Innovation and Startup Acquisition *

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March 8, 2026

Abstract

In this paper, we consider two platforms that compete for the development of a new product to integrate into their ecosystems. The new product can be developed either in-house by the platforms or by an independent startup active only in the technology market. The technology of the startup can be transferred to the platforms either exclusively (startup acquisition) or non-exclusively (licensing). A platform acquires the startup's technology either because it failed to develop the technology itself or to prevent a rival from acquiring it (a killer acquisition). The presence of the startup affects the platforms' R&D efforts through an *insurance effect*, which reduces the cost of failed innovation, and a *competition effect*, which diminishes the returns to innovation. The magnitude of these effects depends on the merger policy decided by the competition authorities. We show that allowing acquisitions stimulates platform innovation, but at the cost of a more concentrated market structure.

Keywords: Innovation; Startup acquisitions; Mergers; Digital; Big Tech; Competition policy.
JEL Codes: D43; G34; K21; L40; L86.

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*We thank the Editor, Julian Wright, and two anonymous referees for valuable comments and suggestions. We also thank Patrice Bougette, Laureen de Barsy and Jean-Christophe Poudou as well as the audiences at the AFREN Summer School in Digital Economics 2023 (Avignon) and EARIE 2024 (Amsterdam), as well as the seminar participants at GAEL (Grenoble, France), the University of Passau (Germany), and the University of Montpellier (France). This paper is part of the ARC project on Digital platforms funded by the University of Liege.

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1 Introduction

Large digital platforms, such as Amazon, Apple, Google, Microsoft, and others, offer a wide range of services. A key aspect of competition among them is the continuous development of new products, features, functionalities, and services. For example, over time, they have introduced innovations such as geo-localization, navigation systems, search engines, payment solutions, AI, virtual reality, and cloud solutions into their ecosystems.

New products can be developed *in-house* by incumbent platforms, or *externally* by startups. In the latter case, platforms may integrate these products by either acquiring the startups or purchasing licenses for their technologies. Startup acquisition and product licensing thus represent two distinct strategies for incorporating external innovation into a platform ecosystem. This paper aims to compare these strategies and assess their respective impacts on platform innovation. We then examine under what conditions a competition authority may find it efficient to regulate startup acquisitions.

Product or technology transfer through acquisition can be efficient, especially in digital industries (Cabral, 2021). However, it raises two important concerns. First, startup acquisitions are not only motivated by product integration; they may also aim at eliminating competitive threats. Killer acquisitions have been documented in the pharmaceutical industry (Cunningham, Ederer and Ma, 2021) and raise concerns in the digital economy as well (Motta and Peitz, 2021). Second, platforms may buy innovations from startups instead of developing their own. Acquisitions of startups may thus crowd out in-house innovation by platforms, a phenomenon that is referred to as *'reverse' killer acquisitions* (Crawford, Valletti and Caffarra, 2020).[1]

The magnitude of these anti-competitive effects is potentially large. It is well documented that in the digital economy, the acquisition of young startups is a pervasive phenomenon (Gautier and Lamesch, 2021; Gautier and Maitry, 2024) and that acquisitions have become the main exit route for startups (Ederer and Pellegrino, 2023). Furthermore, digital ecosystems expand primarily through acquisitions (Heidhues, Koster and Kőszegi, 2024).

In this paper, we study the interplay between startup acquisitions and competition through innovation between digital ecosystems. We consider a model in which two established platforms and a startup compete to develop a new product that complements the platforms' core products. The startup only operates in the technology market, not the final market. It can sell its technology to the platforms through non-exclusive licensing or an acquisition, which confers exclusivity to the acquirer. The platforms and the startup negotiate either an exclusive (acquisition) or a non-exclusive (licensing) agreement, and we use the Nash-in-Nash with Threat of Replacement (NNTR) bargaining solution (Ho and Lee, 2019; Chambolle and Molina, 2023) to determine the terms of technology transfer.

[1] The perspective of being acquired can also change the direction and the intensity of innovation by startups (Bryan and Hovenkamp, 2020; Dijk, Moraga-González and Motchenkova, 2024).

Startup acquisition can be driven by the possibility to access a technology that the platform failed to develop, which we call *technology acquisition*, or to prevent a competing platform from accessing the new technology, which we call *killer acquisition*.

In this environment, a competition authority defines the merger policy. Specifically, it can allow all types of mergers, prohibit all mergers, or only prohibit killer acquisitions. The merger regime chosen by the competition authority affects the *ex-post* market structure, and thus the platforms' incentives to develop the product *ex-ante*.

The presence of the startup in the technology market affects the platforms' incentives to invest in R&D through an *insurance effect* and a *competition effect*. First, the option to access the startup's technology *ex-post* reduces the cost of failed innovation (*insurance effect*). This creates an opportunity cost that reduces the platforms' incentives to invest in R&D. Second, when the startup succeeds in developing the new product, it reduces the returns to innovation for a platform (*competition effect*). This lower return to innovation stems from the fact that the competing platform may also gain access to the startup's technology if its own R&D project fails. If the rival succeeds in doing so, competition in the product market is intensified. Alternatively, if the innovating platform acquires the startup to prevent its technology from being used by its competitor, it must pay rents to do so. In both cases, the expected benefits from innovation are reduced, thereby weakening the platforms' incentives to invest in R&D.

The magnitude of these two effects depends on the merger regime in place. If killer acquisitions are allowed, they occur in equilibrium, and platforms no longer benefit from the insurance effect. Hence, allowing all types of acquisitions stimulates R&D efforts by the platforms. However, the price paid for a killer acquisition reduces the returns to innovation through the competition effect. This effect can be substantial when the acquisition price is high, which happens when the startup has strong bargaining power. Taking these two effects into account, we show that allowing some mergers always leads to more R&D effort by the platforms. However, if the startup has sufficient bargaining power, platform innovation can be greater under a merger ban than under a regime that allows all acquisitions.

In the case of technology acquisitions, when both platforms fail to innovate, they compete fiercely to acquire the startup that manages to capture the monopoly rents. So, platforms would prefer a ban on mergers to benefit from an insurance effect through licensing. The only profitable mergers for the platforms are killer acquisitions. For this reason, platforms prefer a ban on all mergers than a ban on killer acquisitions only. Their preference for a merger ban or a lenient merger policy depends on the relative importance of the competition and insurance effects.

For consumers, allowing mergers increases platforms' incentives to invest in R&D but also leads more frequently to market monopolization by one of the platforms. Therefore, consumers face a classic trade-off between innovation incentives and the diffusion of innovation. The relative magnitude of these effects depends on the cost of innovation for the platforms and the cost of monopolization for the consumers. We show that the preferences of the consumers and the platforms regarding competition policy tend to diverge when the value of appropriating the innovation, measured as the ratio of monopoly profits over duopoly profits, is either low or high.

To finance its product development and its growth, the startup needs funding, which can come from either venture capital (VC) or one of the platforms through corporate venture capital (CVC). We show that VCs are more likely to fund a startup when (at least some) mergers are allowed, i.e., startup acquisitions facilitate entry. For a platform, providing venture funding is motivated not only by financial returns but also by the possibility of preempting rival platforms from acquiring the startup. In this case, the competition for acquisition is reduced and the funding platform can buy the startup at a lower price. We also show that CVC funding reduces overall R&D by the platforms. Finally, we show that the merger regime can influence the direction of the startup's innovation. If the startup can choose between two innovation paths, a conventional path pursued by the platforms or an exploratory path in which it would be the only one to invest, we find that allowing startup acquisitions increases the likelihood that the startup follows a different innovation path from the platforms, as it is a way to escape competition in the technology market.

Literature review

Our paper contributes to the literature on the effects of startup acquisitions on competition and innovation.[2] The literature has shown that acquisitions can have negative effects on competition by allowing incumbent firms to eliminate potential competition threats (see, e.g., Gilbert and Newbery, 1982; Motta and Peitz, 2021). At the same time, acquisitions may also generate pro-competitive effects by facilitating the commercialization of startup innovations or by alleviating their financial constraints (see, e.g., Motta and Peitz, 2021; Fumagalli, Motta and Tarantino, 2022). The literature has also shown that the prospect of being acquired can stimulate startup entry and innovation (the "entry-for-buyout" or "innovation-for-buyout" motive; see e.g. Rasmusen, 1988; Phillips and Zhdanov, 2013; Cabral, 2021; Katz, 2021), although acquirers may have incentives to shelve the startup's innovation when it cannibalizes their existing or future products (see e.g. Motta and Peitz, 2021; Fons-Rosen, Roldan-Blanco and Schmitz, 2021). Finally, the literature has shown that startup acquisitions can shape the direction of startup R&D, encouraging more radical projects (Henkel, Rønde and Wagner, 2015) or influencing whether startups develop substitutes or complements to incumbents' products (Dijk, Moraga-González and Motchenkova, 2024; Motta and Shelegia, 2025).[3]

[2] Innovation is an important dimension of competition among firms and several papers have examined the impact of horizontal mergers on the incentives to innovate of both merger insiders and outsiders. See, among others, Federico, Langus and Valletti, 2018; Motta and Tarantino, 2021; Bourreau, Jullien and Lefouili, 2024; see also Haucap, Rasch and Stiebale (2019) for empirical evidence.

[3] Cabral (2025) derives the optimal merger policy when a startup is a substitute or a complement to the incumbent with an exogenous probability and, using a calibration for the digital sector, shows that moving from a balance of probabilities to a balance of harms standard would increase welfare by about 15%.

The main distinguishing feature of our paper is that we consider two incumbent firms, which compete to acquire the startup's technology. With very few exceptions, the literature focuses on a single incumbent that may acquire the startup. In this case, the mode of technology transfer (licensing or acquisition) plays no fundamental role. In our framework, however, it is crucial for an incumbent to know whether its rival will also have access to the startup's technology (under non-exclusive licensing) or if access will be exclusive (under acquisition).

A notable exception is Bryan and Hovenkamp (2020).[4] As in our paper, they consider two competing platforms, a leader and a laggard, and a startup that develops a component that does not directly compete with the platforms but is used by them to improve their production processes. They focus on the startup's incentives to innovate. They show that, under a 'laissez-faire' regime, the startup is acquired by the leader and there is no licensing to the laggard, resulting in too little diffusion of innovation. They also show that the startup favors innovations that benefit the leader, resulting in an inefficient direction of innovation. Finally, they show that there is an inefficient rate of innovation by the startup. Prohibiting acquisitions by the leader or imposing licensing obligations can mitigate some of these inefficiencies. Differently from Bryan and Hovenkamp (2020), we focus on the incumbents' innovation incentives and on how the presence of the startup affects those incentives.

Another distinguishing feature of our paper is that we focus on the innovation incentives of the incumbents rather than those of the startup. Most of the studies focus on the startup's innovation incentives. Studies that examine how merger policy affects incumbents' innovation include Phillips and Zhdanov (2013)[5] and Letina, Schmutzler and Seibel (2024).[6] Both find that incumbent innovation is higher when acquisitions are allowed. By contrast, we show that a regime in which acquisitions are banned can lead to higher incumbent innovation compared to a regime that allows all acquisitions when the startup's bargaining power is sufficiently strong.

Given these distinct features of our framework, we are able to provide new insights relevant for merger policy. While most of the literature has focused on the incentives to innovate of one or more entrants facing an incumbent, looking at both the intensity and the direction of innovation, our model analyzes the incentives to innovate of two competing platforms facing a startup. We show that while startup entry can crowd out intrinsic innovation by the platforms, a well-established result, this effect can be even stronger when mergers are not allowed, as startups have an alternative strategy to monetize their products (licensing). We also show that competi-

[4]See also Norbäck and Persson (2012). They consider two incumbents competing to acquire a potential entrant and show that increased market competition tends to raise the acquisition price. However, they do not examine the impact of merger policy.

[5]Phillips and Zhdanov (2013) consider a large firm competing against a small firm, which can be interpreted as a startup.

[6]Fons-Rosen, Roldan-Blanco and Schmitz (2021) show in a general equilibrium model that allowing acquisitions generates more startup entry but less innovation by incumbents. Furthermore, the startups' ideas are less often implemented by acquiring incumbents.

tion between platforms to acquire the startup eliminates the safeguard provided by the startup, and the insurance effect is no longer present. All that remains is the cost of protecting a monopolistic position, which requires buying the startup and later killing it.

Structure of the paper

The rest of the paper is organized as follows. In Section 2, we set up the model and solve the benchmark case with a monopoly platform. In Section 3, we solve the equilibrium with competing platforms. In Section 4, we compare the different merger regimes in terms of R&D effort, platform profits, and consumer surplus. In Section 5, we consider three extensions of the baseline setting. We consider the startup's entry decision, possible funding by one of the platforms, and the direction of the startup's innovation project. Finally, we conclude in Section 6. The proofs of our main results are relegated to the Appendix.

2 Model

2.1 Platforms

We consider two competing platforms, 1 and 2. The platforms have a core product, product A, and invest in R&D to develop a complementary product, product B. Product B has no value on its own and is only valuable when combined with product A.

If both platforms successfully develop product B and combine it with A, they form a duopoly in the market for the combined product $A+B$, and each of them has a gross profit of π^D. If only one platform develops product B, it operates as a monopolist in market $A+B$ and earns a profit of π^M. The other platform operates only in market A and has a profit of $\bar{\pi}$, which we normalize to zero without loss of generality. Finally, if neither platform develops product B, they both operate only in market A and make a profit of $\bar{\pi} = 0$. We make the standard assumption that $\pi^M \geq 2\pi^D > 0$.

R&D is probabilistic. If platform i invests $C(p_i) = \phi_i p_i^2/2$ in R&D, it successfully develops product B with probability p_i, where $p_i \in [0,1]$. The firms' R&D projects are probabilistically independent. For simplicity, we assume that $\phi_1 = \phi_2 = \phi$, so the platforms are fully symmetric *ex ante*.

To ensure that the equilibrium is stable,[7] we assume that:

Assumption 1. $\phi > \pi^M - \pi^D$.

This assumption also ensures that R&D efforts are always interior. Note that as $\pi^M \geq 2\pi^D$, Assumption 1 implies that $\phi > \pi^D$, which will be useful in the analysis.

[7] The equilibrium is stable if the slope of the best response functions is less than 1 in absolute terms.

2.2 Startup

In addition to the platforms, a startup S develops its own version of product B. The startup successfully develops the product with probability $p_S \in (0,1)$, which we consider exogenous. For example, the startup could be financially constrained and unable to respond if the platforms increase their R&D efforts. Therefore, we take the startup's R&D effort as given.[8]

The startup only operates in the technology market and does not compete with the platforms in the downstream market, for example, because it lacks product A. Thus, if the platforms develop their own version of B, the startup's product has no added value, and its profit is normalized to zero. Conversely, if a platform fails to develop product B, it can combine its product A with the startup's version of B.

2.3 Technology transfer

We consider two alternative ways to transfer the technology from the startup to the platforms: an exclusive transfer ("acquisition") and a non-exclusive transfer ("licensing"). Under acquisition, a platform purchases the startup and becomes the exclusive user of its technology. By contrast, under licensing we assume that the startup offers a non-exclusive license, meaning it will license its product to both platforms if they each request it.

Assuming it has successfully developed product B, the startup can choose to negotiate an acquisition or licensing agreement with the platforms. We adopt the "Nash-in-Nash with Threat of Replacement" (NNTR) bargaining solution (Ho and Lee, 2019; Chambolle and Molina, 2023) as the equilibrium concept. The NNTR bargaining solution extends the Nash-in-Nash solution (Horn and Wolinsky, 1988) by allowing the startup, during an exclusive negotiation (acquisition), to threaten to replace the negotiating platform with its rival, which is excluded from the negotiation. Specifically, when negotiating with platform i, the startup has the option of replacing its current partner with platform $j \neq i$ at its reservation price.

When the negotiation is non-exclusive (licensing), the NNTR solution is equivalent to the Nash-in-Nash solution. In this case, the startup engages in bilateral negotiations with both platforms. Each platform negotiates with the startup assuming that the other platform has successfully negotiated a deal with S, and the division of surplus in each bilateral negotiation is determined according to the Nash bargaining solution.[9] We denote by $\beta \in (0,1)$ the bargaining weight of the startup.

[8] We further discuss the startup's R&D technology in Section 5.1.

[9] A typical microfoundation of the Nash-in-Nash solution is that the startup sends two independent delegates who cannot communicate with each other and negotiate a license deal with each platform according to the Nash bargaining solution (Crémer and Riordan, 1987), or that the delegates have passive beliefs (Rey and Tirole, 2007).

2.4 Competition policy

There are two possible types of acquisitions: *technology acquisitions* and *killer acquisitions.* A *killer acquisition* occurs when the acquiring platform has successfully developed product B, while its competitor has not. The successful platform acquires S in order to block the rival platform's access to the $A+B$ market. In this case, the acquiring platform has two versions of product B, its own and the one developed by S, and it kills one of them. In all other cases, when the acquiring platform has not developed product B, we refer to the transaction as a *technology acquisition.*

Competition policy can prohibit all mergers or only some of them. Specifically, we assume that a competition authority decides whether a merger between a platform and the startup is allowed. The competition authority can choose among three different merger regimes: (i) allow all mergers, (ii) prohibit all mergers, or (iii) prohibit only "killer acquisitions".[10] Licensing, by contrast, is not regulated by the competition authority.[11]

The competition authority chooses the merger regime that maximizes consumer surplus. Depending on the R&D outcome and the merger policy in place, the market structure can be a duopoly, a monopoly, or no active platform. The consumer surplus associated with these different market configurations is CS^D, CS^M, and $CS^\varnothing$, respectively, and we make the natural assumption that $CS^D \geq CS^M > CS^\varnothing = 0$. The merger rules set by the competition authority are common knowledge.

2.5 Timing of the game

The timing of the game is as follows:

1. The competition authority announces its merger policy.

2. The platforms decide on their levels of R&D effort.

3. The platforms observe the success of the R&D projects.

4. The startup decides whether to negotiate an acquisition or non-exclusive licensing agreements. It then engages in bilateral simultaneous negotiations with the platforms. The platforms pay a fixed price to acquire the startup or to purchase a license.

5. Profits are realized.

We look for the subgame perfect equilibrium of this game.

[10]To identify potential killer acquisitions, the competition authority should check whether the acquirer has developed a technology or a product that is similar to the product provided by S. If so, the acquisition can be labeled as a killer acquisition. Otherwise, the acquisition of S is a standard technology acquisition.

[11]Although, in some cases, competition authorities have imposed licensing obligations.

2.6 Monopoly platform benchmark

To understand how the presence of the startup affects the competition between the platforms, it is useful to consider as a benchmark the case with a single (monopoly) platform and the startup. As in the baseline model, if its own project fails, the monopoly platform can acquire the startup's technology if it is successful. Nash bargaining over the fixed transfer price yields a payment to the startup equal to $\beta\pi^M$.[12] Denoting by p the platform's R&D effort, the expected profit of the platform is then:

$$\Pi = p\pi^M + (1-p)p_S(1-\beta)\pi^M - \phi\frac{p^2}{2}.$$

The first-order condition (FOC) with respect to p is:

$$\pi^M - p_S(1-\beta)\pi^M = \phi p, \tag{1}$$

which yields profit-maximizing effort for the monopoly platform $p^M = \min\left\{1, \frac{(1-p_S(1-\beta))\pi^M}{\phi}\right\}$, and the corresponding profit when p^M is interior $\Pi^M = \phi(p^M)^2/2 + (1-\beta)p_S\pi^M$. We can easily show that:

Lemma 1. *Suppose that there is a monopoly platform and a startup. The platform's equilibrium innovation effort decreases in p_S and increases in β. Its equilibrium profit increases in p_S and decreases in β.*

Proof. The first part of the lemma follows directly from the expression of p^M. For the second part, when p^M is interior, we have $\frac{\partial \Pi^M}{\partial p^s} = (1-\beta)\pi^M(1-p^M) > 0$ and $\frac{\partial \Pi^M}{\partial \beta} = -p_S\pi^M(1-p^M) < 0$. □

In this monopoly benchmark, we observe a *reverse killer (acquisition) effect* (Crawford, Valletti and Caffarra, 2020): the monopoly platform invests *less* in R&D when a startup invests in a similar project. The startup provides the monopolist with insurance against failure in R&D, which reduces the platform's innovation effort.[13] In other words, the research efforts of the monopolist and the startup are *substitutes*, with the latter crowding out the former.[14]

This reduction in research effort is larger when the startup has a higher probability of success (p_S is higher) and when the price paid for the startup's technology is lower (β is lower). Despite a lower intrinsic research effort, the presence of the startup increases the monopoly platform's profit because the insurance more than compensates for the lower research effort.

[12] In the monopoly case, licensing and acquisition are both exclusive and thus equivalent.

[13] This insurance effect remains at play if we endogenize the startup's R&D effort. Assuming that the startup faces the same R&D cost as the platform, it chooses p_S to maximize its profit $(1-p)p_S\beta\pi^M - \phi(p_S)^2/2$. The startup's best-response to an effort p by the incumbent is then $p_S^{BR}(p) = (1-p)\beta\pi^M/\phi$. Substituting $p_S = p_S^{BR}(p)$ into (1), we can see that the insurance effect remains and becomes weaker as the platform increases its R&D effort.

[14] This crowding out effect is not necessarily inefficient. If R&D exhibits decreasing returns to scale, as it the case for the research effort by the platform, splitting effort between different firms can lead to a more cost-effective R&D process.

3 Equilibrium with competing platforms

In this section, we solve for the equilibrium when platforms compete. First, we define the different possible research outcomes.

The two platforms and the startup perform R&D to develop product B. Thus, at the end of the research phase, we can have 0, 1, 2, or 3 firms that have successfully developed product B. This leads to the following possible cases:

Case 0: With probability $(1-p_1)(1-p_2)(1-p_S)$, all firms fail and there is no product B. All firms have zero profit: $\pi_1 = \pi_2 = \pi_S = 0$.

Case 1: With probability $p_1 p_2$, both platforms have their version of product B. The market is a duopoly and the startup has no value, even if it has successfully developed product B: $\pi_1 = \pi_2 = \pi^D$, $\pi_S = 0$.

Case 2: With probability $p_i(1-p_j)(1-p_S)$, only platform i is successful and it operates as a monopoly: $\pi_i = \pi^M$, $\pi_j = 0$, $\pi_S = 0$.

Case 3: With probability $(1-p_1)(1-p_2)p_S$, only the startup is successful.

Case 4: With probability $p_i(1-p_j)p_S$, platform i and the startup are successful, platform j fails.

Table 1 reports platform profits in the different cases for all possible merger regimes. While the firms' payoffs are immediate in cases 0, 1, and 2, for cases 3 and 4, we need to determine the outcome of the negotiations between the platforms and the startup. This will be done in the next section.

	Merger regimes		
	No acquisition	All acquisitions allowed	Killer acquisitions prohibited
Case 1	Duopoly $\pi_1 = \pi_2 = \pi^D$	Duopoly $\pi_1 = \pi_2 = \pi^D$	Duopoly $\pi_1 = \pi_2 = \pi^D$
Case 2	Monopoly platform i $\pi_i = \pi^M, \pi_j = 0$	Monopoly platform i $\pi_i = \pi^M, \pi_j = 0$	Monopoly platform i $\pi_i = \pi^M, \pi_j = 0$
Case 3	Duopoly $\pi_1 = \pi_2 = (1-\beta)\pi^D$	Monopoly & acquisition $\pi_i = \pi_j = 0$	Monopoly & acquisition $\pi_i = \pi_j = 0$
Case 4	Duopoly $\pi_i = \pi^D, \pi_j = (1-\beta)\pi^D$	Monopoly i & acquisition $\pi_i = \pi^M - \max\{\pi^D, \beta\pi^M\}, \pi_j = 0$	Duopoly $\pi_i = \pi^D, \pi_j = (1-\beta)\pi^D$

Table 1: Platforms' profits in the different market configurations and merger regimes.

3.1 Licensing and acquisition

In Stage 4, having observed the outcomes of the R&D projects, the startup chooses whether to negotiate licensing agreements with the two platforms or an acquisition, subject to the prevailing merger policy.

3.1.1 Licensing

First, suppose that S engages in bilateral negotiations with the two platforms over a non-exclusive license (Case 3). Formally, the fixed license fee negotiated between platform i and S, denoted F_i, is the solution to:

$$\max_{F_i} (F_i)^{\beta} \left(\pi^D - F_i\right)^{1-\beta}. \tag{2}$$

The gains from trade for the startup and platform i are $F_i + F_j^*$ and $\pi^D - F_i$, respectively, while their payoffs in case of disagreement are F_j^* and 0, where F_j^* is the fee paid by platform j to S if an agreement is reached. The solution to problem (2) is $F_i = \beta\pi^D$ for each platform $i = 1, 2$. The solution is identical when the startup negotiates a unique licensing deal with the unsuccessful platform in Case 4. We can therefore state that:

Lemma 2. *Under licensing, platforms that failed to innovate purchase a license at price $F^L = \beta\pi^D$, and the market operates as a duopoly.*

3.1.2 Startup acquisition

Now, consider the case where the platforms bargain for acquiring the startup. The NNTR solution allows us to model the negotiation between S and a given platform i over the acquisition price, under the threat that S could replace platform i with platform $j \neq i$ in this negotiation. As we will show, the outcome depends on whether a platform has a version of product B and on the merger regime in place.

We need to consider three different cases. First, consider the case in which both platforms have failed to develop product B (Case 3) and acquisitions are allowed. In this case, the acquiring platform monopolizes the market and earns the gross profit π^M. Suppose that S negotiates with some platform i for an acquisition. According to the NNTR solution, the acquisition price must solve:

$$\max_{F_i} (F_i)^{\beta} \left(\pi^M - F_i\right)^{1-\beta} \text{ s.t. } F_i \geq f_j, \tag{3}$$

where f_j is platform j's reservation price for the startup. Note that the status quo payoffs for platform i and the startup are equal to 0, because they are not engaged in any other bilateral negotiation. As platform j is willing to pay up to π^M for acquiring the startup, we have $f_j = \pi^M$. So, the solution to (3) is $F_i = \max\{\beta\pi^M, \pi^M\} = \pi^M$.

We can then state the following:

Lemma 3. *Under acquisition, if both platforms fail to develop product B while S successfully develops it, one platform acquires the startup, and the startup extracts the entire monopoly profit, i.e., $F^A = \pi^M$.*

Second, consider the case in which platform i has developed product B while j has not (Case 4). In this case, an acquisition by platform i would be considered as a killer acquisition.

Suppose that is is allowed by the competition authority. Following Ho and Lee (2019) and Chambolle and Molina (2023), we apply the NNTR solution only to stable startup acquisition deals, which requires that the deal generates greater bilateral surplus than any alternative acquisition used as a replacement threat. Otherwise, the acquisition would not be stable, as S would prefer to switch to another partner that yields a higher surplus. As the bilateral surplus when dealing with platform i (π^M) is greater than when dealing with platform $j \neq i$ (π^D), S engages in an exclusive bilateral negotiation with platform i. According to the NNTR solution, the price of the acquisition must then solve:

$$\max_{F_i} (F_i)^\beta \left(\pi^M - F_i\right)^{1-\beta} \text{ s.t. } F_i \geq f_j, \tag{4}$$

where f_j is platform j's reservation price for the platform. As platform j is willing to pay up to π^D for acquiring the startup, we have $f_j = \pi^D$. So, the solution to (4) is $F_i = \max\{\beta\pi^M, \pi^D\}$.

Lemma 4. *Under acquisition, if platform i and the startup successfully develop product B, but platform j does not, platform i acquires the startup at a price of* $F^K = \max\{\beta\pi^M, \pi^D\}$.

Finally, in Case 4, if killer acquisitions are not allowed, the startup can only negotiate an acquisition with the unsuccessful platform j. The acquisition price then solves $\max_{F_j} \left(F_j\right)^\beta \left(\pi^D - F_j\right)^{1-\beta}$, and we have $F_j = \beta\pi^D$. In this case, the startup is indifferent between selling a license or the company to platform j.

3.1.3 Comparison

Depending on the merger regime in place, the startup may be able to choose between negotiating an acquisition or a licensing deal. The previous analysis shows that:

Proposition 1. *If it is allowed, the startup prefers to negotiate an acquisition deal over a licensing deal.*

The startup's profit is always higher under acquisition than under licensing. This is because, platforms are willing to pay more for an exclusive deal. Hence, the startup prefers to negotiate an acquisition, and licensing occurs only when acquisitions are prohibited. Based on this analysis, we report the firms' profits in the different scenarios in Table 1.

3.2 R&D Effort

In Stage 2, platforms choose their R&D efforts, taking into account the merger policy that affects how the startup's technology can be acquired later on.

3.2.1 No acquisition

When acquisitions are not allowed, the startup's technology can be acquired only through non-exclusive licensing. Using Table 1, platform i's expected profit is then:

$$\pi_i = p_i(1-p_j)\pi^M + p_i p_j \pi^D + (1-p_i)p_S(1-\beta)\pi^D - p_i(1-p_j)p_S(\pi^M - \pi^D) - \phi\frac{p_i^2}{2}. \qquad (5)$$

The first-order condition with respect to p_i is:[15]

$$\frac{d\pi_i}{dp_i} = (1-p_j)\pi^M + p_j\pi^D \underbrace{-p_S(1-\beta)\pi^D}_{\text{Insurance effect}} \underbrace{-p_S(1-p_j)(\pi^M-\pi^D)}_{\text{Competition effect}} - \phi p_i = 0. \qquad (6)$$

The FOC (6) shows that the presence of the startup in the technology market affects the platforms' R&D incentives through an *insurance effect* and a *competition effect*.

First, the startup provides an insurance against the failure of an R&D project; the platform can make positive profits even if it fails to develop product B, as shown by the third term in (5). Thus, the possibility of acquiring the startup's technology represents an opportunity cost for in-house R&D, as it can be seen in the corresponding term in the FOC (6). This opportunity cost reduces the incentives to invest in R&D, which we call the *insurance effect*.

Second, the startup reduces the returns to innovation for the platform if it succeeds in developing product B. Without the startup, if platform i succeeds while platform j fails, platform i can safely enjoy a monopoly position. With the startup, the benefits of innovation are reduced, because the competing platform can obtain a license to the startup's technology, as shown by the fourth term in (5). This *competition effect*, identified in the FOC (6), also reduces the platform's incentives to innovate.

Since we look for a symmetric equilibrium, we can set $p_j = p_i$ in the FOC (6). Solving for p_i, we obtain the symmetric equilibrium level of R&D:

$$p^N = \frac{(1-p_S)\pi^M + p_S\beta\pi^D}{\phi + (1-p_S)(\pi^M - \pi^D)}. \qquad (7)$$

Note that $p^N < 1$ because $\phi > \pi^D$ under Assumption 1.

3.2.2 All types of acquisitions are allowed

Now, consider the case where the merger policy allows all types of acquisitions. Using Table 1, the expected profit of platform i is:

$$\pi_i = p_i(1-p_j)\pi^M + p_i p_j\pi^D - p_i(1-p_j)p_S F^K - \phi\frac{p_i^2}{2}, \qquad (8)$$

where $F^K = \max\{\pi^D, \beta\pi^M\}$ is the fee paid by platform i for acquiring the startup when platform j has failed (see Lemma 4). The first-order condition with respect to p_i is then:

$$\frac{d\pi_i}{dp_i} = (1-p_j)\pi^M + p_j\pi^D \underbrace{-p_S(1-p_j)F^K}_{\text{competition effect}} - \phi p_i = 0. \qquad (9)$$

[15]The second-order condition is satisfied as $\phi > 0$.

Note that only the competition effect is at play; platform i purchases the startup to secure its monopoly position if platform j has not developed product B and tries to buy the startup's technology. As it is costly to maintain the monopolistic position, the benefits of innovation are reduced. This competition effect is particularly strong when the startup has substantial bargaining power (β is high), as in this case, it can extract a large payoff from a killer acquisition. There is no insurance effect, because if platform i fails to develop product B, the startup either captures all downstream profits (case 3) or is acquired by the competing platform (case 4).

Replacing p_j for p_i and solving the FOC (9) for p_i, we obtain the symmetric equilibrium level of R&D,

$$p^A = \begin{cases} \frac{\pi^M - p_S\pi^D}{\phi+\pi^M-(1+p_S)\pi^D} & \text{if } \beta \le \hat{\beta} \equiv \frac{\pi^D}{\pi^M} \\ \frac{\pi^M - p_S\beta\pi^M}{\phi+\pi^M-\pi^D-p_S\beta\pi^M} & \text{if } \beta > \hat{\beta} \end{cases}, \tag{10}$$

where $p^A \in (0,1)$, as $\pi^M > p_S\pi^D$ and $\phi > \pi^D$ under Assumption 1. Note that $\hat{\beta} \in (0,1/2)$, as $\pi^M > 2\pi^D > 0$.

3.2.3 Killer acquisitions are prohibited

Finally, consider the case in which technology acquisitions are permitted, while killer acquisitions are prohibited, which means that a platform is not allowed to acquire the startup if it owns a similar technology (here, product B). Thus, in case 4, where platform i innovates but platform j fails, platform i cannot acquire S. Using Table 1, platform i's expected profit is then:

$$\pi_i = p_i(1-p_j)\pi^M + p_ip_j\pi^D + (1-p_i)p_jp_S(1-\beta)\pi^D - p_i(1-p_j)p_S(\pi^M-\pi^D) - \phi\frac{p_i^2}{2}. \tag{11}$$

The first-order condition with respect to p_i is:

$$\frac{d\pi_i}{dp_i} = (1-p_j)\pi^M + p_j\pi^D \underbrace{-p_Sp_j(1-\beta)\pi^D}_{\text{insurance effect}} \underbrace{-p_S(1-p_j)(\pi^M-\pi^D)}_{\text{competition effect}} - \phi p_i = 0. \tag{12}$$

The insurance effect kicks in because killer acquisitions are prohibited. So, if platform i fails while platform j succeeds, platform i can still obtain S's technology provided the startup is successful. The competition effect here stems from the fact that if platform j fails, it can nevertheless acquire the startup's technology, which dissipates part of the return to innovation for platform i ($\pi^M - \pi^D$).

Replacing p_j for p_i into the FOC (12) and solving for p_i, we obtain the symmetric equilibrium level of R&D effort,

$$p^K = \frac{(1-p_S)\pi^M + p_S\pi^D}{\phi + (\pi^M-\pi^D) - p_S(\pi^M-(2-\beta)\pi^D)}, \tag{13}$$

with $p^K < 1$, because $\phi > \pi^D$ under Assumption 1.

4 Comparison of merger regimes

In this section, we compare R&D effort (Section 4.1), profits (Section 4.2), and consumer surplus (Section 4.3) under the three merger regimes.

4.1 R&D effort

First, we characterize the variation of the R&D effort with respect to the startup's bargaining power β. We can show that:

Lemma 5. *Both p^N and p^K increase in β, whereas for $\beta > \hat{\beta} = \pi^D/\pi^M$, p^A decreases in β.*

Proof. This follows directly from the expressions of p^N and p^K, and by derivating p^A with respect to β. □

An increase in the startup's bargaining power β raises the price that firms must pay for a license. Consequently, the insurance effect weakens, which stimulates platform R&D in the regimes where the insurance effect is at play (N and K). Additionally, greater bargaining power for the startup increases the price of a killer acquisition, as the startup can extract (weakly) more from the acquiring platform. This reduces the return to R&D, thereby strengthening the competition effect and lowering incentives to undertake R&D in regime A, the only regime in which killer acquisitions are allowed.

Next, we analyze how the R&D effort is affected by the startup's ability to develop the innovation, i.e., its probability of success p_S.

Lemma 6. *In all three merger regimes, R&D effort decreases with p_S.*

In all merger regimes, the magnitude of the insurance and competition effects increases with the startup's ability to develop the innovation, p_S. Therefore, in-house R&D decreases with p_S.

Using these results, we can classify the R&D efforts in the three regimes as follows:

Lemma 7. *For $p_S > 0$, there exists β_1 and β_2 with $\hat{\beta} < \beta_1 < \beta_2 < 1$ such that*

- *For $\beta < \beta_1$, $p^N < p^K < p^A$;*
- *For $\beta \in [\beta_1, \beta_2]$, $p^N < p^A < p^K$;*
- *For $\beta \in [\beta_2, 1]$, $p^A < p^N < p^K$.*

As discussed above, the presence of the startup in the technology market affects the platforms' R&D through an *insurance effect* and a *competition effect*, both of which reduce the platforms' R&D incentives. The magnitude of the two effects differs across the three merger regimes. Comparing the FOC (6), (9) and (12), we can see that the magnitude of the insurance effect is highest when no acquisitions are allowed (regime N) and lowest when they are all allowed (regime A). Moreover, for a given p_j, the competition effect is the same in regimes N and K and, when β is small ($\beta < 1-\hat{\beta}$), with a higher magnitude than in regime A.[16] Therefore, the overall impact of the insurance and competition effects is highest in regime N and lowest in regime A.

For higher values of β ($\beta > 1-\hat{\beta}$), the competition effect is stronger is regime A than in regimes N and K, and its magnitude in regime A increases with β. This reduces R&D effort in regime A (Lemma 5) and leads to a reversal of the ranking of efforts for sufficiently high values of β.

From a policy point of view, this result suggests that a more lenient merger policy allowing acquisitions can stimulate R&D by incumbent platforms. However, permitting all types of mergers, including killer acquisitions, may not always be the most effective policy for encouraging R&D; when the startup has strong bargaining power, banning killer acquisitions leads to higher R&D investment.

4.2 Platforms' profits

We now compare the equilibrium profits of the platforms in the three merger regimes, which can be written as follows:

$$\pi^N = \frac{\phi}{2}\left(p^N\right)^2 + (1-\beta)p_S\pi^D, \tag{14}$$

$$\pi^A = \frac{\phi}{2}\left(p^A\right)^2, \tag{15}$$

$$\pi^K = \frac{\phi}{2}\left(p^K\right)^2 + (1-\beta)p_S p^K\pi^D. \tag{16}$$

The first term in the profit equations is the net benefit of the innovation effort, that is, the expected profit from a successful innovation, net of R&D costs. The second term in (14) and (16) represents the value of the insurance from the startup's presence, which is nonzero when all acquisitions are banned (regime N) or only killer acquisitions are banned (regime K).

When all acquisitions are allowed (regime A), the value of the insurance is zero, because the platforms dissipate this value in their competition to acquire the startup. Therefore, a higher probability of success for the startup always hurts the platforms.

Lemma 8. *When all acquisitions are allowed, the platforms' profit π^A decreases in p_S.*

Proof. Immediate from the fact that p^A decreases in p_S (Lemma 6). □

This result is a direct consequence of the competition effect discussed above. A higher probability of a startup's success p_s decreases the benefit of a successful innovation for the platforms,

[16] The magnitude of the competition effect in regimes N and K is $p_j(1-p_S)(\pi^M-\pi^D)$, and it is $p_j(1-p_S)F^K$ in regime A, with $F^K = \max\{\pi^D, \beta\pi^M\}$. So, the competition effect is lower in regime A if $F^K < \pi^M - \pi^D$. When $\beta < \hat{\beta}$ (in which case, $F^K = \pi^D$), this is always true. When $\beta > \hat{\beta}$ (in which case, $F^K = \beta\pi^M$), this is true if $\beta < 1-\hat{\beta}$ (remember that $\hat{\beta} < 1/2$).

thus reducing their profit. At the limit, when all acquisitions are allowed, the platforms are better off if there is no startup ($p_S = 0$).

When some or all the acquisitions are prohibited, the effect of the startup's probability of success on platform profits is ambiguous. On the one hand, a higher p_S increases the risk of profit dissipation if the startup succeeds and some platforms fail (competition effect). On the other hand, a higher p_S also increases the profits of the platforms in case of failure (insurance effect). For this reason, π^K and π^L are not always monotone in p_S.

We now turn to a comparison of platform profits in the different regimes.

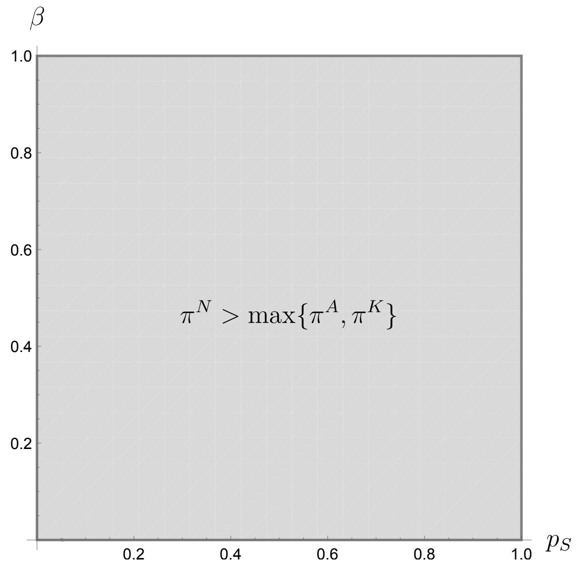
Proposition 2. *Platform profits under the three merger regimes compare as follows:*

- *Platforms always prefer a ban on all types of acquisitions to a ban on killer acquisitions only (i.e., $\pi^N \geq \pi^K$).*
- *Platforms prefer a ban on all types of acquisitions (regime N) if β is high ($\beta > \beta_2$) or if $\pi^D/\pi^M > 0.382$, irrespective of β.*
- *Platforms prefer the acquisition regime (regime A) for some value of β if π^D/π^M is sufficiently low.*

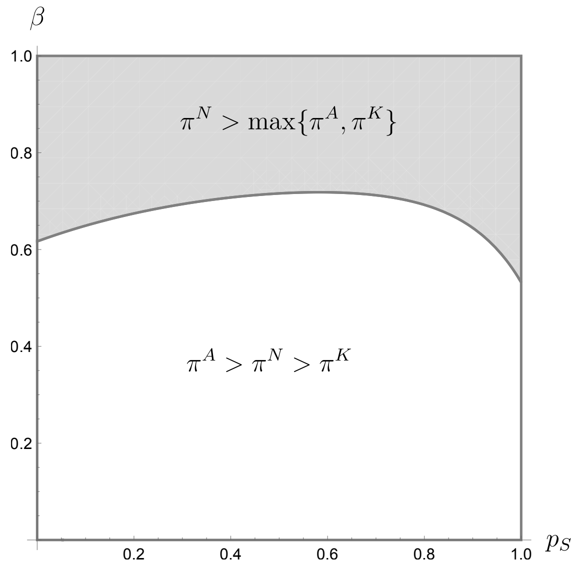
The fact that the platforms prefer a ban on all types of acquisitions to a ban on killer acquisitions only can be easily understood by looking at Table 1: There is only one case where the market outcome differs between the two regimes, when both platforms failed (case 3). In this case, the outcome for the platforms is worse when technology acquisitions are possible, because the startup extracts all their profits. As a consequence, their profit is (weakly) lower in regime K compared to regime N (with equality when $\beta = 1$).

Compared with the acquisition regime A, the licensing regime N provides an insurance value to the platforms. Moreover, when the startup's bargaining power β is high ($\beta > \beta_2$), the net return to R&D is larger in regime N than in regime A. In this case, platforms unambiguously prefer regime N. When β is lower, the platforms face a trade-off: while regime N offers insurance, appropriability of the innovation is greater under regime A. In this case, platforms tend to prefer regime A when the value of appropriating the innovation is high (π^D/π^M is low) and regime N when it is low (π^D/π^M is high).

Figure 1 illustrates these results. It shows which merger regime yields the highest profits for the platforms as a function of p_S on the horizontal axis and β on the vertical axis, when π^D/π^M is relatively high (Fig 1a) and when it is relatively low (Fig 1b). The gray area corresponds to the case where the licensing regime N is preferred, and the white area corresponds to the case where it is the acquisition regime A that is preferred (we use the same color code for the other figures). Platforms prefer the acquisition regime when the value of appropriating the innovation is high and the startup's bargaining power is not too strong. Otherwise, they tend to favor the licensing regime, where all acquisitions are banned, for all values of p_S and β.



(a) $\pi^M = 1.5$, $\pi^D = 0.33$, $\phi = 0.7$



(b) $\pi^M = 4$, $\pi^D = 0.5$, $\phi = 4$

Figure 1: Merger regime maximizing platform profits.

4.3 Consumer surplus and competition policy

In the first stage, the competition authority chooses the merger regime that maximizes consumer surplus. Consumer surplus depends only on the (ex-post) market structure, specifically on the number of active platforms – it does not matter to consumers whether a platform develops the innovation in-house or obtains it through licensing or acquisition.

In equilibrium, the market for the combined product $A + B$ can be a monopoly, a duopoly, or non-existent if there is no innovation, with a corresponding consumer surplus of CS^M, CS^D and $CS^\emptyset = 0$, and $CS^D \geq CS^M > CS^\emptyset = 0$.

For each merger regime $r \in \{N, A, K\}$, we can calculate the probability θ^r_M of having a monopoly, the probability θ^r_D of having a duopoly, and the probability $\theta^r_\emptyset$ that the market does not emerge, with $\theta^r_M + \theta^r_D + \theta^r_\emptyset = 1$. The expected consumer surplus is then:[17]

$$CS^r = \theta^r_M CS^M + \theta^r_D CS^D.$$

For consumers, there is a classic trade-off between, on the one hand, the diffusion of innovation in the market, for which it is better to prohibit mergers because they lead to monopolization, and, on the other hand, the incentives of platforms to innovate, which depend on the merger regime and the bargaining power of the startup (see Lemma 7). On this basis, we can isolate two special cases. Consumer surplus is highest under:

1. The no-acquisition regime when the cost of R&D is very high ($\phi \to \infty$);

2. The acquisition or the killer acquisition regime when $CS^M \to CS^D$.

[17]The expression of expected consumer surplus in the three regimes is provided in the Appendix.

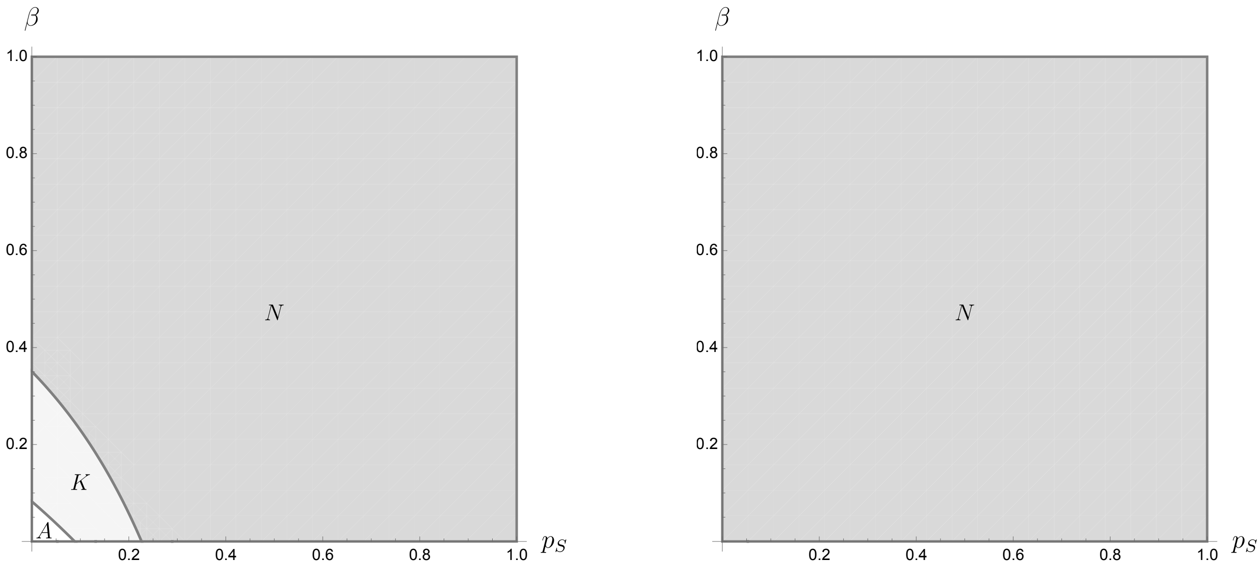
When $\phi \to \infty$, the platforms' R&D efforts go to 0 for all merger regimes. We find that $CS^A = CS^K \approx p_S CS^M < p_S CS^D \approx CS^N$. When the cost of R&D ϕ is very high, platforms don't invest in R&D. Innovation comes only from the startup. Therefore, acquisitions must be prohibited to avoid the monopolization of the innovation and to maximize its diffusion.

When $CS^M \to CS^D$, which can happen for instance with regulated or zero prices, the market structure has little importance for consumers, and what matters is the probability to innovate. In any regime r, it is given by $1-(1-p_S)(1-p^r)^2$ and $p^A > \max\{p^K, p^N\}$ if $\beta < \beta_1$, while $p^K > \max\{p^A, p^N\}$ if $\beta > \beta_1$ (see Lemma 7). Therefore, consumers are better off if startup acquisitions are allowed (possibly with a ban on killer acquisitions), as this stimulates innovation effort by the platforms.

In all the other cases, allowing mergers stimulates innovation but also leads to market monopolization. To illustrate the trade-off and identify the optimal regime, we have used the demand model of Singh and Vives (1984) to set values for consumer surplus consistent with the values for profits used in Figure 1. Specifically, we calibrate the parameters of the demand model so that $\pi^M = 1$ and $\pi^D = 0.33$ (Fig 1a) and $\pi^M = 4$ and $\pi^D = 0.5$ (Fig 1b). We then calculate consumer surplus and obtain in the first case $CS^M = 1/2$ and $CS^D \approx 1.51$, and in the second case $CS^M = 2$ and $CS^D \approx 7.25$ (see the Appendix for details).

Figure 2 shows consumers' preferred merger regime, when π^D/π^M is relatively high (Fig 2a) and when it is relatively low (Fig 2b). It shows that, for consumers, the diffusion of the innovation matters more than the incentives to innovate. For most parameter values, consumers prefer that acquisitions are not allowed (i.e., regime N). It is only when p_S is small, licenses are cheap (i.e., β is low), and CS^M is not too low relative to CS^D (as in Fig 2a) that consumers prefer that the competition authority allows some or all acquisitions. The intuition is as follows. When p_s is small, the startup's innovation is relatively unlikely, and the platforms' R&D efforts become particularly important. However, when β is low, platforms benefit from a strong insurance effect and exert little effort when mergers are prohibited. In such circumstances, a ban on mergers benefits consumers if the loss from having a monopoly instead of a duopoly is not too large.

The preferences of consumers should be contrasted with those of the platforms. By comparing Figures 1 and 2, we observe two types of divergences between consumers' and platforms' preferences over the merger regime. First, when the value of appropriating the innovation is high (i.e., π^M is high relative to π^D, as in Figure 2b), platforms may prefer the acquisition regime, whereas consumers favor the diffusion of the innovation and therefore prefer the licensing regime. Second, when the value of appropriating the innovation is low (i.e., π^M is low relative to π^D, as in Figure 2a) and the startup rarely innovates (i.e., p_S is low), consumers prefer allowing some acquisitions in order to stimulate the platforms' innovation efforts. In this case, the optimal merger policy for consumers may involve permitting (some) acquisitions, whereas platforms would still prefer a ban and thus favor the licensing regime.



(a) $\pi^M = 1.5$, $\pi^D = 0.33$, $\phi = 0.7$

(b) $\pi^M = 4$, $\pi^D = 0.5$, $\phi = 4$

Figure 2: Merger regime maximizing consumer surplus.

5 Extensions

In this section, we extend the baseline model in three directions. First, we study the startup's entry decision. Second, we analyze the case where a platform can fund the startup, giving the funding platform a first-mover advantage in the acquisition game. Third, we study how the merger regime affects the startup's innovation direction.

5.1 Venture financing and startup entry

In our model, the startup makes a profit if its R&D project is successful and at least one platform fails to develop product B. But we have, so far, treated the R&D investment of S as exogenous. Suppose that the startup must incur a fixed cost F for its R&D project and if it does so, the project succeeds with probability p_S.[18] For startups, investments in R&D are often funded by a venture capital (VC) fund. Assuming that the VC is risk neutral, it will fund the startup (and entry will occur) if the startup's expected profit exceeds the R&D cost F. Also, as the startup's profit depends on the merger regime, merger policy affects the startup's entry decision.

Using Lemmas 2, 3 and 4, we can write the startup's expected profits in the three merger

[18] Startups typically pursue innovation strategies that differ from those of incumbent platforms. To capture this, we assume that the startup has a different cost function for its R&D activities. In our model, the startup's R&D process is non-divisible, reflecting the fact that the startup has limited resources. Note that if the startup's R&D process were similar to that of the platforms, with a divisible effort and a convex R&D cost function, the determination of optimal effort levels would be considerably more complex, as the first-order conditions would be of higher order.

regimes are as follows:

$$\pi_S^N = p_S\left[(1-p^N)^2\cdot 2\beta\pi^D + 2p^N(1-p^N)\cdot\beta\pi^D\right] = 2p_S(1-p^N)\beta\pi^D, \quad (17)$$

$$\pi_S^A = p_S\left[(1-p^A)^2\pi^M + 2p^A(1-p^A)\max\{\beta\pi^M,\pi^D\}\right], \quad (18)$$

$$\pi_S^K = p_S\left[(1-p^K)^2\pi^M + 2p^K(1-p^K)\beta\pi^D\right]. \quad (19)$$

The merger regime affects the startup's profit in two ways. First, for a given level of R&D effort by the platforms, the startup always prefers to be acquired, because it can extract a larger share of the platforms' profits through an exclusive acquisition than through non-exclusive licensing (Proposition 1). Second, the probability that the startup can sell its technology is lower when the platforms exert more intense R&D effort. So, the startup may prefer the merger regime in which the platform make less R&D effort, which is a ban on acquisitions when its bargaining power is not too high (see Lemma 6). The balance between these two conflicting effects is ambiguous and difficult to characterize in general.

For our analysis, we will focus on the case where the cost of R&D is high for the platforms, corresponding to a high value for the parameter ϕ. In such a case, the impact of the merger regime on the platforms' R&D effort is more limited. We can establish the following.

Proposition 3. *Assume that $\phi > \pi^M$. Then, the startup prefers a merger regime that allows at least some acquisitions. Moreover, if $\beta > \beta_1$, it prefers the regime in which all acquisitions are allowed.*

The proposition shows that when the R&D cost is high, the startup is always better off if the competition policy allows at least some acquisitions.[19] Then, if its bargaining power is sufficiently high, the startup unambiguously prefers that all acquisitions be allowed, as this increases both the likelihood of being acquired and the acquisition price. As it increases the startup's profit, entry and funding by a venture capitalist are more likely.

5.2 Corporate Venture Capital

As an alternative to Venture Capital (VC) funded by private investors, institutional investors, or limited partners (LPs), startups can rely on Corporate Venture Capital (CVC), which is funded by large corporations (e.g., Google Ventures, Intel Capital). In addition to financial returns, CVC may also seek strategic benefits, such as improved access to information about innovations or higher returns when acquiring startups (Benson and Ziedonis, 2009).

Negotiations with CVC funding We consider that when a platform i provides CVC funding, it has the priority to negotiate an acquisition with S first. If this negotiation fails, the other platform j negotiates with S. Finally, if the startup is not acquired, platforms negotiate licenses.

[19]Note that the startup cannot credibly commit not to sell to firms that have developed the same technology (killer acquisitions), as ex-post, it is always better off accepting an acquisition offer. In that respect, a ban on killer acquisitions serves as a commitment device for the startup.

The negotiations with S are sequential and we use Nash bargaining with the outcome of the next stage as the default point in the bargaining. To simplify the analysis, we focus on the case where all acquisitions are allowed by the competition authority. We can then show that when the startup's bargaining power is not too strong, that is, when $\beta \leq \bar{\beta}$, with $\bar{\beta} > \hat{\beta}$, the CVC funder always acquires the startup at a lower acquisition price. We focus on this case for the remainder of the analysis.[20]

R&D effort by the platforms Using the outcome of the negotiations, we can define the profits of the platforms and calculate their optimal efforts, p_i^V and p_j^V (see the appendix for details).

For the funding platform i, there is both a competition effect and an insurance effect. Compared to the baseline case, the competition effect is reduced because the competition for acquisition is less intense and platform i manages to acquire the startup more often and at a lower price. But there is also an insurance effect, as the venture capitalist has the option to buy the startup if it fails and make some profit. For the non-funding platform j, there is only a competition effect that reduces the return to innovation, as it can no longer buy and kill S to monopolize the market (given that $\beta \leq \bar{\beta}$), but must share the market.

Taking all these effects into account, we find that the non-funding platform exerts more effort than the other. Moreover, when the startup's bargaining power is not too high, there is an overall reduction in the level of R&D effort.

Lemma 9. *Assume that $\beta \leq \bar{\beta}$. The funding platform i makes less R&D effort than its competitor, i.e., $p_i^V < p_j^V$. When $\beta < \hat{\beta}$, the total innovation effort is lower compared to the baseline case: $p_i^V + p_j^V < 2p^A$.*

Competition for corporate venture funding We can now turn to the initial stage of the game where the platforms decide whether to fund the startup. We assume that if both platforms propose funding, then each platform has an equal chance of funding the startup. If no platform proposes funding, we assume that the startup can find an outside investor, provided that $\pi_S^A \geq F$. The game played by the platforms is represented in Table 2.

		Platform 2	
		Fund	No fund
Platform 1	Fund	$\left(\frac{1}{2}(\pi_i^V - F + \pi_j^V), \frac{1}{2}(\pi_i^V - F + \pi_j^V)\right)$	$\left(\pi_i^V - F, \pi_j^V\right)$
	No fund	$\left(\pi_j^V, \pi_i^V - F\right)$	$\left(\pi_S^A, \pi_S^A\right)$

Table 2: Funding game.

[20] If $\beta > \bar{\beta}$, the non-funding firm, platform j, acquires the startup when its R&D project is successful and platform i has failed. See Lemma 10 in the Appendix.

Proposition 4. *When the platforms can provide venture funding to the startup:*

- *If* $F \leq \min\{\pi_i^V - \pi_j^V, \pi_i^V - \pi_S^A\}$*, there is a unique equilibrium where both platforms offer funding to the startup;*

- *If* $\pi_i^V - \pi_S^A < F \leq \pi_i^V - \pi_j^V$*, there are two equilibria where either both platforms offer funding or neither does;*

- *If* $\pi_i^V - \pi_j^V < F \leq \pi_i^V - \pi_S^A$*, there are two equilibria where only one platform offers funding.*

So, if $F \leq \max\left\{\pi_i^V - \pi_j^V, \pi_i^V - \pi_S^A\right\} \equiv \Delta\pi$, platform funding arises in equilibrium. In the numerical examples developed above, this is the case for most of the parameters we considered.

5.3 Direction of innovation

We have shown that the merger policy affects the intensity of innovation by the platforms and the likelihood of startup entry. In this subsection, we argue that merger policy can also influence the direction of the startup's innovation. It is well documented that startups do not always follow the same innovation path than established firms. For instance, they are more likely to develop disruptive and radical innovations (Gans, 2017). Recent research has also shown that the perspective of a merger can shape startups' innovation activities. Bryan and Hovenkamp (2020) show that technology choices of startups tend to be biased towards those of leading incumbents, while Dijk, Moraga-González and Motchenkova (2024) show that acquisitions induce startup to strategically reallocate funding across R&D projects.

To address this question, we consider that there are two possible innovation paths to develop product B. The two incumbent platforms follow the same path, which we call 'conventional'. The startup can decide to follow the same conventional (C) path or an alternative exploratory path (E). Only one research path is successful. Specifically, we assume that path E is successful with probability θ^e. If it fails, path C succeeds. So, this path is successful with probability $\theta^c = 1 - \theta^e$. There is no other difference between the two paths; in particular, both lead to the same product B if successful. The timing of the game is then modified as follows:

1. The competition authority decides on its merger policy.
2. The startup chooses a research path, C or E.
3. The platforms decide on their level of effort in R&D.
4. Nature decides on which innovation path is successful.
5. The platforms observe the success of the R&D projects and they play the continuation game as in the baseline case.

As usual, we solve the game backwards.

If the startup chooses research path E, its R&D project is successful with probability $\theta^e p_S$. In this case, as the only successful innovator, the startup earns a profit equal to π^M if mergers are allowed and to $2\beta\pi^D$ if they are not.[21] If instead the startup chooses path C, the game is the same as in the baseline case and the startup earns the expected profit π_S^N if acquisitions are prohibited, π_S^A if they are allowed, and π_S^K if killer acquisitions are prohibited. Therefore, the startup chooses innovation path E if:

$$\theta^e p_S(2\beta\pi^D) \geq \theta^c \pi_S^N = \theta^c p_S(1-p^N)(2\beta\pi^D) \quad \text{in regime } N, \tag{20}$$

$$\theta^e p_S \pi^M \geq \theta^c \pi_S^A = \theta^c p_S\left[(1-p^A)^2\pi^M + 2p^A(1-p^A)\max\{\beta\pi^M, \pi^D\}\right] \quad \text{in regime } A, \tag{21}$$

$$\theta^e p_S \pi^M \geq \theta^c \pi_S^K = \theta^c p_S\left[(1-p^K)^2\pi^M + 2p^K(1-p^K)\beta\pi^D\right] \quad \text{in regime } K. \tag{22}$$

Inspection of these conditions shows that choosing path E allows the startup to escape competition from incumbents in the technology market and to appropriate a larger share of the profits from its innovation when successful.

Conditions (20), (21) and (22) show that the startup chooses innovation path E if the ratio θ^e/θ^c is above a given threshold. The startup is then more likely to choose path E when this threshold is lower. Comparing the three conditions, we can then establish that:

Proposition 5. *The startup is more likely to choose the alternative exploratory innovation path E when at least some mergers are allowed.*

Therefore, allowing startup acquisitions changes the direction of innovation. If at least some mergers are allowed, a startup is more likely to choose a different research path than the platforms. We have shown in Proposition 3 that a startup is better able to monetize its innovation through acquisition than through licensing, as platforms compete for acquisition but not for licensing. Proposition 5 shows that the startup can extract even more surplus if it can escape from competition from the platforms in the technology market. This can be achieved by choosing a research path that is orthogonal to those of the platforms.

6 Conclusion

In our setting, startup innovation complements platform innovation. The startup's product has no intrinsic value and must be combined with the platforms' core products, which are one-way essential complements (Chen and Nalebuff, 2006). However, the startup's innovation is also a substitute, as it can displace organic innovation by the platforms. Indeed, in the digital economy, many startups develop new functionalities for users of established platforms. In doing so, they build on the existing networks of the incumbent platforms rather than developing their

[21] It does not matter whether killer acquisitions are allowed or not, because the case where one platform succeeds while the other fails cannot arise when the path C failed.

own. However, this strategy also places startups in competition with the platforms, which have their own research programs to develop (sometimes comparable) functionalities.

In this context, we examine the incentives of platforms to engage in R&D. A well-established result in the literature (see, e.g., Phillips and Zhdanov, 2013) is that the possibility to acquire the startup crowds out platforms' innovation effort, as the startup's innovation is a substitute for their own research efforts. In this paper, we identify two channels for this crowding-out effect, an insurance effect that reduces the cost of failing to innovate and a competition effect that dissipates the revenue from successful innovation. We show that the magnitude of these effects depends on the attitude of competition authority regarding startup acquisition. A prohibition of mergers favors the diffusion of innovation through non-exclusive licensing but it provides more insurance for failing platforms and reduces their incentives to innovate. Furthermore, licensing reduces the benefits of innovation as a successful platform is more likely to face a competitor on the market. A more lenient policy allows platforms to acquire the startup to protect their monopoly position. This suppresses the insurance effect, but maintaining a monopolistic position becomes costly as firms compete fiercely for acquisition (i.e., the competition effect might be strong). The balance between these two effects influences the R&D efforts by the platforms, their resulting profits, and ultimately consumer surplus.

Acquisitions of small, technology oriented firms by dominant digital platforms are increasingly scrutinized by competition authorities. To better monitor acquisitions in the tech sector, authorities have revised their intervention thresholds. When, as in our paper, a large platform in market A acquires a startup active only in market B, competition authorities may raise at least three types of concerns. First, the acquiring platform may degrade interoperability between the merged entity and third party competitors, thereby foreclosing the market.[22]. Second, the acquisition may eliminate a potential competitor. We do not consider such a case in our framework. We exclude scenarios where the startup enters market B and challenges the incumbents in the $A+B$ market. In that context, an acquisition would serve to neutralize a potential rival before it can achieve full-scale entry across the $A+B$ market (Motta and Peitz, 2021). Third, the acquiring platform may accumulate functionalities and data, reinforcing its market power and increasing barriers to entry, an effect often referred to as an *ecosystem effect*. Recent competition cases echo these concerns.[23]

Regarding interoperability, we show that in the case of a *technology acquisition*, the acquiring platform has no incentive to make product B available to the users of the rival platform, an extreme form of degraded interoperability. Blocking such mergers and allowing the startup to

[22] Relatedly, a dominant platform may deny interoperability to ensure the success of its own technology. See Motta and Peitz (2025).

[23] Interoperability was central in Google/Fitbit; elimination of a potential competitor in Adobe/Figma; and ecosystem concerns in Booking/Etraveli. In Booking/Etraveli, the acquisition of a flight OTA would have allowed Booking to strengthen its position in the hotel OTA market by gaining new functionalities and a new customer acquisition channel.

license its technology to both platforms is a possible remedy, but we show that this comes at a cost in terms of platforms' incentives to innovate.

Our model is more directly related to ecosystem concerns. What we call a *killer acquisition* is a strategy through which the acquiring platform strengthens its dominant position by acquiring a startup in a seemingly unrelated market and deprives the rival platform of access to the $A+B$ market. Our model shows that consumers may be better off when such mergers are prohibited, but this comes again at the cost of reduced platforms' incentives to innovate, an effect that has received little attention in the existing literature.

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Appendix

Singh and Vives illustrative model

The utility of the representative consumer is $U(q_1,q_2) = a(q_1+q_2) - (q_1^2 + 2\gamma q_1 q_2 + q_2^2)/2$, where q_1 and q_2 are the quantities of the firms, a is the intercept of demand, and γ measures the substitutability between the products. Maximizing the net utility $U(q_1,q_2) - p_1q_1 - p_2q_2$ with respect to quantities, we find the demand function of firm = 1, 2:

$$D_i(p_i,p_j) = \frac{a(1-\gamma) - p_i + \gamma p_j}{1-\gamma^2}.$$

Assuming zero marginal costs, firms maximize their profit $p_iD_i(p_i,p_j)$ with respect to their price p_i. We find the equilibrium duopoly profit:

$$\pi^D = \frac{a^2(1-\gamma)}{(1+\gamma)(2-\gamma)^2}.$$

The monopoly price, which maximizes $p(a-p)$, is $p^M = a/2$ and therefore the monopoly profit is $\pi^M = a^2/4$. We then calibrate this model using the values in Figure 1:

- Figure 1a: we have $\pi^M = a^2/4 = 1$, so $a = 2$. Then, we look for the value of γ such that $\pi^D = 0.33$ and find $\gamma \approx 0.78$.
- Figure 1b: we have $\pi^M = a^2/4 = 4$, so $a = 4$. Then, we look for the value of γ such that $\pi^D = 0.5$ and find $\gamma \approx 0.93$.

Consumer surplus is given by the net utility of the representative consumer. We find that:

$$CS^D = \frac{a^2}{(1+\gamma)(2-\gamma)^2} \quad \text{and} \quad CS^M = \frac{a^2}{8}.$$

With our calibrations, this leads to $CS^D \approx 1.51$ and $CS^M = 1/2$ for Figure 1a, and $CS^D \approx 7.25$ and $CS^M = 2$ for Figure 1b.

Finally, the expected consumer surplus in the three regimes is:

$$CS^N = 2(1-p_S)(1-p_N)p_N CS^M + \left[p_S + (1-p_S)p_N^2\right] CS^D,$$
$$CS^A = (1-p_A)\left[p_S + (2-p_S)p_A\right] CS^M + p_A^2 CS^D,$$
$$CS^K = (1-p_K)(p_S + p_K(2-3p_S))CS^M + p_K(p_K + 2p_S(1-p_K))CS^D.$$

Proofs

Proof of Lemma 6 We have:

$$\frac{dp^N}{dp_S} = \frac{\beta\pi^D\left(\pi^M - \pi^D\right) - \phi\left(\pi^M - \beta\pi^D\right)}{\left[\phi + (1-p_S)(\pi^M - \pi^D)\right]^2} < 0,$$

because $\phi > \beta\pi^D$ under Assumption 1 and $\pi^M - \beta\pi^D > \pi^M - \pi^D$, and

$$\frac{dp^K}{dp_S} = -\frac{\phi(\pi^M - \pi^D) - \pi^D(\beta\pi^M - \pi^D)}{\left[\phi + (\pi^M - \pi^D) - p_S(\pi^M - (2-\beta)\pi^D)\right]^2} < 0,$$

using the fact that $\phi > \pi^D$ and $\beta < 1$. Finally, we have

$$\frac{dp^A}{dp_S} = \frac{F^K(\pi^D - \phi)}{\left[\phi + \pi^M - \pi^D - p_S F^K\right]^2} < 0,$$

using the fact that F^K does not depend on p_S and $\pi^D - \phi < 0$ under Assumption 1.

Proof of Lemma 7 Under Assumption 1, we have:

$$p^K - p^N = \frac{p_S(1-\beta)\pi^D\left[\phi - \pi^D + p_S(1-\beta)\pi^D\right]}{\left[\phi + (\pi^M - \pi^D) - p_S(\pi^M - (2-\beta)\pi^D)\right]\left[\phi + (1-p_S)(\pi^M - \pi^D)\right]} > 0,$$

which shows that $p^K > p^N$ for all β. Moreover, if $\beta \leq \hat{\beta}$, we have:

$$p^A - p^K = p_S\frac{\phi(\pi^M - 2\pi^D) - \pi^D(\beta\pi^M - 2\pi^D + p_S\pi^D(1-\beta))}{\left[\phi + \pi^M - (1+p_S)\pi^D\right]\left[\phi + (\pi^M - \pi^D) - p_S(\pi^M - (2-\beta)\pi^D)\right]} > 0,$$

because $\phi > \pi^D$ under Assumption 1 and $\pi^M - 2\pi^D \geq \beta\pi^M - 2\pi^D + p_S\pi^D(1-\beta)$. So, if $\beta \leq \hat{\beta}$, we have $p^N < p^K < p^A$.

Now, consider the case $\beta > \hat{\beta}$. First, we know that $p^N < p^K$ for all β and that at $\beta = \hat{\beta}$, $p^N < p^K < p^A$. Besides, from Lemma 5, we know that p^K and p^N increase with β, whereas p^A decreases with β. Let us show that $p^A < p^N$ at $\beta = 1$. Indeed, we have

$$p^A - p^N\big|_{\beta=1} = \frac{p_S\pi^D(\pi^D - \phi)}{\left(\phi + (1-p_S)(\pi^M - \pi^D)\right)\left(\phi - \pi^D + (1-p_S)\pi^M\right)} < 0,$$

because $\phi > \pi^D$ under Assumption 1. It follows that there exists β_1 and β_2, with $\hat{\beta} < \beta_1 < \beta_2 < 1$, such that

- For $\beta < \beta_1$, $p^N < p^K < p^A$;
- For $\beta \in [\beta_1, \beta_2]$, $p^N < p^A < p^K$;
- For $\beta \in [\beta_2, 1]$, $p^A < p^N < p^K$.

Proof of Proposition 2 First, we compare the profits in the no acquisition and killer acquisition regimes, π^N and π^K. We have $\pi^N > \pi^K$ if $\beta < 1$ and $\pi^N = \pi^K$ if $\beta = 1$. Indeed, comparing the profit functions in regimes N and K, given by equations (5) and (11), respectively, we can see that $\pi_i^N(p_i, p_j) = \pi_i^K(p_i, p_j) + (1-p_i)(1-p_j)p_s(1-\beta)\pi^D$. So, $\pi_i^N(p^K, p^K) > \pi_i^K(p^K, p^K) = \pi^K$ if $\beta < 1$. Since $\pi_i^N(p^N, p^N) = \pi^N \geq \pi_i^N(p^K, p^K)$, it follows that $\pi^N > \pi^K$ if $\beta < 1$. If $\beta = 1$, $\pi_i^N(p_i, p_j) = \pi_i^K(p_i, p_j)$, and therefore, $\pi^N = \pi^K$.

As $\pi^N \geq \pi^K$, which regime is preferred by the platforms then depends on the comparison of π^N and π^A. Using (14) and (15), we have:

$$\pi^N - \pi^A = \frac{\phi}{2}\left(\left(p^N\right)^2 - \left(p^A\right)^2\right) + (1-\beta)p_S\pi^D.$$

From Lemma 6, we have $p^N > p^A$ for $\beta > \beta_2$, with $\beta_2 < 1$. So, for $\beta > \beta_2$, we have $\pi^N > \pi^A$, and overall regime N leads to the highest profits for the platforms.

Now, note that π^N decreases with β, as we have:

$$\frac{\partial \pi^N}{\partial \beta} = -p_S\pi^D \frac{(1-p_S)^2(\pi^M-\pi^D)^2 + \phi\left[\phi + (1-p_S)\pi^M - \pi^D\left(2(1-p_S)+\beta p_S\right)\right]}{(\phi+(1-p_S)(\pi^M-\pi^D))^2} < 0,$$

using $\pi^M > 2\pi^D$. Moreover, as $\pi^A = \phi\left(p^A\right)^2/2$, using Lemma 6, it follows that π^A does not depend on β for $\beta < \hat{\beta}$ and decreases with β for $\beta > \hat{\beta}$, with $\hat{\beta} < \beta_2$. So, $\pi^N > \pi^A$ for all β if and only if $\pi^N(\hat{\beta}) > \pi^A(\hat{\beta})$. Conversely, if $\pi^N(\hat{\beta}) < \pi^A(\hat{\beta})$, there are values of β such that $\pi^N < \pi^A$.

We derive a sufficient condition for $\pi^N(\hat{\beta}) > \pi^A(\hat{\beta})$, where $\hat{\beta} = \pi^D/\pi^M$. We have:

$$\pi^N(p_A,p_A) - \pi^A(p_A,p_A)\big|_{\beta=\hat{\beta}} = p_S(1-p^A)\left[(1-\hat{\beta})\pi^D - p^A(\pi^M - 2\pi^D)\right]. \tag{23}$$

As $\pi^N = \pi^N(p_N,p_N) \geq \pi^N(p_A,p_A)$, a sufficient condition for $\pi^N(\hat{\beta}) > \pi^A(\hat{\beta})$ is that the RHS of (23) is positive. This is always true if $(1-\hat{\beta})\pi^D > \pi^M - 2\pi^D$, that is, $\pi^D/\pi^M > (3+\sqrt{5})/2 \approx 0.38197$.

Finally, denote $x \equiv \pi^D/\pi^M \in (0,1/2)$ and $y \equiv \phi/(\pi^M - \pi^D) > 1$. We find that when $x \to 0$, $\pi^N(\hat{\beta}) - \pi^A(\hat{\beta})$ has the sign of $(p_S-1)(1+y) + p_S - (1+y) < 0$. So, in this case, $\pi^N(\hat{\beta}) < \pi^A(\hat{\beta})$ and the platforms prefer regime A for some values of β (in particular at $\beta = \hat{\beta}$).

Proof of Proposition 3 First, we prove that $\pi_S^N < \pi_S^K$ when $\phi > \pi^M$. Let $k \equiv \pi^M/(2\pi^D)$ and $\alpha \equiv \phi/\pi^M$. As $\pi^M > 2\pi^D$, we have $k > 1$. Moreover, as $\phi > \pi^M$, we have $\alpha > 1$. We can then write:

$$\pi_S^N - \pi_S^K = 2p_S\pi^D \underbrace{\left[1 - 2k\alpha - (1-\beta)p_S\right]}_{(-)} Y,$$

with

$$Y = \underbrace{\frac{-\beta}{(2k-1)(1-p_S)+2k\alpha}}_{(-)} + \underbrace{\frac{k(k\alpha - 1 + p_S) + \beta p_S + 2\beta k(1-p_S) + k(k\alpha - \beta p_S)}{\left[(2k-1)(1-p_S)+2k\alpha + p_S(1-\beta)\right]^2}}_{(+)}.$$

We have $\pi_S^N - \pi_S^K < 0$ if and only if $Y > 0$, that is, if

$$z = \left[k(k\alpha - 1 + p_S) + \beta p_S + 2\beta k(1-p_S) + k(k\alpha - \beta p_S)\right]\left[(2k-1)(1-p_S) + 2k\alpha\right] - \beta\left[(2k-1)(1-p_S) + 2k\alpha + p_S(1-\beta)\right]^2 > 0.$$

The rest of the proof consists in proving that $z > 0$ for all $\alpha \in [1,+\infty]$. We find that $z''(\alpha) > 0$, so $z'(\alpha)$ is increasing. Since $z'(1) > 0$, then $z(\alpha)$ is increasing. Finally, we find that $z(1) > 0$, which proves that $z(\alpha) > 0$ for all $\alpha \in [1,+\infty]$. Therefore, we have $\pi_S^N < \pi_S^K$. This shows that S prefers that at least some acquisitions are allowed.

Second, from Lemma 7, we know that $p^A < p^K$ if $\beta > \beta_1$, in which case S is more likely to be acquired in regime A than in regime K. Furthermore, the startup is acquired at a (weakly) higher price when all acquisitions are allowed compared to the regime where killer acquisitions are banned. It follows that if $\beta > \beta_1$, S prefers the regime where all acquisitions are allowed.

Proof of Proposition 5 Condition (20) can be written as:

$$\frac{\theta^e}{\theta^c} \geq \frac{\pi_S^N}{2p_S\beta\pi^D} = 1 - p^N.$$

Similarly, condition (22) can be written as:

$$\frac{\theta^e}{\theta^c} \geq \frac{\pi_S^K}{p_S\pi^M} = \left(1-p^K\right)^2 + p^K\left(1-p^K\right)\frac{2\beta\pi^D}{\pi^M}.$$

Therefore, the startup is more likely to choose path E in regime K than in regime N if

$$1-p^N \geq \left(1-p^K\right)^2 + p^K\left(1-p^K\right)\frac{2\beta\pi^D}{\pi^M}.$$

This condition always hold. Indeed, since $2\beta\pi^D/\pi^M < 1$, we have

$$\left(1-p^K\right)^2 + p^K\left(1-p^K\right)\frac{2\beta\pi^D}{\pi^M} < \left(1-p^K\right)^2 + p^K\left(1-p^K\right) = 1-p^K.$$

Using Lemma 7, we can then write:

$$1-p^N > 1-p^K > \left(1-p^K\right)^2 + p^K\left(1-p^K\right)\frac{2\beta\pi^D}{\pi^M}.$$

The comparison of the thresholds in regimes N and A is more ambiguous. Condition (21) can be written as:

$$\frac{\theta^e}{\theta^c} \geq \frac{\pi_S^A}{p_S\pi^M} = \left(1-p^A\right)^2 + 2p^A\left(1-p^A\right)\frac{\max\{\pi^D,\beta\pi^M\}}{\pi^M}.$$

So, the startup is more likely to choose path E in regime A than in regime N if

$$1-p^N \geq \left(1-p^A\right)^2 + p^A\left(1-p^A\right)\frac{\max\{2\pi^D,2\beta\pi^M\}}{\pi^M}.$$

If $\beta < \hat{\beta}$, we have $\max\{2\pi^D,2\beta\pi^M\}/\pi^M = 2\pi^D/\pi^M < 1$, and therefore

$$\left(1-p^A\right)^2 + p^A\left(1-p^A\right)\frac{\max\{2\pi^D,2\beta\pi^M\}}{\pi^M} < \left(1-p^A\right)^2 + p^A\left(1-p^A\right) = 1-p^A.$$

From Lemma 7, as $\beta < \hat{\beta}$, we have $p^A > p^N$, and we can then write:

$$1-p^N > 1-p^A > \left(1-p^A\right)^2 + p^A\left(1-p^A\right)\frac{\max\{2\pi^D,2\beta\pi^M\}}{\pi^M}.$$

However, when $\beta = 1$,

$$\left(1-p^A\right)^2 + p^A\left(1-p^A\right)\frac{\max\{2\pi^D,2\beta\pi^M\}}{\pi^M} > \left(1-p^A\right)^2 + p^A\left(1-p^A\right) = 1-p^A.$$

As $p^A < p^N$ for $\beta = 1$ (see Lemma 7), then $1-p^N < 1-p^A$, so the threshold is lower in regime N than in regime A.

Complement to Section 5.2: Corporate Venture Capital

Outcome of acquisition game with CVC funding

The following lemma characterizes the equilibrium:

Lemma 10. *(i) If both platforms fail to develop product B while S successfully develops it, platform i, which provided venture funding, acquires s at a price $\beta((1-\beta)^2\pi^D + (2-\beta)\pi^M) < \pi^M$.*
(ii) If only one platform and the startup successfully develop product B:

- *If platform i is successful, it acquires S for a price of $\beta(\pi^M - \beta\pi^D)$;*
- *If platform j is successful, platform i acquires S for a price of $\beta(\pi^D + (1-\beta)(\pi^M - \beta\pi^D))$ if $\beta \leq \bar{\beta} = \frac{\pi^M - \sqrt{(\pi^M)^2 - 4(\pi^D)^2}}{2\pi^D} < 1$; otherwise platform j acquires S for a price of $\beta(\pi^M - \beta\pi^D)$.*

Proof. Negotiations take place in three sequential stages:

1. Platform i and S negotiate an acquisition;
2. If S is not acquired by i, platform j and S negotiate an acquisition;
3. If S is not acquired by platform j, i and j can negotiate licenses.

We need to consider 3 situations:

Case 1: platforms i and j failed to develop product B

At stage 3, both platforms negotiate a license for a price of $\beta\pi^D$, as in the baseline model. At stage 2, the acquisition price for platform j solves:

$$\max_{F_j}(\pi^M - F_j - (1-\beta)\pi^D)^{(1-\beta)}(F_j - 2\beta\pi^D)^\beta,$$

which gives $F_j^* = \beta(\pi^M + (1-\beta)\pi^D) > 2\beta\pi^D$.

At stage 1, the acquisition price for platform i solves:

$$\max_{F_i}(\pi^M - F_i)^{(1-\beta)}(F_i - F_j^*)^\beta,$$

which gives $F_i^* = \beta((1-\beta)^2\pi^D + (2-\beta)\pi^M)$, with $F_j^* < F_i^* < \pi^M$, and platform i acquires S.

Case 2: platform j failed to develop product B

At stage 3, platform j can negotiate a license at a price of $\beta\pi^D$, as in the baseline model. At stage 2, the acquisition price for platform j solves:

$$\max_{F_j}(\pi^D - F_j - (1-\beta)\pi^D)^{(1-\beta)}(F_j - \beta\pi^D)^\beta,$$

which gives $F_j^* = \beta\pi^D$. At stage 1, the acquisition price for platform i solves:

$$\max_{F_i}(\pi^M - F_i - \pi^D)^{(1-\beta)}(F_i - F_j^*)^\beta$$

which gives $F_i^* = \beta(\pi^M - \beta\pi^D)$, with $F_j^* < F_i^* < \max\{\beta\pi^M, \pi^D\}$, and platform i acquires S.

Case 3: platform i failed to develop product B

At stage 3, platform i can negotiate a license at a price of $\beta\pi^D$, as in the baseline model. At stage 2, the acquisition price for platform j solves:

$$\max_{F_j}(\pi^M - F_j - \pi^D)^{(1-\beta)}(F_j - \beta\pi^D)^{\beta},$$

which gives $F_j^* = \beta(\pi^M - \beta\pi^D)$. At stage 1, the acquisition price for platform i solves:

$$\max_{F_i}(\pi^D - F_i)^{(1-\beta)}(F_i - F_j^*)^{\beta},$$

which gives $F_i^* = \beta(\pi^D + (1-\beta)(\pi^M - \beta\pi^D))$.

We have $F_j^* < F_i^* < \pi^D$ if and only if $\pi^D > \beta(\pi^M - \beta\pi^D)$. This condition is satisfied for $\beta < \bar{\beta}$, with $\bar{\beta} = \frac{\pi^M - \sqrt{(\pi^M)^2 - 4(\pi^D)^2}}{2\pi^D} \in (0,1)$. If $\beta \in [0, \bar{\beta}]$, platform i negotiates with S and acquires it. If $\beta \in (\bar{\beta}, 1]$, the negotiation between platform i and S fails and platform j acquires S for $F_j^* = \beta(\pi^M - \beta\pi^D)$. □

Compared to the baseline case, there are three main differences. First, when both platforms' R&D projects fail, the venture funder acquires S for a lower price, so S no longer captures the full monopoly profits. Second, when platform i makes a killer acquisition, it does so at a lower price. Third, for low values of β, platform i can acquire S and prevent a killer acquisition by platform j. Otherwise, the startup is too expensive for platform i, and S is acquired by platform j, as in the baseline case, but at a lower price.

Optimal efforts and proof of Lemma 9

Given the equilibrium of the acquisition game under $\beta \le \bar{\beta}$, the profits of the funding platform i and non-funding platform j are as follows:

$$\begin{aligned}
\pi_i^V &= p_i(1-p_j)\pi^M + p_i p_j \pi^D - p_S p_i (1-p_j)\beta(\pi^M - \beta\pi^D) \\
&+ p_S(1-p_i)\left(p_j(\pi^D - \beta(\pi^D + (1-\beta)(\pi^M - \beta\pi^D))) + (1-p_j)(\pi^M - \beta((2-\beta)\pi^M + (1-\beta)^2\pi^D))\right) - \phi\frac{p_i^2}{2}, \\
\pi_j^V &= p_j(1-p_i)\pi^M + p_j p_i \pi^D - p_S p_j (1-p_i)(\pi^M - \pi^D) - \phi\frac{p_j^2}{2}.
\end{aligned}$$

The first-order conditions with respect to the R&D efforts are:

$$\begin{aligned}
\frac{d\pi_i^V}{dp_i} &= (1-p_j)\pi^M + p_j\pi^D \underbrace{- p_S(1-p_j)\beta(\pi^M - \beta\pi^D)}_{\text{competition effect}} \\
&- \underbrace{p_S\left(p_j(\pi^D - \beta((1-\beta)\pi^M - \beta(1-\beta(1-\beta))\pi^D)) + (1-p_j)(\pi^M - \beta((2-\beta)\pi^M + (1-\beta)^2\pi^D))\right)}_{\text{insurance effect}} - \phi p_i = 0, \\
\frac{d\pi_j^V}{dp_j} &= (1-p_i)\pi^M + p_i\pi^D \underbrace{- p_S(1-p_i)(\pi^M - \pi^D)}_{\text{competition effect}} - \phi p_j = 0.
\end{aligned}$$

Solving the first-order conditions, we obtain the equilibrium R&D efforts:

$$p_i^V = \frac{\phi(\pi^M - p_S(1-(1-\beta)\beta)(\pi^M - \beta\pi^D)) - (1-p_S)(\pi^M - \pi^D)((1-p_S)\pi^M + p_S\pi^D)}{\phi^2 - (1-p_S)^2(\pi^M - \pi^D)^2},$$
$$p_j^V = \frac{\phi((1-p_S)\pi^M + p_S\pi^D) - (1-p_S)(\pi^M - \pi^D)(\pi^M - (1-(1-\beta)\beta)p_S(\pi^M - \beta\pi^D)))}{\phi^2 - (1-p_S)^2(\pi^M - \pi^D)^2}.$$

Assumption 1 ensures that the equilibrium is stable and that the R&D efforts are positive.

We have:

$$p_i^V - p_j^V = \frac{-p_S(1-\beta)((1+\beta^2)\pi^D - \beta\pi^M)}{\phi - (1-p_S)(\pi^M - \pi^D)} < 0,$$

as $(1+\beta^2)\pi^D - \beta\pi^M > 0$ for $\beta < \bar{\beta}$. Furthermore, for $\beta < \hat{\beta}$, we have

$$p_i^V + p_j^V = \frac{(2 - p_S(2-\beta(1-\beta)))\pi^M + p_S(1+\beta(1-\beta)+\beta^3)\pi^D}{\phi + (1-p_S)(\pi^M - \pi^D)} < 2p^A,$$

and this expression is increasing in β. At the cut-off value $\hat{\beta}$, the above condition holds true. Hence, effort is lower compared to the baseline case.