expected, and although we do not have access to absolutely comparable data across firms in this case, our results suggest that the strategic reorientation outlined above leads to a modification in the allocation of borrowers' resources, with more resources invested in patent monetization compared to research and innovation (see Table 6). In most cases, R&D expenditures decrease (or, at least, do not increase) significantly once the financing agreement has been concluded. This is especially noticeable for firms 'A' and 'B'. Similarly, at least for firms 'B' and 'C', patent monetization expenditures (for instance, licensing fees or patent acquisition expenditures) increase significantly.

#### 4.2.3. Outcomes and performance

Finally, and still in line with previous results, we also observe a change in the outcomes and performance of the funded firms, with less revenue stemming from the sales of industrial activities and more from licensing and patent monetization (see Table 7). This can be observed at several levels. For instance, one observes an increase in the number of litigation cases, suggesting a hardening of the litigation strategies of funded firms. This is especially noticeable for firms 'A', 'B' and 'C'. Similarly, one observes a decrease in revenue related to product development and sales. This is the case for firms 'A', 'B' and 'C'. However, the amount of revenue generated from licensing and patent monetization does not seem to increase significantly immediately after the obtention of LSPs. We observe stagnation for Firm 'D' and even a decrease for Firm 'A'. Interestingly, this indicates that although firms display the strategic intent to monetize their patents and devote significant resources to it (including partnerships with expert firms such as "INVESTOR"), it remains difficult to yield significant monetary returns out of patent monetization, at least in the short term. This is indicated by a former board member of one of the studied technological firms:

*"We were very euphoric and enthusiastic before discovering the reality of legal activity, which is much more sober: it took 4 or 5 years to settle the case when everyone thought it would be settled quickly in a year. We found ourselves in a situation where the judge who was going to deal with the case was promoted to another court. A new judge arrived, and he had to know the case. It took a lot of delay, and the expenses continued and increased because we had to pay the lawyers who work on the file... In addition, during this time, the patents were getting older and you know, patents are like bananas: when they are too ripe, they are less good..."*

(Excerpt from an interview with a former board member of one of the studied technological firms).

The likely consequences will be the obligation for those firms that failed to monetize their patents and will find themselves unable to reimburse their loan to transfer the ownership of their patents to "INVESTOR". In addition to uncertainties regarding its outcomes, the patent monetization strategy creates risks for the company's legacy business:

*"When we embarked on patent monetization, we were very afraid of being on the red list of our suppliers because we wanted to license people who sold us memory integrated circuits. The global market for these components is very concentrated with three important suppliers who decide who could buy their products. The risk of patent monetization is that these people refuse to sell us these products and that we find ourselves without supplies. It was our biggest fear"*

(Excerpt from an interview with a former board member of one of the studied technological firms).

Finally, the financial performance of borrowers before and after the obtention of LSPs from "INVESTOR" is displayed in Table 8. First, we observe that, in most cases, ROE and ROA are significantly negative before the deal, indicating that borrowers had poor financial performance. This might suggest that, in the face of this bad financial situation, borrowers deliberately decided to switch to patent monetization

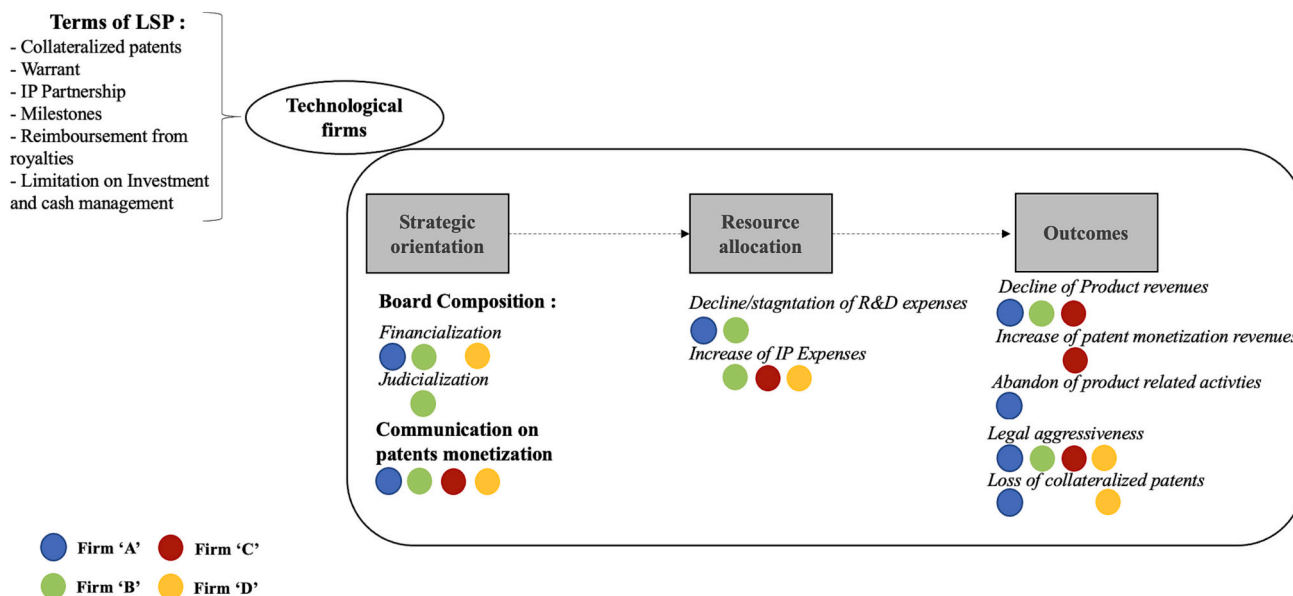


Fig. 1. The impact of LSP terms on borrowers.

Table 4  
Annual report content analysis (% frequency occurrence).

		2011	2012	2013	2014	2015	2016
Firm 'A'	IP management	2.7 %	2.6 %	<b>4.1 %</b>	5.6 %	5.7 %	10.6 %
	IP monetization	1.14 %	1.11 %	<b>2.98 %</b>	6.89 %	5.95 %	13.36 %
	Industrial activities	7.39 %	5.2 %	<b>5.3 %</b>	8.2 %	6.8 %	5.68 %
Firm 'B'	IP management	1.8 %	1.7 %	<b>3.8 %</b>	2.6 %	3 %	2.4 %
	IP monetization	0 %	0 %	<b>1.6 %</b>	1.1 %	1.4 %	1.0 %
	Industrial activities	13.7 %	13.9 %	<b>12 %</b>	14.2 %	14.6 %	11.5 %
Firm 'C'	IP management	1 %	1.8 %	3 %	<b>3.2 %</b>	3.8 %	3.7 %
	IP monetization	0.1 %	0.1 %	1.8 %	<b>2.0 %</b>	2.2 %	2.2 %
	Industrial activities	7.2 %	13.2 %	23.9 %	<b>12.2 %</b>	11.8 %	11.24 %
Firm 'D'	IP management	2.40 %	2.70 %	3.60 %	<b>5.50 %</b>	5.20 %	6.10 %
	IP monetization	0.4 %	2.6 %	1.3 %	<b>4.9 %</b>	5.2 %	2.7 %
	Industrial activities	9.9 %	7.8 %	9.8 %	<b>10.2 %</b>	9.1 %	8.5 %

Note: totals equal <100 % because of multiple themes discussed in the annual reports that were not relevant to the three categories. In bold: the year of the financial deal with INVESTOR.

activities (or, at least, that “INVESTOR” did not have much difficulty convincing them to do so). Since their insolvency and lack of profitability likely prevented them from accessing alternative funding, technological firms might have had no other choice than to embrace the patent monetization strategy encouraged by “INVESTOR”. Second, we observe that borrowers' financial performance tends to improve right after the deal, despite a firm size being relatively constant. This is particularly noticeable for firms ‘C’ and ‘D’. In line with the above remark on the possible borrowers' deliberate decisions to embrace patent monetization, this suggests that, at least in the very short run, this decision is a rational one.

In summary, and although the results for each of the indicators taken in isolation are not always convergent for the four companies, when all

Table 5  
Evolution of board composition.

	2011	2012	2013	2014	2015	2016
Firm 'A'	I: 80 %; F: 20 %	I: 80 %; F: 20 %	<b>I: 50 %;</b> <b>F: 50 %</b>	I: 40 %; F: 60 %	I: 40 %; F: 60 %	I: 40 %; F: 60 %
	Firm 'B'	I: 80 %; F: 20 %	I: 83 %; F: 17 %	<b>I: 100 %</b>	I: 80 %; L & IP: 10 %	I: 50 %; L & IP: 33 %
Firm 'C'		I: 80 %; F: 20 %	I: 80 %; F: 20 %	I: 80 %; F: 20 %	<b>I: 80 %;</b> <b>F: 20 %</b>	I: 80 %; F: 20 %
	Firm 'D'	I: 50 %; L & IP: 17 %	I: 44 %; L & IP: 28 %	I: 25 %; L & IP: 50 %	<b>I: 29 %;</b> <b>F: 14 %;</b> <b>L &amp; IP: 57 %</b>	I: 14 %; F: 43 %

Note: Board composition: F (background and expertise in finance), L (background and expertise in IP and licensing), I (background and expertise in industry, technology, and business development). In bold: the year of the financial deal with INVESTOR.

the indicators are considered globally, we see a clear indication that LSPs granted by INVESTOR modify the strategic orientation, the allocation of resources and the performance of the companies financed.<sup>12</sup> Furthermore, our results mostly suggest that the change is in the direction of a reorientation of the activities toward the immediate monetization of patents. To formalize and capture the essence of these empirical findings, in the next section, we propose a theoretical model that analyzes the links between LSPs and borrowers' innovation and licensing strategies.

<sup>12</sup> Note here that the lack of convergence between the companies observed is well in line with the complexity and multiplicity of NPEs' business models. As the latter relates to a multidimensional problem, it is no wonder that it is reflected in different ways according to the context. It is therefore more the consistency across a multitude of indicators that matters to us than the consistency provided by a single indicator taken apart from the others.

**Table 6**  
Evolution of resource allocation (in millions of US dollars).

		2011	2012	2013	2014	2015	2016
Firm 'A'	R&D expenses	10,702	11,408	<b>10,475</b>	5,675	4,784	NC
	Cost of revenue (IP license, royalties and other)	2,308	2,301	<b>2,401</b>	1,12	1,276	0,17
Firm 'B'	R&D expenses	14,924	12,845	<b>4,568</b>	4,835	6,049	6,3
	Intellectual property legal fees	NC	NC	<b>2,115</b>	6,138	5,588	3,11
Firm 'C'	R&D expenses	0,76	0,75	0,70	<b>0,49</b>	0,77	0,77
	Patent monetization expenses	NC	NC	NC	<b>1,69</b>	8,22	2,37
Firm 'D'	R&D expenses	0,285	0,491	0,254	<b>0,462</b>	0,470	0,435
	Patent monetization expenses	0,154	0,358	1,000	NC	NC	NC

Note: In bold: the year of the financial deal with INVESTOR. NC: not communicated.

**Table 7**  
Evolution of firms' outcomes.

		2011	2012	2013	2014	2015	2016
Firm 'A'	Revenue from licensing	10,546	8,143	<b>7,222</b>	7,101	5,286	0,674
	Revenue from products	4,441	5,856	<b>5,412</b>	4,048	2,535	NC
	Number of litigation cases	0	2	<b>5</b>	11	11	3
	Number of litigated patents	0	5	<b>11</b>	19	11	5
Firm 'B'	Revenue from licensing	NC	NC	<b>NC</b>	NC	NC	NC
	Revenue from products	60,7	36,9	<b>23,0</b>	19,2	8,0	19,655
	Number of litigation cases	0	0	<b>3</b>	14	2	9
	Number of litigated patents	0	0	<b>17</b>	14	2	21
Firm 'C'	Revenue from licensing	1,33	0,64	1,23	<b>0,90</b>	12,85	3,17
	Revenue from products	2,83	2,68	2,02	<b>0,33</b>	0,39	0,41
	Number of litigation cases	0	0	0	<b>3</b>	14	6
	Number of litigated patents	0	0	0	<b>12</b>	38	12
Firm 'D'	Revenue from technology sales, services and licensing	1,45	1,83	2,03	<b>1,81</b>	1,80	1,90
	Revenue from products	11,94	15,29	15,43	<b>16,48</b>	15,70	17,28
	Number of litigation cases	0	10	2	<b>7</b>	8	6
	Number of litigated patents	0	34	5	<b>8</b>	10	6

Note: In bold: the year of the financial deal with INVESTOR. Revenue from licensing and products are in millions of US dollars. NC: not communicated.

**Table 8**  
Evolution of borrowers' financial performance.

		2011	2012	2013	2014	2015	2016
Firm 'A'	ROE	-95	-536	<b>152 %</b>	3691	-295	-23 %
		%	%	%	%	%	%
	ROA	-49	-89 %	<b>-97 %</b>	-104	-61 %	-13 %
		%	%	%	%	%	%
	Firm Size	9,64	9,39	<b>9,42</b>	9,09	9,61	8,63
Firm 'B'	ROE	-28	-102	<b>-154</b>	-326	1539	2123
		%	%	%	%	%	%
	ROA	-17	-62 %	<b>-61 %</b>	-95 %	-83 %	-56 %
		%	%	%	%	%	%
	Firm Size	10,38	10,02	<b>9,78</b>	9,70	10,11	9,90
Firm 'C'	ROE	-11	-45 %	-51 %	<b>445 %</b>	120 %	-91 %
		%	%	%	%	%	%
	ROA	-10	-40 %	-40 %	<b>-58 %</b>	35 %	-34 %
		%	%	%	%	%	%
	Firm Size	15,47	15,13	14,84	<b>15,42</b>	15,98	15,13
Firm 'D'	ROE	-59	-49 %	4 %	<b>104 %</b>	426 %	-29 %
		%	%	%	%	%	%
	ROA	-25	-30 %	4 %	<b>59 %</b>	100 %	-5 %
		%	%	%	%	%	%
	Firm Size	16,37	16,47	18,03	<b>17,14</b>	16,57	16,73

Note: In bold: the year of the financial deal with INVESTOR. Firm size is defined as the natural logarithm of a firm's total assets in millions of dollars.

## 5. How might LSPs distort innovation activities? A theoretical model

### 5.1. The benchmark model

Consider two firms, a technological firm called T (she) and a finan-

cial firm called F (he). T has the choice between two projects. A long-term one, which consists of conducting an industrial innovative product (P), or a short-term one, which consists of immediate patent monetization (M). Both projects require a fixed investment I from the financial firm F.<sup>13</sup> T is cashless but has patents to pledge as collateral. F can propose two types of loans to T: a standard loan with no patent as collateral (L) or a loan secured by patents (LSPs) in which T's patents become the property of F in case of T's failure. The structure of the game is such that at the first stage of the game, F proposes a loan to T (with or without a patent as collateral), and at the second stage of the game, after having observed the loan offered by F, T decides to engage in project P or M. The payoffs are as follows:

- Project P yields payoff  $R_P$  in the long term with probability  $\alpha_P$  and zero otherwise. In the case of success, a proportion of  $R_P$ , that is,  $R_P^F$ , is repaid to F, and  $R_P^T$  goes to T ( $R_P^F + R_P^T = R_P$ ).<sup>14</sup> Since P yields a payoff only in the long run, it is discounted by  $\delta \in (0;1)$ . An important assumption of the game is that at the end of project P, the residual value of T's patents is equal to zero (since P is a long-term project, we assume that at the end of the project, the technology becomes obsolete), which means that if project P fails, even in the case of an LSP, F gets nothing.
- Project M yields an immediate cash flow  $R_M$  with probability  $\alpha_M$  and 0 otherwise. In the case of success, a proportion of  $R_M$  that is  $R_M^F$  is repaid to F, and  $R_M^T$  goes to T ( $R_M^F + R_M^T = R_M$ ). In the case of an LSP, if project M fails, F obtains T's patents, which amount to a total value A in the long run and therefore must be discounted by  $\delta \in (0;1)$ . In other

<sup>13</sup> T is protected by limited liability (not modeled here), her incentives to get financed are always sustainable (receive a private benefit).

<sup>14</sup> We assume that  $\alpha_P R_P > I$  and  $\alpha_M R_M > I$ . Under this assumption, both projects, if financed and if successful, yield to a positive net present value.

words, F's payoffs are equal to  $R_M^F$  in the case of success of project M or are equal to  $\delta A$  in the case of failure.

Let us first examine the situation with a standard loan L. We note  $V_N$ , with  $N \in \{F, T\}$ , the total payoffs of both firms. Furthermore, we note  $x_T = \{0, 1\}$  as the strategy chosen by firm T, such that  $x_T = 0$  if T chooses project P and  $x_T = 1$  if T chooses project M. The payoffs of both firms are the following:

$$V^N = x_T \alpha_M R_M^N + (1 - x_T) \delta \alpha_P R_P^N, \text{ with } N \in \{F, T\}$$

Project M ( $x_T = 1$ ) leads to an immediate gain (with probability  $\alpha_M$ ) but no discounted future gain, and project P ( $x_T = 0$ ) leads to a discounted future gain (with probability  $\alpha_P$ ). In other words, firms face a trade-off between short-term (patents' monetization) and long-term profits (innovative product).

Let us now turn to the situation with LSPs. The introduction of LSPs changes firm F payoffs (while T's payoffs remain unchanged<sup>15</sup>). In the case of failure of project M, firm F obtains T's patents, so its value function becomes:

$$V^F = x_T [\alpha_M R_M^F + (1 - \alpha_M) \delta A] + (1 - x_T) \delta \alpha_P R_P^F$$

We immediately observe that F's value function with LSPs is higher than that without patent collateral. As a consequence, on the one hand, when loans are secured by patents, F payoffs increase, thus boosting the ability of technological firms to borrow funds. This result is in line with the literature, particularly Hochberg et al. (2018) and Mann (2018). On the other hand, the introduction of patent collateral may induce a divergence between T and F's preferred outcome of the game. Indeed, starting from a situation where in the absence of patent collateral, F and T would both prefer the outcome P (that is, assuming that  $\alpha_M R_M \leq \delta \alpha_P R_P$ ), the collateralization may induce F to prefer M rather than P, whereas T still prefers the outcome P. This is made possible because the collateral increases F's outcome only when M is chosen by T (while T's outcome remains unchanged compared to the case without collateral). Therefore, it is straightforward to observe that when  $R_M^T \leq \frac{\delta \alpha_P R_P^T}{\alpha_M}$ , that is, when T has low skills in terms of patent monetization, she will choose project P. Simultaneously, when F has more incentives for immediate gain ( $\delta$  very low) and when the patent redeployment value A is high enough ( $\delta \leq \frac{\alpha_M R_M^F}{\alpha_P R_P^F - (1 - \alpha_M) A}$ ), he prefers strategy M rather than P. In this case, due to the introduction of patents as collateral, the preferences of the two firms as to the preferred outcome of the game are not aligned. Therefore, our first proposition is as follows:

**Proposition 1.** Starting from a situation where the two firms prefer P, the introduction of LSPs might introduce a divergence between T and F's preferred outcome of the game. In particular, when  $\delta$  is sufficiently low and A sufficiently high (that is, when  $\leq \frac{\alpha_M R_M^F}{\alpha_P R_P^F - (1 - \alpha_M) A}$ ), LSPs might induce F to prefer M, whereas T still prefers P.

An immediate consequence of Proposition 1 is that LSPs are likely to lead financial firms to try to divert technological firms from long-term industrial strategies (P) and to turn them instead toward more short-term strategies based on the direct monetization of their patents (M). In the following, we examine how F might introduce specific terms in LSP contracts to incentivize T to choose M.

<sup>15</sup> For sake of simplicity, we make the assumption that LSPs are costless for T so that T's value function remains unchanged. In reality, since LSPs put some constraints on the use of pledged patent and alter the salvage value of the borrower in case of default, they are likely to reduce T's value function in case of LSPs. However, the introduction of such a cost would not change the logic of our results.

## 5.2. LSPs with milestones and/or liquidity restrictions

To align the incentives of both firms, let us assume now that project investment I is financed by F in two tranches of sizes  $I_1$  and  $I_2$ , respectively (where  $I_1 + I_2 = I$ ). The payment of the second and final tranche of money  $I_2$  can be made only conditional on a short-term success of the project undertaken, i.e., only if T can demonstrate a short-term payoff. As the model assumes that project P yields revenue only in the long term, this implicitly means that if P is undertaken, T can never claim the second tranche of financing. We further assume that the revenue outcome decreases compared to the case with no milestone since the technological firm will obtain only a fraction of the investment  $I_1 < I$ , that is,  $R_P^N < R_P^N$  and  $R_M^N < R_M^N$  with  $N \in \{F, T\}$ . The value function thus becomes:

$$V^N = x_T [\alpha_M R_M^N + 1_F (1 - \alpha_M) \delta A] + (1 - x_T) \delta \alpha_P R_P^N, \text{ with } N \in \{F, T\}$$

where  $1_F$  is a dummy variable that equals 1 if the firm is F and 0 otherwise. One immediately observes that the milestone loan decreases T outcomes if project P is undertaken since  $R_P^T < R_P^T$ . In this case, T will be induced to choose project M as soon as:

$$\alpha_M R_M^T \geq \delta \alpha_P R_P^T \text{ (T's incentive constraint)}$$

That is, as soon as, thanks to the milestones, T's payoffs associated with strategy P diminish sufficiently compared to her payoffs associated with strategy M. Furthermore, this change might also be in the interest of F if:

$$\alpha_M R_M^F + (1 - \alpha_M) \delta A \geq \delta \alpha_P R_P^F \text{ (F's participation constraint)}$$

That is, when the revenue yielded from M with the milestone loan is greater than the revenue yielded from project P without the milestone loan. This is the case whenever F has more incentives for immediate gain ( $\delta$  very low) and when the patents' redeployment value A is high enough (when  $\delta \leq \frac{\alpha_M R_M^F}{\alpha_P R_P^F - (1 - \alpha_M) A}$ ).

Following the same reasoning, F may also impose certain financial covenants, including a requirement to maintain a minimum of unrestricted cash at each period. In this case, the technological firm T can invest only a proportion  $\rho$  of the first investment  $I_1$  and keep the remaining that is  $(1 - \rho) I_1$  in cash. This restrictive clause decreases the revenue outcome  $R_P^N < R_P^N$  and  $R_M^N < R_M^N$  with  $N \in \{F, T\}$  and, following the same logic as above, may also induce T to choose M rather than P under certain conditions (T's incentive constraint and F's participation constraint). Therefore, our second proposition is as follows:

**Proposition 2.** LSPs with milestone (resp. liquidity restriction) decrease the income expectation of T when it chooses strategy P. When T's incentive constraint and F's participation constraint are both satisfied, there exists a subgame perfect Nash equilibrium where i) F chooses the LSPs with milestones (resp. liquidity restrictions) and ii) T chooses strategy M.

In other words, starting from a situation where firm T would have preferred to play P, the loan with milestones and/or with liquidity restrictions might induce firm T to choose strategy M instead of strategy P, decisions that are in the interest of firm F.

## 5.3. LSPs with IP partnership

Instead of imposing financial restrictions that lower T's expected payoffs associated with strategy P, firm F can attempt to increase T's payoffs associated with strategy M. This can be done, for instance, by complementing the loan agreement with financial, technical and even legal assistance when the monetization's project is chosen. This IP Partnership increases the project M outcome  $R_{Mip}^N > R_M^N$  ( $R_{Mip}^F + R_{Mip}^T = R_{Mip}$ ), since a higher skilled board is implied. In return, F obtains a

higher proportion of RIP that is  $R_{MIP}^F > R_M^F$ .<sup>16</sup> The value function of the two firms becomes:

$$V^N = x_T \cdot \left[ \alpha_M R_{MIP}^N + 1_F \cdot (1 - \alpha_M) \delta A \right] + (1 - x_T) \delta \alpha_P R_P^N$$

One immediately sees that the IP partnership increases both firms' returns when the monetization project is chosen by T. In particular, when  $R_{MIP}^T \geq \frac{\delta \alpha_P R_P^T}{\alpha_M}$ , T is more likely to take advantage of short-term profits rather than the innovative product (T's incentive constraint). This strategy is also profitable to F as soon as  $\alpha_M R_{MIP}^F + (1 - \alpha_M) \delta A > \delta \alpha_P R_P^F$ , that is, whenever F has more incentives for immediate gain ( $\delta$  very low) and when the patents' redeployment value A is high enough (that  $\delta \leq \frac{\alpha_M R_{MIP}^F}{\alpha_P R_P^F - (1 - \alpha_M) A}$ ) (F's participation constraint). Therefore, our third proposition is as follows:

**Proposition 3.** IP Partnership increases the income of both T and F when T engages in strategy M. When T's incentive constraint and F's participation constraint are both satisfied, there exists a subgame perfect Nash equilibrium where i) F chooses to offer an IP partnership to T (F's payoffs are higher with than without IP partnership) and ii) T chooses strategy M.

In other words, starting from a situation where firm T would have preferred to play P, the IP partnership might induce firm T to choose strategy M instead of strategy P, decisions that are in the interest of firm F.

In summary, our theoretical model highlights the fact that financing firms can influence the strategies of technological firms by using LSP contracts. However, our empirical insights also suggest that the decision to switch to patent monetization might similarly be initiated by the technological firm itself. For instance, when the technological firm finds itself in financial distress or when expected outcomes associated with the industrial strategy are low, the technological firm might deliberately choose to throw itself into the arms of intellectual property financing firms, thus inducing a phenomenon of "consenting victim".<sup>17</sup> This is illustrated in the next section.

#### 5.4. An extension of the game with two financing firms and different levels of quality

Suppose now that projects come in two types of quality: H, that is, high quality in terms of innovation and industrial potential (i.e., high potential with regard to strategy P) or L, which is a low-quality project with regard to strategy P). H innovative project succeeds with probability  $\alpha_P^H$  and L innovative project succeeds with probability  $\alpha_P^L < \alpha_P^H$ . For simplicity, we assume that financing and technological firms perfectly know the quality of the project when they make their decision. As previously, we assume that firm T needs to invest an amount I but cannot finance her own project. Therefore, she approaches a lender F who can be of two types: a bank ( $F_B$ ) or a financial entity specialized in IP financing ( $F_{IPF}$ ).  $F_B$  offers normal loans without patent collateral (because standard banks usually do not have the IP expertise to deal with this type of loan).  $F_{IPF}$  offers LSPs in which T's patents become his own property in case of T's failure. The timing of the game is as described in Fig. 2. The bank  $F_B$ , which is approached first, screens the project and decides whether to finance it or not. If accepted, then firm T must decide

between strategy P or M. If not accepted, firm T turns toward  $F_{IPF}$ , which decides whether to offer an LSP. If financed, firm T chooses between projects P and M.

The payoffs of the game are as follows: If project P is undertaken and fails, T receives 0, and the financing firm ( $F_B$  or  $F_{IPF}$ ) loses his initial investment I. If project M fails and  $F_B$  is the lender, T receives 0, and  $F_B$  loses I. However, if  $F_{IPF}$  is the lender and if project M fails, he recovers the patents that have a value equal to  $\delta A$ . If project P succeeds, it yields a value  $R_P$ , a share  $R_P^T$  of it goes to T, and the other share  $R_P^N$ , with  $N \in \{F_B, F_{IPF}\}$ , is repaid to F. If project M succeeds, it yields a value  $R_M$ , a share  $R_M^T$  of it goes to T, and the other share  $R_M^N$ , with  $N \in \{F_B, F_{IPF}\}$ , is repaid to F.

We solve this game by backward induction. At the last step of the game, Firm T observes the financing decision and decides which project to undertake, M or P. At the beginning of the game,  $F_B$  anticipates the decision of firm T and decides whether to offer a normal loan. If he decides not to finance her, then  $F_{IPF}$  anticipates T's decision at the last step and decides whether or not to offer an LSP.

When the project is of quality H, if it is financed, either by  $F_B$  or by  $F_{IPF}$ , Firm T chooses strategy P instead of M if and only if  $\alpha_P^H \delta R_P^T \geq \alpha_M R_M^T$ . Anticipating that Firm T will choose strategy P, at the beginning of the game,  $F_B$  accepts financing the project if and only if  $\alpha_P^H \delta R_P^{F_B} + (1 - \alpha_P^H)(-I) \geq 0$ . Similarly, when the project is of quality L, if it is financed, either by  $F_B$  or by  $F_{IPF}$ , Firm T chooses strategy M instead of P if and only if  $\alpha_P^L \delta R_P^T \leq \alpha_M R_M^T$ . Anticipating that Firm T will choose strategy M, at the step before,  $F_{IPF}$  accepts financing the project if and only if  $\alpha_M R_M^{F_{IPF}} + (1 - \alpha_M)(\delta A - I) \geq 0$ . Furthermore, still at the step before,  $F_B$  rejects the project if and only if  $\alpha_M R_M^{F_B} + (1 - \alpha_M)(-I) \leq 0$ .

These inequalities give us the constraints on parameters  $\alpha_P^H$ ,  $\alpha_P^L$  and  $\alpha_M$  that ensure the existence of a subgame perfect Nash equilibrium where i) if the project is of high quality, the bank  $F_B$  decides to finance it and the technological firm T decides to undertake the innovative and industrial project P. However, ii) if the project is of low quality,  $F_B$  decides to reject it, thus leading T to turn toward  $F_{IPF}$ , who chooses to offer an LSP, which leads firm T to choose strategy M. This is the case if and only if Firm T chooses strategy M when the project is of quality L, that is, when  $\alpha_M \geq \frac{\alpha_P^L \delta R_P^T}{R_M^T}$ ;  $F_{IPF}$  chooses to finance the project when it is of quality L, that is, when  $\alpha_M \geq \frac{I - \delta A}{R_M^{F_{IPF}} + I - \delta A}$ ;  $F_B$  chooses to reject the project when it is of quality L, that is, when  $\alpha_M \leq \frac{I}{R_M^{F_B} + I}$ ;  $F_B$  approves the project when it is of quality H, that is, when  $\alpha_P^H \geq \frac{I}{\delta R_P^T + I}$ ; and Firm T chooses strategy P when the project is of quality H, that is, when  $\alpha_P^H \geq \frac{\alpha_M R_M^T}{\delta R_P^T}$ . Thus, our fourth proposition.

**Proposition 4.** Under the conditions above with regard to  $\alpha_P^H$ ,  $\alpha_P^L$  and  $\alpha_M$ , there exists a subgame perfect Nash equilibrium where if the project is of quality H, the bank chooses to finance it and the technological firm chooses strategy P; if the project is of quality L, the bank chooses not to finance it, but the IP funding entity does finance it with an LSP, therefore leading firm T to choose strategy M.

In other words, the probability of industrial success associated with H quality project ( $\alpha_P^H$ ) must be sufficiently high to ensure that the bank approves the project and that Firm T chooses strategy P when the project is of quality H. Similarly, the probability of industrial success associated with L quality project ( $\alpha_P^L$ ) must be sufficiently low to ensure that Firm T chooses strategy M when the project is of quality L. Finally, the probability of patent monetization success associated with L quality projects ( $\alpha_M^L$ ) must not be high enough that the bank rejects the project if it is of quality L but also cannot be low enough that  $F_{IPF}$  approves the project even if it is of quality L.

## 6. Discussion and concluding remarks

Analyzing the impact of LSPs on borrowers' patent and innovation

<sup>16</sup> In practice, the IP partnership implies a cost incurred by F. For simplicity, we assume that  $R_{IP}^F$  already includes this cost.

<sup>17</sup> We have examples in which technological firms ask troll to get financing after having been rejected from lenders that do not have skills in terms of patent's monetization. For instance, in 2013, Firm B entered into a loan and security agreement with 'INVESTOR', partly because it was in financial distress and needed to repay an existing consolidated term loan with another lender specialized in LSPs.

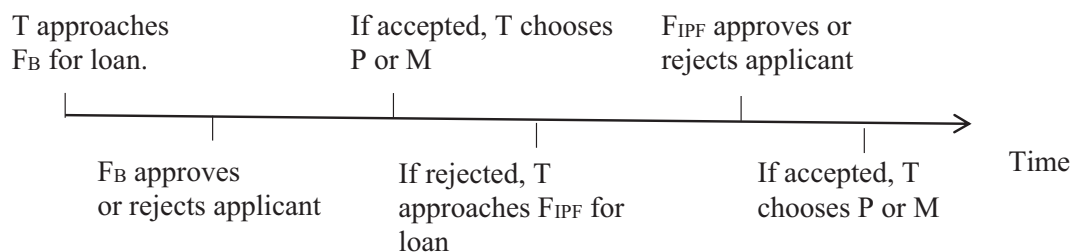


Fig. 2. Timing of the game.

strategies, our research provides evidence that LSPs might induce technological firms to deviate from innovative activities toward more short-term strategies based on the monetization and litigation of their patents. We also show that if lenders are likely to find it profitable to initiate, if not to force, this strategic change, for instance, by using specific terms included in LSP contracts, technological firms in financial distress might also deliberately decide to embrace this new strategy and approach lenders, which would in this case only accompany and facilitate their transformation.

This research contributes to the literature on both the management of innovation and finance. First, previous studies have outlined NPEs' characteristics and heterogeneous business models (Benassi and Di Minin, 2009; Dushnitsky and Kluefer, 2011; Hagi and Yoffie, 2013; Abrams et al., 2019). We contribute to this literature by highlighting the complexity and multidimensional nature of NPEs, thus making their characterization, and more importantly, the identification of the different types of NPEs (for instance, brokers versus trolls), ever more difficult. We also contribute to previous works focusing on the anatomy and antecedents of licensing business models (Leiponen and Delcamp, 2019) by revealing how the financing mode can drive a strategic switch from manufacturing to patent monetization and by providing new insights into the business model of NPEs. Because of the contractual conditions of patent collateralization, this business model might be propagated to companies that had previously shown technological and industrial activity. These firms are incentivized to move toward the monetization of their patent portfolio to repay their loans. This is fundamentally different from the cases that have been documented in the literature and highlights the importance of the extreme financialization of the innovation and intellectual property world.

Second, we contribute to the finance literature on LSPs, which has received growing attention with two key points of convergence among scholars: the focus on the lenders' perspective and the recognition of the importance of debt secured by patents as a main source of financing for low-tangibility firms. In regard to existing studies, to the best of our knowledge, our study is the first to provide evidence that patent collateralization might significantly affect borrowers' behaviors and strategies. We offer empirical and theoretical arguments that LSPs are not neutral *vis-à-vis* the strategic (re)orientation of borrowers and could induce outcomes (for instance, decline in R&D expenditures and increased litigations) that are different from those previously documented (i.e., increase in employment and innovation productivity) (Hochberg et al., 2018; Mann, 2018; Appel et al., 2019). Furthermore, our research also suggests that, interestingly, lenders might not always choose technological firms for their product development potential but, conversely, precisely because they have financial difficulties.<sup>18</sup> As a consequence, contrary to Fischer and Ringle (2014), who suggested that the legal exclusive right potential of patents as collateral remained

<sup>18</sup> This is clearly indicated, for instance, by the president of the IP Finance group of 'INVESTOR' who claims that they only focus on the value of patents. If they estimate that the patents are good enough to support a loan based on these assets as pledge, they will lend the money...The companies that they look at most of the time are those who cannot get equity investment.

underexploited, our study offers empirical evidence that lenders' decisions can be strongly related to legal exclusion rights. Relying on the formal exclusive dimension of patents can be promising for lenders since this value is the same even though the technological value of the project always remains difficult to evaluate. This runs counter to the conventional wisdom that technology companies are targeted and supported by financial actors for their technological potential, as revealed by their patent portfolio. This finding echoes the results of a recent survey indicating that approximately 30 % of lawsuits are backed by third-party financing (Unified Patent, 2023) and suggests that an unexpected portion of lenders tend to value the exclusion right of patents.

At a higher theoretical level, our study is one of the first to bridge the literature on LSPs and patent monetization strategies. Existing works highlight either how patent monetizers act as buyers of collateralized patents or how their opportunistic behavior (i.e., trolling activities) affects the use of LSPs by technological firms (Fischer and Ringle, 2014; Appel et al., 2019; Ma et al., 2022). By showing how LSPs induce borrowers to become patent monetizers, we connect these two research streams and advance our understanding of how finance and innovation management interact.

These theoretical contributions also have strong strategic and managerial implications. Of course, not all financing firms are patent trolls or want to feed patent trolling.<sup>19</sup> However, because of its contaminating aspect, which multiplies its potential, it is likely that if the financing model presented in this article were to spread, the consequences on the innovation process would be significant and lasting. It might open entirely new strategic possibilities for technological firms, which could increasingly embrace this type of strategy and switch toward NPEs business models. For large industrial groups, symmetrically, this might require significant adaptation. Manufacturing firms have to anticipate this change to avoid costly patent litigations with NPEs as much as possible. However, this work of anticipation might become increasingly difficult since our research also suggests a possible increased confusion between patent trolls and other types of NPEs. In the end, if even start-ups may become trolls, the troll identification exercise will become more delicate and probably much more expensive. Finally, for the innovation system as a whole, this could disrupt the tight balance between industrial and technological firms. This balance is based on a logic of specialization and complementarity: start-ups invest in upstream research, patent it and grant licenses to industrial firms. The latter invest in downstream research and the commercialization of technologies. Historically, this complementarity is supported by the patent system and financing institutions (e.g., venture capitalists). However, the changes documented in this research introduce new logics, no longer based on complementarity but on dispute and conflict between technological and industrial companies.

This research might also have important consequences for economic

<sup>19</sup> For instance, Feldman (2013) finds that a total of 65 % of respondents disagreed with the question "as a venture capitalist I consider the potential to selling patents to PAEs if the company fails" but that 18 % of respondents agreed, thus indicating that a significant share of financiers might contribute to feeding NPEs.

policy and regulation. Even though the welfare implications of our findings are difficult to evaluate (and are not studied in this paper), it is likely that if the strategies emphasized in this research were to be adopted at a large scale by financial institutions, the impact on the efficiency of the innovation process could be significant. In any case, with regard to normative implications, our findings nuance previous studies that consider that LSPs have only positive welfare implications, thus calling for the growth of this funding mechanism and for a reinforcement of debtor rights (Mann, 2018). In this paper, we have instead outlined both the positive and negative roles of NPEs. Therefore, should the expansion of LSPs contribute mostly to securing and encouraging technological firms, thanks to the development of patent intermediation, the impact on social welfare is likely to remain positive. However, should the expansion of LSPs contribute mainly to accelerating patent troll phenomena, which could disseminate to start-ups in a viral and contaminating way (Ayerbe et al., 2020), the impact on social welfare might well be disastrous, and public authorities should seriously think about adequate measures to limit these contaminant patent trolling practices.<sup>20</sup> In any case, this fundamental question related to the positive versus negative welfare implications of NPEs is left for future research.

### CRedit authorship contribution statement

**Cécile AYERBE:** conceptualization (formulation or evolution of overarching research goals and aims), qualitative methodology; writing  
**- Jamal AZZAM:** conceptualization (ideas, formulation or evolution of overarching research goals and aims), qualitative methodology; writing  
**- Selman BOUSSETA:** theoretical model; writing  
**- Julien PENIN:** conceptualization (ideas, formulation or evolution of overarching research goals and aims), theoretical model; writing; supervision

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Upon request from referees, we anonymized the names of the studied companies.

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<sup>20</sup> For instance, it is well known that the opacity of patent information, the large number of titles in force, the uncertainties regarding the scope of patent protection or their actual user, strongly favor such trolling practices (Menell and Meurer, 2013; Pénin and Neicu, 2018). In that respect, all measures allowing to improve the quality of patent information, for example by improving patent classifications, by accelerating their publication, by improving their readability, etc., should be encouraged.

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