

# Incentives versus Synergies in Markets for Talent\*

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## Abstract

This paper studies the organizational location of projects where talent is pivotal and can walk away. Conventional wisdom says that such projects will be hosted by narrow-focused firms that provide strong incentives for talent. Offering high-powered incentives within corporations sacrifices synergies, making corporations less suited to financing of such projects. Yet in many industries talent is discovered, trained, and employed by multi-project corporations where incentives are often blunt.

The central result is that weak property rights over talent encourage multi-project corporations to invest. Weak property rights create an ex-post market for talent that relaxes the tradeoff between incentives and synergies within corporations. It does so by forcing corporations to match talent's outside option, thereby making credible its commitment to share surplus with talent. Holdup by talent thus limits expropriation by corporations, an instance of the second-best principle that two distortions can cancel each other out rather than adding up. We use the model to shed light on several apparently puzzling phenomena in markets for talent.

**Key words:** conflicts of interest, corporations, outside option, second-best principle, self-dealing, weak property rights

**JEL classification:** D23, L22

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## 1. Introduction

This paper studies what type of organization will host a project where a talented individual is essential for its successful completion (i.e. talent is pivotal), but can leave after his or her talent has been “discovered.” Discovery may mean that the individual has been revealed to be talented, has acquired a specific skill, or has learnt a key piece of knowledge or information. In all cases, “discovery” requires effort and money.

It is often claimed that in such settings talent requires strong incentives which are best provided by narrow-focused firms.<sup>1</sup> But, a surprisingly large fraction of such projects are done in corporations where incentive structures are blunt and organizations bureaucratic. For example, despite the success of venture capital over the past twenty years, more than 90% of commercial R&D is still done within corporations. In other industries like arts, sports, and entertainment talented individuals complain about the loss of creative freedom within corporations, and allegations of conflicts of interest, self-dealing and expropriation are common. And, corporate managers acknowledge this tension as well: for example, the president of a major media conglomerate recently noted that “all the benefits of size, whether its leverage, synergy or scope, are fundamentally the enemies of creativity.”<sup>2</sup> Yet, recent trends are towards conglomeration rather than specialization in these industries.

These observations raise positive and normative questions. Why are projects where talent is pivotal so often hosted by multi-business corporations, despite the large incentive costs and the presence of viable alternatives in the marketplace? Why do talented individuals voluntarily contract with large firms in these circumstances? How should one reconcile the empirical facts with the widely held view that narrow-focused firms and specialist financiers that offer strong incentives are the best places to locate projects that rely on talent? Indeed, is there a massive misallocation of talented individuals in the economy?

In our model talent becomes embodied in individuals and property rights are weak—talent may leave after acquiring skills. Two different organizations compete to host projects: on the one hand, the project may be set up as a stand-alone firm financed by a specialist financier (for example, an angel, a bank, a venture capitalist or an investment fund). On the other hand, a multi-project firm—call it a “corporation”—may insert the project in its existing organization. The key difference between these two types of

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<sup>1</sup>We use the term “talent” to highlight the wide applicability of these two characteristics. Thus, although salient differences exist in the nature of creative talent across industries, the characteristics of interest here are likely common to many of these settings, including the financing of actors, musicians, performers, scientific researchers, and athletes. Related to embodied talent and weak property rights is the notion of “inalienable” human capital that has been studied by Hart and Moore (1994) in the context of entrepreneurial finance.

<sup>2</sup>Quote attributed to Peter Chernin (News Corporation), in “Tangled Webs”, *The Economist*, May 23rd, 2002.

organizations stems from their impact on effort incentives. The specialist can write a contract that makes talent the residual claimant over project surplus, thus providing first-best effort incentives.<sup>3</sup> By contrast, the corporation faces a tradeoff: it can exploit synergies by centralizing operations. But with centralization it is harder to credibly transfer surplus to talent and incentives are blunted.<sup>4</sup>

There are many reasons why centralization may weaken incentives. In this paper we assume that it facilitates account manipulation and expropriation of the surplus created by the project. This assumption makes economic sense because by now it is well known that corporations can engage in many practices that make accounting uninformative.<sup>5</sup> Two consequences follow. First, expropriation limits the corporation’s ability to transfer surplus and gives an edge to the specialist financier. Second, expropriation makes it difficult to make talent residual claimant—hence weaker incentives.

The main result is as follows. Weak property rights give the corporation an edge over the specialist financier and enlarge the scope of projects that the corporation finances. More than that, we find that corporate profits increase as property rights weaken; and corporations never choose to mimic specialists and eschew first-best effort incentives because it is always optimal to sacrifice some incentives to realize synergies. Last, corporate financing is socially efficient whenever observed. Of course, if property rights are *very* weak (we give a precise meaning to ‘very weak’ below), financing will not occur.

A claim that corporations benefit from weak property rights might seem strange, because they are typically thought to hurt investment. What are the mechanics at work? At the center is the fact that, *ceteris paribus*, synergies enlarge the size of the pie and enable the corporation to offer talent a better deal in principle than a specialist financier. Of course, the difficulty is that the corporation has a credibility problem. It can commit neither to make talent the residual claimant nor to transfer the surplus that is created

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<sup>3</sup>There is a large literature arguing that specialist financiers provide powerful effort incentives. For example, Gompers and Lerner (2001) note that in venture-capital backed companies, “[...] the sensitivity of the CEO’s pay-for-performance is almost sixty times higher than it is in large, mature public companies.”

<sup>4</sup>The incentive-synergies tradeoff has been studied by various authors, and labeled variously. For example, Hart and Holmstrom (2002) examine the tradeoff between “coordination” of units and the “independence” of managers in each unit, and Mailath et al. (2003) study the tradeoff between “integration” and “worker initiative.” Some authors have examined one or the other of these features. For example, in a related strand of work, Gertner et al. (1994) compare internal and external capital markets, noting that the former are characterized by weaker entrepreneurial incentives, but have the advantage of superior monitoring and asset reemployability. Gromb and Scharfstein (2004) also focus on the incentives-redeployability tradeoff. Other authors have examined different costs of enhancing synergies. A recent example is Dessein et al. (2003) who study how organizing to increase synergies compromises the firms’s ability to adapt to local information.

<sup>5</sup>Holmstrom (1989), for example, notes that a firm “[...] has control of many levers to make accounting measures less reliable.” Relatedly, New York State’s Attorney General, Eliot Spitzer—after recently initiating investigations against several major investment banks that were accused of compromising the objectivity of their research activities to enhance their underwriting business—noted that “synergies is just another word for conflicts of interest.”

by synergies. It is here where weak property rights help: they improve talent's outside option (as long as the outside option is increasing in her effort), and force the corporation to pay more to retain talent. By doing so, it restores the ability of the corporation to credibly commit to compensate talent, thereby allowing it to take advantage of synergies without sacrificing too much in incentive costs. In this sense, weak property rights relax the incentives-synergies trade off within corporations.

Conventional wisdom is that weak property rights hurt the incentive of corporations to *invest*. But, this ignores a positive effect: by creating a market for talent, weak property rights improve the incentives of talent to *invent* (i.e., exert effort) The key point is that with weak property rights, incentives through *markets* substitute for incentives provided within corporations. Corporations can then exploit their advantage from synergies without the associated incentive costs.

One can look at this result from a slightly different perspective. The general principle at work is that one distortion, weak property rights, cancels out the deleterious effects on effort of another distortion, account manipulation. This is reminiscent of the well-known second-best principle that two distortions may cancel out instead of adding up.<sup>6</sup>

The impact of weak property rights on the competition for talent can be illustrated with a simple example. Two organizations, a corporation and a specialist, compete to attract a talented and cash-constrained individual. The organization must incur an investment cost of 6 in the first period in order to reveal the skill of talent.<sup>7</sup> In the second period, talent produces a surplus of 10. Surplus can be obtained only with the participation of talent—i.e. talent is “pivotal.” The corporation can take advantage of synergies between talent and the rest of its activities, which adds 5 to the benefits of the project. Nevertheless, it manipulates accounts *ex post*, and can therefore commit to pay at most 3 to talent. On the other hand, the specialist finances as a stand alone operation and does not enjoy any synergies. But it can credibly commit to transfer any arbitrary amount to talent *ex post*.

In principle, the corporation is better-suited to finance the project with talent, because it can take advantage of synergies and create  $(10 - 6) + 5 = 9$  in surplus. By contrast, the specialist creates a surplus of only  $(10 - 6) = 4$ . Nevertheless, because the corporation can transfer at most 3 to talent, and the specialist will credibly commit to pay talent up to 4, the specialist will finance the project.

Now suppose talent can walk away at any time after her skill is revealed: that is, property rights over talent are weak. If she leaves and implements the project elsewhere, she gets 10, i.e., the entire surplus. But the financier can block the project and retain the surplus with probability  $p$ . (Thus,  $p$  parametrizes the strength of property rights over

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<sup>6</sup>See Lipsey and Lancaster (1956) and Bhagwati (1971). The second-best principle says that with pre-existing distortions an additional distortion may increase efficiency and welfare.

<sup>7</sup>Another interpretation is that only a few individuals are revealed to be talented *ex-post*; then, the investment cost of discovering talent also includes the cost of revealing other individuals not to be talented.

talent: the closer to 0, the weaker are property rights). It follows that to prevent talent from leaving, the organization must pay talent at least  $(1 - p)10$  ex-post—her expected value from leaving.

It is straightforward to see that if  $p < 0.6$ , the specialist financier will not invest—since matching talent’s outside option does not leave enough surplus to cover the investment cost. (This is the classic holdup problem). But, even then, corporations may be willing to invest in talent. The reason is that synergies can leave the corporation enough surplus even after the payout to talent. For example, when  $p = 0.5$ , talent gets paid 5, and the corporation gets net surplus of  $10 - (1 - p)10 - 6 + 5 = 4$ . Indeed, as long as  $0.3 \leq p \leq 0.6$ , the corporation will invest even though the specialist will not. (When  $p < 0.3$ , property rights are “very weak” for even the corporation to finance).

Key to this result is that as property rights get weaker, talent’s outside option improves, forcing the corporation to match it. Indeed, as long as  $p < 0.7$ , talent will get more from the corporation than in the case that she could not leave ( $p = 1$ ) – when she gets 3. In other words, the weaker are property rights over talent, the greater is the surplus that the corporation can credibly commit to transfer to talent. And, the corporation can now exploit the benefit of synergies without the accompanying credibility problem—in a sense, a free lunch.

This simple example illustrates the logic behind the result that weak property rights help corporations. Notice that this logic does not rely on effort incentives being important: the example only invokes the tradeoff within corporations between synergies and expropriation, which creates a credibility problem in sharing surplus. In certain markets for talent, *this* particular tradeoff, and its impact on surplus sharing, is perhaps the central force at work. At the same time, effort incentives are clearly important in other markets for talent: for example, R&D. And, one might speculate that incorporating effort incentives might reverse the basic intuition of this example, since effort incentives might be stronger with the specialist and surplus in turn is endogenous to effort. The model in section 4 generalizes this simple example to incorporate effort incentives. We show that the basic intuition of this example is reinforced in a model with effort: since weak property rights also help corporations to sharpen incentives. The model also generalizes this simple example in other ways. For example, it parametrizes the tradeoff between synergies and expropriation, which in turn allows one in section 4 to endogenize the optimal level of synergies within the corporation.

Before proceeding we call attention to a caveat. We are aware that the term “synergies” is sometimes used loosely and imprecisely. In this paper it denotes complementarities that can be exploited only within the boundaries of a firm. Thus synergies could arise from common assets (e.g. a brand name, a database, or routines) or shared activities (e.g. centralized manufacturing, purchasing, or sales) but cannot be accessed through the market or via contracts, perhaps due to transactions costs or contract incompleteness.

Having defined what we mean, we will use the term throughout the rest of the paper without further apology.

The rest of the paper is organized as follows. In section 2, we relate this paper with the literature. In section 3 we present three examples that illustrate the building blocks of the model, holdup by pivotal talent and the incentives-synergies trade off. In section 3 we describe the setup of the model and the timeline of the game. Section 4 examines competition between specialists and corporations, and characterizes the organizational location of projects in equilibrium. In section 5 we illustrate the second-best principle with three examples. Section 6 concludes.

## 2. Related literature

It will become apparent as we proceed that perhaps the closest paper in spirit to our's is Merges (1999), who studies how the law allocates ownership to inventions made by employees. He notes that while ownership is generally assigned to the employer, the law and courts typically allow creative employees to exit a firm before an inventive concept has taken a concrete tangible form. The exit option granted by the law, Merges argues, increases inventor compensation for specific inventions, thus strengthening incentives.

Our central theme—exploring what types of organizations are best suited to finance projects where property rights over human capital are weak—is also that of Morrison and Wilhelm (2003). In their model unskilled agents are trained by a firm but may be tempted to sell their labour to the highest bidder after acquiring tacit human capital. They show that the specifics of the partnership organization—opaqueness about the ability of candidates, illiquid partnership stakes, and specialization in human-capital intensive experience goods—can be explained as adjustments to overcome the problems caused by weak property rights over human capital. Also, like us, they study how the strength of property rights impact competing organizations differently. Specifically, they argue that the strengthening of property rights over time is one reason why partnerships are being replaced by joint-stock companies in industries like consulting or investment banking.

Our second-best result is reminiscent of some recent explanations for why firms invest in “general training” that improves worker’s outside options. In particular, Acemoglu and Pischke (1998, 1999) argue that firms are more willing to finance training in general skills when labor-market distortions impair the mobility of workers. These distortions include search costs, informational asymmetries, or efficiency wages, and are assumed to be an exogenous feature of the labor market in general. In contrast, our paper examines a distortion that is endogenous to a particular form of organization. Consequently, organizational heterogeneity, rather than market characteristics, solves the free-riding problem. Another strand of the literature focuses on the reverse problem: if something “binds” workers to firms, what prevents firms from expropriating workers? For example, a paper with a mechanism that works similarly to ours is Balmaceda’s (2003). He shows that

firms may be willing to finance training in general skills that improve workers' outside options in order to stimulate them to invest in firm-specific human capital which firms can expropriate—again, two distortions cancel out.

The second best result suggests that corporations can be expected to prefer weaker property rights. This result is proved formally in section 4. This is consistent with recent theoretical arguments that weak property rights may be socially and privately beneficial. For example, Boldrin and Levine (2002 and 2003, chapter 2) show that falling copying costs, which imply weaker property rights over the original innovation, may increase the present value of introducing an innovation if demand for the final product is elastic.

Other salient aspects of markets for talent as studied here are also relevant in R&D. In particular, in markets for talent ideas are typically embodied in individuals who need to be motivated with strong incentives. Our focus on such a setting thus extends the literature that studies how entrepreneurial ventures will be financed (e.g. Aghion and Tirole [1994], Gans and Stern [2000], Hellmann [2002]).<sup>8</sup> Whereas these studies assume that property rights over assets can be perfectly established and arbitrarily allocated, we analyze the consequences of weak property rights on effort incentives. Our paper is thus also related to a second strand of the R&D literature that studies the effect of weak property rights on R&D finance (e.g. Anton and Yao [1994, 1995, 2002] and Anand and Galetovic [2000]). We go beyond these papers by analyzing how effort incentives are affected by weak property rights and internal organization.

Last, a recent paper that studies the market for talent is Terviö's (2003). He shows that when talent can leave after being discovered (i.e., using our terminology, when property rights are weak) the discovery of talent is inefficiently low. Our paper, by contrast, asks how the given stock of talent is allocated among different types of organizations and whether that allocation is efficient. In addition, the organizational heterogeneity that results from synergies suggests a mechanism that possibly moderates the inefficiency detected by Terviö: talent locates in firms that can use the surpluses created by synergies to offer wages that can be competitive with outside options.

### 3. Three examples

The model we present has two key ingredients. The first is holdup by pivotal talent because property rights are weak. The problem is that talent may walk away and complete the project elsewhere, which can weaken the ex-ante investment incentives of the financier.

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<sup>8</sup>Another paper with a setting similar to ours is Amador and Landier (2003). In their model, a manager comes up with an idea that can be implemented either within an existing organization or in a new firm financed by a venture capitalist. As in our model, the existing organization enjoys lower costs because it can share existing assets; but the venture capitalist can better reward the manager with the cash flows generated by the project. Nevertheless, their focus is a different problem: how entrepreneurial overoptimism impacts the organizational location of innovation.

The second building block is the incentive-synergies trade off within corporations. On the one hand, corporations can mimic narrow-focused firms and sharpen incentives. But to do so they have to decentralize operations and lose synergies that would increase the total value of the project.

Before formally presenting the model, we illustrate these building blocks in the context of three examples. Of course, the three markets differ in many important respects. At the same time, they share certain characteristics on which we focus our attention.

### 3.1. R&D

**Holdup** Knowledge acquired by individuals during research is often key to develop innovations into marketable products. But when ideas are embodied in individuals, the financier may be held up because, in terms defined by Hart and Moore (1994), human capital is inalienable. Hence, an entrepreneur or researcher can always threaten to repudiate a contract by withdrawing her human capital from the project. And, evidence is substantial that firms find it difficult to prevent employees from leaving and commercializing ideas.<sup>9</sup>

Why isn't ex post holdup controlled via ex ante contracts that prevent employees from leaving? Indeed, default rules in the law are such that inventions made by employees who are "hired to invent" are generally property of the employer. But, in a recent exhaustive description of the treatment in the law concerning employee inventions, Merges (1999) argues, when it comes to disputes with *former* employees, who departed and started a new firm, conditions are far less favorable for employers, and that "it is in many cases quite feasible to leave a firm after one arrives at the general notion of an invention, but before any of the provable milestones of invention arrive."

What is a "provable milestone of invention"? Merges (1999, p. 54) notes that:

The earliest observable milestone in the invention process is the legal event known as 'conception.' The operative legal rule is that conception is the first occurrence of the complete invention in the mind of the inventor, *as corroborated by objective evidence*. Despite its name, then, conception is not in practice

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<sup>9</sup>Perhaps the most cited example of a firm that consistently failed to capture value from the ideas it financed is Xerox and its research arm, Xerox PARC. As *The Economist* noted, "Xerox PARC is famous for having pioneered ideas (including a superior personal computer, the facsimile machine, the Ethernet, and the laser printer) that made fortunes for many of its Silicon Valley neighbours but little for itself." Elsewhere, "[...] people at Bell Labs have still not forgotten how, half a century ago, William Shockley took the transistor idea, which he and his colleagues had invented at Murray Hill, to Palo Alto in California and started a company (Fairchild Semiconductor) that eventually became Intel." Indeed, the notion that ideas walk with individuals rather than residing in the black box of firms was strikingly illustrated in a survey of 100 founders of the 1989 Inc 500 fastest-growing private companies in the United States. Bhidé (1994) found that 71 percent of these founders "replicated or modified an idea encountered through previous employment." Delaney (1993, p. 216) says the majority of startup founders report that they arrived at the most important technology for their new venture from previous experiences such as their prior jobs.

simply a mental event; it requires that the idea be written down or otherwise embodied and that some evidence of the event be kept. [...] Thus in all cases, an inventor must do something affirmative—and hence observable—before an invention can be identified.

As a result, since “the law focuses almost exclusively on these milestones, in many cases an employed inventor has a de facto exit option. Once this is understood, it becomes clear that the inventor often opts into firm ownership as dictated by his employment contract. Put another way, the inventor *chooses* to remain bound by the terms of the agreement by revealing his invention.”<sup>10</sup>

**The incentives-synergies tradeoff** In view of the holdup problem one might expect researchers to receive strong incentives to prompt them to stay in corporations. But while corporations exhibit a large variety of compensation schemes, it seems that narrow-focused firms offer far more potent incentives. For example, Gompers and Lerner (2001) note that in venture-capital backed companies, “[...] the sensitivity of the CEO’s pay-for-performance is almost sixty times higher than it is in large, mature public companies.” This need not be surprising: strong incentives schemes are most likely inappropriate for corporations because the standard multi-task agency problem is pervasive. But, in addition, providing strong incentives may also be difficult. The reason, as pointed out by Holmstrom (1989) is that:

Difficulties in identifying relevant costs and benefits, so as to make the innovator bear his marginal share, are central. Of course, even as an individual entrepreneur, measurement problems are substantial. The entrepreneur does not know all the relevant figures either. But the knowledge that the money will flow into his own pockets, that nothing will be taken away, still provides appropriate incentives. It is when financial accounts are integrated that the difficulties of measurement become consequential and severe, [...]. The key point is that verifiability is an endogenous variable, which depends on the incentives of those who collect the information.<sup>11</sup>

In view of the preceding, one might expect R&D predominantly be conducted as stand-alone projects. Yet the evidence is quite different, as most R&D is done in corporations and a minor share is financed by venture capitalists. For example, Kortum and Lerner (2000) note that “[...] our estimates suggest that venture capital, [...] averaged less than 3% of corporate R&D [spending] from 1983 to 1992” and, in terms of output, is responsible

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<sup>10</sup>Merges (1999, p. 54).

<sup>11</sup>In a similar vein, Merges (1999) notes that “credibility is a serious problem with intra-firm reward programs” because of “egregious opportunism on the part of firms.”

for about 8% of U.S. industrial innovations during that decade. This order of magnitude of VC financing of R&D is confirmed by other authors. Zider (1998) estimates R&D expenditures by corporations in \$133 billion; by government in \$63 billion; and that less than \$1 billion came from venture capitalists. Indeed, he notes that most venture capital funding went to finance projects originally developed through the expenditures of government and corporations. Surveying an earlier period, Sahlman (1990) argues that the \$3 billion disbursed by all professional venture capitalists in 1988 was only slightly less than one-third the amount invested by IBM in capital expenditures and R&D in the same year, and 25% of the amount invested by General Motors. One could call this the 60-90 puzzle: why do corporations finance around 90% of private R&D even though VCs provide incentives that are 60 times more potent?

### 3.2. TV shows

**Holdup** Pivotal talent characterizes entertainment. Consider, for example, TV shows. Mega successes such as *Seinfeld*, *ER*, *The Sopranos* or *Friends* are heavily dependent on one or a group of individuals. Not only that, but the success of a network may depend on a show whose success, in turn, depends on pivotal talent. This opens the door for holdup, which works as follows.

TV shows and talent are discovered to be successful, as networks try many shows, but only a few succeed.<sup>12,13</sup> And, in addition, it takes a while until a mega hit is recognized as such, a period in which networks must make a series of investments to promote it and pay the opportunity cost of prime time.<sup>14</sup> However, when a show becomes a hit, actors pivotal to the show typically renegotiate their contracts, often after a sour fight.

The well-known show *The Sopranos* is a case in point. In 2003 its star, James Gandolfini, sued to void his contract, after HBO refused to meet his salary demands.<sup>15</sup> HBO then countersued with a \$ 100 million breach-of-contract charge, noting that he was still signed to do the series. HBO and Gandolfini eventually renegotiated the contract and he increased his year-five earnings to about \$ 13 million.<sup>16</sup> Gandolfini had more leverage than

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<sup>12</sup>Take for example, James Gandolfini, the star of *The Sopranos*. According to New York's *Daily News* (March 12, 2003), "Gandolfini wasn't exactly burning up the cinematic waters before *Sopranos* creator David Chase and HBO took a chance on him; as a character actor, he was forging a solid career, but not necessarily a star-making one. *The Sopranos* made Gandolfini what he is today [...]"

<sup>13</sup>According to Barth (2003, p. 29), who looked at the survival rate of TV shows between 1991 and 2000, 69% of shows run for not more than a season, 80.9% run for at most two years and only 11.5% reached four years.

<sup>14</sup>For example, *Seinfeld*, eventually one of the most successful network shows in history, had mediocre ratings during its first two years but was still heavily promoted by NBC and kept on the air .

<sup>15</sup>According to the *Los Angeles Times* (March 17, 2003), initially HBO offered to more than double his salary to \$650,000 per episode, but his representatives demanded \$2 million per episode.

<sup>16</sup>Similarly, producers of *E.R.*, the top-rated show on network television for a decade, increased their payout by \$12 million *per episode* during renegotiation with NBC, which alone allegedly wiped out NBC's

most, because there is no “Sopranos” without his Tony Soprano character. Same was true with “Malcolm in the Middle” mom Jane Kaczmarek, whose headaches kept her off the set for several days, until a new paycheck suddenly made the pain go away.

**Expropriation versus synergies** Television networks display a variety of organizational forms. For example, some are vertically integrated, others combine many channels under same roof, and there are also stand-alone ventures. Benefits of broad scope are synergies. For example, content aired on the primary network channel can be spliced and reassembled for airing on secondary channels of the same firm, cross-promoted by these other channels, or repackaged for airing on foreign channels. Similarly, experience in scheduling, promotion and show selection strategies can be more easily transferred across channels inside a conglomerate.

Synergies, however, come at an incentive cost. For example, according to *The Economist*, “independent screenwriters argue that creativity has been stifled now that the broadcast networks have been swallowed up, with production houses, into giant conglomerates—economies of scale and vertical integration stifle creativity.<sup>17</sup> Similarly, a recent report by the Writers Guild of America argued that “The vital marketplace of ideas is paralyzed by a system of preferential treatment.” And, as described at the outset, corporate managers themselves recognize and acknowledge this tension.

An additional cost of conglomeration is that it opens the door for conflicts of interest and self dealing. Recent lawsuits by artists and producers against large entertainment conglomerates are illustrative. In 1998, David Duchovny, star of the hit television show *X-Files*, sued entertainment conglomerate News Corporation and its Fox Television Network, “[...] accusing Fox of limiting the potential back-end gross of the show—and thereby his take through profit participation points—by cutting sweetheart deals with Fox-owned entities at below-market prices.” A few months later, producer Steven Bochko also filed a lawsuit against News Corporation for selling the show *NYPD Blue* (in which Bochko had a profit sharing stake) to its own cable channel, FX, at below-market prices, and observed that “[...] this is just the 1999 version of what they used to call ‘creative bookkeeping.’”<sup>18,19</sup>

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entire annual profits. Other fights include the star cast of *Friends*, (Jennifer Aniston, Courteney Cox, David Schwimmer, Matt LeBlanc, Lisa Kudrow and Matthew Perry) who threatened to strike in 1996 unless they received pay increases And the *Seinfeld* cast (Jason Alexander, Julia Louis-Dreyfus and Michael Richards), almost held up the show’s final season and eventually picked up \$ 600,000 an episode.

Sometimes actors lose. In 1980 Suzanne Somers of *Threes Company* asked for a pay raise and a percentage of the profits, but she was reduced to only a few lines on each episode. Malik Yoba and Michael DeLorenzo of *New York Undercover* asked for more money in 1996. They returned to work after show creator Dick Wolf threatened to kill their characters.

<sup>17</sup> “Tangled Webs,” May 23rd, 2002.

<sup>18</sup> See “Media Mergers Bottom Line So Far? Lawsuits,” *Los Angeles Times*, September 17, 1999.

<sup>19</sup> Expropriation also occurs in other parts of the entertainment business. For example, “profit” is considered an elusive word in Hollywood. If a film costs \$30 million to make and another \$30 million to market,

### 3.3. IMG and agents for talent

**Holdup** Many firms are in the business of discovering and representing athletes. Some are individual agents, others large firms like International Management Group (IMG). Securing representation with star athletes often requires establishing personal relationships with athletes *before* they become stars—sometimes as early as when they are ten years old. The problem is that many of these relationships turn out to be wasted—athletes who don’t fulfil their early promise are abundant. And, those relationships that are not wasted embody the problem of holdup: agents can leave firms taking stars with them, or stars might themselves leave to be represented by another firm.<sup>20</sup> Holdup is costly since profits made from discovering stars pay the cost of relationships with individuals that do not become one.<sup>21</sup>

**Expropriation versus Synergies** In this setting, both individual agents and large firms compete for talent. IMG, for example, has a strikingly broad vertical and horizontal presence in the value chain, unlike most others. In golf, for example, it is present in hosting and managing golf tournaments, designing and marketing golf courses, producing and distributing television programming for golf events, and operating training academies for golfers of different ages. But, IMG’s presence in different businesses and representation of both individuals and teams, has led to frequent charges of interest conflicts and, on occasion, lawsuits. A recent example occurred in late 2001, when IMG client and New York Yankees star Derek Jeter re-signed with the Yankees for 10 years and \$189 million, an amount substantially lower than what Jeter could have got from another team. Critics noted that Jeter’s re-signing had considerably enhanced the value of IMG’s just-signed \$900 million, 10-year television deal with the Yankees.

What does the organization of this market look like? One might expect that the market should comprise many individual agents. Setup costs into this business are negligible, relationships are embodied in individual agents rather than in the firms, and agents can avoid the costs of large firms. Main costs are “personality makeovers” that athletes frequently

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then earns in excess of \$100 million at the box-office, the assumption is that profit participants have hit a jackpot. Reality, however, is that once the numbers have been crunched, film studios will often claim that the profit earned by an otherwise box-office blockbuster is “less than zero”. In fact, industry insiders joke that true creativity lies not with the talent, but with the accountants, and that creative accounting methods used by film production companies have rendered the bulk of profit participations meaningless.

<sup>20</sup>Examples are many. Consider, for example, the case of IMG: in 1992, IMG agents John Simpson and Julian Jacobi left to found Stellar Management because they “didn’t have any equity in this business.” And in 1999, IMG agent Jeffrey Schwarz quit, taking with him three of IMG’s tennis stars: Pete Sampras, Martina Hingis, and Marcelo Rios. Similarly, golf stars Nick Faldo, Greg Norman, and Nick Price left IMG at the peak of their success in the 1990s.

<sup>21</sup>Holdup concerns are also noted in other industries served by agents: one industry expert, commenting on the poaching of classical music singers by competing agencies, noted that “[...] it could take ten years for an agent to build a singer’s career and another five before star fees come cashing in [...] You lose one artist and you’re upset. You lose three stars and you’re in trouble.” (Anand and Attea [2002, p.8]).

complain of, and conflicts of interest. As it turns out, however, the market is dominated by large firms like IMG. Why?

**Two qualifications** The examples above suggest keeping in mind two facts about the model. First, the discussion on R&D point out that patents are not a solution to the holdup problem. The key point is that patents help to establish property rights *ex post*, *after* the discovery has been made. By contrast, hold up here is an *ex ante* problem, i.e., *before* there is a “provable milestone of invention.”

The discussion on the entertainment industry should make clear that this is not a paper about firm scope. The question here is what type of organization will host a project where a talented individual is pivotal. In other words, we take as given the fact that some organizations might be broad-based and multi-project, and focus on whether the *marginal* project will be located in such firms or as a standalone. Our goal is neither to explain why multi-project firms exist nor what their equilibrium scope will be. Indeed, while firm scope is likely to be affected by the factors at play here, there are also likely to be many other drivers of scope.

## 4. The model

### 4.1. Setup

**Agents** There are two periods: investment and execution of the project; and three dates: date 0 before investment; date 1, in-between investment and execution; and date 2, after execution of the project. The output of the investment phase is a “skill” that is necessary to develop a marketable idea or perform an activity. There are two types of organizations, the corporation (*c*) and the specialist financier (*f*). But to invest and execute the project, the input of a cash-constrained talented individual (henceforth referred to simply as “talent”) is essential. All agents are risk-neutral. (Table 4.1 summarizes the notation.)

Table 4.1: Notation

$I$	Cost of acquiring skill
$e \geq 0$	Talent’s effort
$S(e)$	Project’s surplus (net of investment cost)
$p \in [0, 1]$	Strength of property rights
$v \in [0, 1]$	Intensity of decentralization
$G(v)$	Synergies
$F_s$	Specialist’s offer
$F_c$	Corporation’s offer

**The project** To obtain the skill,  $I$  must be spent. The fate of the project also depends on the intensity of nonverifiable effort  $e$  exerted by talent during the investment phase. Thus, the project's surplus gross of investment cost, which materializes on date 2, is a function  $S(e)$ . We assume that  $e \geq 0$  and the cost of effort level  $e$  is  $e$  dollars. Furthermore, we assume that  $S' > 0$ ,  $S'' < 0$  and  $S(0) = 0$  and, for convenience, that  $S''' < 0$ . Two additional assumptions are needed to ensure non-trivial results: (i)  $\lim_{e \rightarrow 0} S'(e) = \infty$ ; and (ii)  $\lim_{e \rightarrow \infty} S'(e) < 1$ . This ensures that effort will be positive but bounded.

Now call  $e^*$  first-best effort, that is  $e^* = \arg \max\{S(e) - e\}$ . Given the conditions just imposed on  $S$ , there exists a unique  $e^*$ . We further assume that  $S(e^*) - e^* - I > 0$ : net surpluses are positive.

**Property rights** Following the literature on incomplete contracts (going back to Grossman and Hart [1986]) we assume that neither the skill nor the project can be described at time 0. Moreover, the skill is embodied in talent, and property rights over it are imperfect. We parametrize the strength of property rights as follows. If talent leaves at date 1 the financing organization can block the project's execution with probability  $p \leq 1$  and retain its surplus. Hence, with probability  $1 - p$  talent can successfully execute the project elsewhere and appropriate all the surplus  $S(e)$ . It follows that  $p = 0$  parametrizes inexistent property rights; at the other extreme,  $p = 1$  corresponds to perfect property rights.<sup>22</sup>

**Synergies, decentralization and surplus verification** We assume that surplus verification is straightforward with a specialist financier. Hence, talent and the specialist financier can agree to any arbitrary sharing rule. Without loss of generality, we may consider only sharing rules such that talent is made a residual claimant. Specifically, talent receives  $\max\{0, S(e) - F_s\}$  and, consequently, the specialist keeps amount  $\min\{S(e), F_s\}$ , with  $F_s$  independent of  $S(e)$ . Thus, talent is a residual claimant if  $e$  is such that  $S(e) \geq F_s$ .<sup>23</sup>

The corporation is a bit more complex and its interaction with talent is characterized by  $v \in [0, 1]$ , which parametrizes how decentralized the project is run. When  $v = 1$  the project is fully decentralized and run exactly like a single-project firm; at the other extreme, when  $v = 0$  the project is fully embedded in the corporation's structure.

The benefit of centralization are synergies. Specifically, if centralization is  $v$ , then synergies of value  $G(v)$  are created, which fully accrue to the corporation. Synergies fall with decentralization ( $G' < 0$ ) and disappear when the corporation replicates the single-project firm with  $v = 1$  (that is,  $G(1) = 0$ ). We further assume that  $G'' < 0$ .

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<sup>22</sup>The strength of property rights  $p$  is exogenous. That is, the fact that talent cannot be prevented from walking away does not merely reflect weak enforcement of non-competes. Indeed, in many cases, it may be simply difficult to specify *what* the employee has stolen from you. In that case, contractually limiting her work elsewhere may be tantamount to slavery.

<sup>23</sup>Allowing linear contracts of the form  $F_s + \mu S(e)$ , or even more general ones, will not alter the results because it is always optimal for the specialist to make talent residual claimant by choosing  $\mu = 0$ .

On the other hand, centralization weakens the corporation’s ability to make talent residual claimant because it makes surplus verification difficult thus, we will show, reducing talent’s effort incentives.

We model this as follows. Just like the specialist, the corporation would like to make talent residual claimant. As we have already seen, if surplus is verifiable that would be achieved with a sharing rule such that talent keeps  $\max\{0, S(e) - F_c\}$  and the corporation receives  $\min\{S(e), F_c\}$ ; where  $F_c$  is a fixed payment made by talent. Nevertheless, we assume that with probability  $v$  the corporation can misrepresent surplus and report any  $S^r \in [0, S(e) + F_c]$ . In that case talent receives  $\max\{0, S^r - F_c\}$  according to the contract and the corporation keeps

$$\min\{S(e), F_c + [S(e) - S^r]\},$$

where  $S(e) - S^r$  is the additional payoff that the corporation grabs by manipulating accounts. Note that to fully expropriate surplus  $S(e)$  the corporation need only claim that  $S^r = F_c$  (i.e. total surplus is just equal to the payment that talent has to make according to contract). Because it is always in the corporation’s interest to grab as much surplus as possible ex post, it is as if the corporation makes an all-or-nothing offer to talent when surplus is nonverifiable.

We should note in passing that we are *not* ruling out pay-for-performance contracts a priori. What we do assume, however, is that the ability of the corporation to commit to such a contract depends on  $v$ , i.e. on how verifiable accounts are —if  $v = 0$ , any contract that makes talent residual claimant is not credible. In the analysis that follows, we will consider  $v$ ’s over the whole interval  $[0, 1]$ . This approach is justified because incentive schemes vary considerably across different corporations. As Merges (1999) notes in the context of R&D: “The history of intra-firm R&D management is a history of experimentation to find the right set of incentives.” Some firms offer powerful incentives, others don’t; the model allows for both.

## 4.2. Timeline

We now describe the time-line of the game, also summarized in Figure 1.

1. At date 0 the specialist financier and the corporation simultaneously offer contracts to talent. The specialist’s offer is completely summarized by  $F_s$ , and the corporation’s offer by  $F_c$ .
2. *Specialist finances project*: if talent accepts the specialist’s offer, then:
  - During the investment phase the specialist pays the investment cost  $I$  and talent chooses effort  $e$ .
  - At date 1 either of the following happens:

1. Talent leaves. The specialist sues and with probability  $p$  blocks project execution, forces talent to participate and retains surplus  $S(e)$ ; with probability  $1 - p$  the specialist is unsuccessful, talent executes the project and cashes surplus  $S(e)$  at date 2.
  2. Talent stays. The project is executed and surplus is shared according to contract at date 2.
3. *Corporation finances project*: if talent accepts the corporation's offer, then:
- During the investment phase the corporation pays the investment cost  $I$  and talent chooses effort  $e$ .
  - At date 1, effort  $e$  is observed by the financier. With probability  $v$  surplus is verifiable; with probability  $1 - v$  surplus is not verifiable.
  - If surplus is verifiable, talent decides whether to stay:
    1. Talent leaves. The corporation sues and with probability  $p$  blocks project execution and retains surplus  $S(e)$ ; with probability  $1 - p$  the corporation is unsuccessful, talent executes the project and obtains surplus  $S(e)$  at date 2.
    2. Talent stays. The project is executed and surplus is shared according to contract at date 2.
  - If surplus is not verifiable, the corporation commits to report surplus  $S^r$  and talent decides whether to stay.
    1. Talent leaves. The corporation sues and with probability  $p$  blocks project execution; with probability  $1 - p$  the corporation is unsuccessful, talent executes the project and obtains surplus  $S(e)$  at date 2.
    2. Talent stays, the project is executed and the corporation reports surplus  $S^r$  at date 2 which is shared according to contract.

## 5. The organizational location of talent

### 5.1. A roadmap

In this section we study whether talent will be financed in equilibrium and, if so, by what type of organization. There are several different cases to consider and the discussion will be easier to follow if we start with a summary of results. This we do with the help of Figure 2, which shows who will finance in equilibrium for each pair  $(v, p) \in [0, 1] \times [0, 1]$ . It can be seen that the  $(v, p)$  space is divided in four regions:

- Region I: When the corporation is sufficiently centralized ( $v$  is close to 0) and property rights are strong enough ( $p$  is close to 1 and in any case not smaller than  $p^*$ ), talent

will be financed by the specialist and locate in a single-project firm. Essentially, when the corporation is centralized effort incentives are weak and when property rights are strong talent's outside option is of little value. Thus, talent prefers to be financed by the specialist, who can commit to make her the residual claimant.

- **Region IIa:** If the corporation is sufficiently decentralized ( $v$  is large enough) or, for a given  $v$ , property rights are weak enough ( $p$  is small enough), the corporation can offer a better deal to talent and therefore beat the specialist. As we will see, in part this is so because synergies make total surplus larger with the corporation. But weaker property rights enlarge the scope for corporate financing because they induce stronger effort.
- **Region IIb:** As  $p$  falls, it becomes increasingly costly to retain talent. When  $p$  falls below a critical value, call it  $p^*$ , the specialist is no longer willing to finance because holdup is too attractive and retaining talent too expensive. But the corporation is still willing to finance because it benefits from synergies.
- **Region III:** If property rights are too weak, neither the specialist nor the corporation will be willing to finance: holdup at date 1 is too attractive and neither can pay to prevent it and cover the investment cost  $I$ .

In what follows (section 5 and Appendix A) we will rigorously derive Figure 2 and efficiency results associated with each region. The model we study is a dynamic game which is solved by backwards induction. Nevertheless, there is one game for each pair  $(v, p)$  and it would be exceedingly cumbersome to characterize equilibrium strategies and outcomes in general. Therefore, we relegate the formal derivation of figure 2 to the appendix, and instead proceed here as follows. In the next subsection, we characterize the optimal effort decision within each relevant region and the main comparative statics. In section 5.3, we characterize competition between financiers.

## 5.2. Some simple economics of effort

**Effort when the specialist finances in equilibrium (Region I)** Consider pairs  $(v, p)$  such that it is optimal for talent to accept the specialist's offer in equilibrium. To characterize such equilibria one solves the left-hand side branch of the game tree in Figure 1 by backwards induction.

It is straightforward to note that along that branch it is optimal to make talent the residual claimant. Thus, in Region I she must be maximizing  $S(e) - e - F_s$  and exerting first best effort  $e^*$ . Hence:

**Proposition 5.1.** *There is no effort distortion when the specialist finances.*

In what follows we denote talent's equilibrium payoff when financed by a specialist by  $\pi^* = S^* - e^* - F_s$ , with  $S^* \equiv S(e^*)$ .

**Effort when the corporation finances in equilibrium (Regions IIa and IIb)** Next consider pairs  $(v, p)$  such that the corporation finances in equilibrium. To characterize such equilibria, one solves the right-hand side branch of the game tree in Figure 1.

On the one hand, when surplus is verifiable, talent is a residual claimant. On the other hand, the corporation must choose its report  $S^r$  when surplus is not verifiable. The following lemma shows that the corporation will report a surplus which is just enough to pay talent her outside option.

**Lemma 5.2 (Surplus expropriation).** *If surplus is not verifiable, then the corporation reports  $S^r = (1 - p)S(e) + F_c$  and talent receives her outside option. Hence, surplus expropriation falls as property rights weaken.*

**Proof.** If talent leaves, she receives her outside option  $(1 - p)S(e)$ . If talent stays and the corporation reports  $S^r = (1 - p)S(e) + F_c$ , she receives  $S^r - F_c = [(1 - p)S(e) + F_c] - F_c = (1 - p)S(e)$ . Thus, reporting something higher than  $(1 - p)S(e) + F_c$  would just leave money in talent's pocket, and reporting less would prompt talent to leave. ■

Thus if surplus is not verifiable talent receives exactly her outside option. The central implication of Lemma 5.2 is that the corporation will always extract some fraction of the surplus from talent, even if it claims to make her residual claimant. This result also suggests that talent's effort will increase with the value of her outside option. To obtain talent's effort, note that in equilibrium the corporation receives  $F_c$  with probability  $v$  and  $S(e) - S^r + F_c = pS(e)$  with probability  $1 - v$  or

$$T(F_c; v, p) \equiv vF_c + (1 - v)pS(e)$$

in expected value. Function  $T$  (for 'transfer') highlights the fact that the corporation will keep some fraction of the surplus  $S(e)$ . Note that  $F_c = 0$  is the best contract the corporation can offer to talent.

Talent, on the other hand, must receive the rest of the project's surplus, viz

$$S(e) - e - T(F_c; v, p). \tag{5.1}$$

Thus, when deciding how much effort to exert, talent maximizes (5.1). Optimal effort, denoted  $e^c$ , then satisfies the first order condition  $S'(e^c) = \frac{1}{1 - (1 - v)p}$ .<sup>24</sup> Of course, since

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<sup>24</sup>This expression is not defined for the pair  $(v, p) = (0, 1)$ . Nevertheless,  $S'(e^c) \rightarrow \infty$  when  $(v, p) \rightarrow (0, 1)$  which implies that  $e^c(0, 1) = 0$ .

$S'(e^c) > 1 = S'(e^*)$   $e^c < e^*$ . That is, unless the corporation fully decentralizes the project, effort will be less than with the specialist financier.

How distorting is centralization? Since

$$\frac{\partial e^c}{\partial v} = -\frac{p}{[1 - (1 - v)p]^2 S''} > 0,$$

it is clear that effort will be greater the higher is  $v$ , that is the more decentralized the corporation. But because synergies fall with decentralization ( $G'(v) < 0$ ), we have the well-known tradeoff between incentives and synergies.

Note also that

$$\frac{\partial e^c}{\partial p} = \frac{1 - v}{[1 - (1 - v)p]^2 S''} < 0.$$

This says that as long as the corporation is willing to finance, effort increases as property rights weaken. The mechanics is that weaker property rights increase the value of the outside option and moderate the corporation's inability to make talent a residual claimant. It is useful to state this explicitly:

**Proposition 5.3.** *Weaker property rights substitute for a financier's commitment to make talent the residual claimant.*

This second-best result—namely, one distortion (weaker property rights) moderates another (the inability of the corporation to report surplus truthfully)—is central to the analysis that follows in the next section.

For convenience, in what follows we denote talent's payoff if financed by a specialist by

$$\pi^c = S^c - e^c - T(F_c; v, p),$$

with  $S^c \equiv S(e^c)$ .

**Time consistent holdup** Before proceeding we note two technical points. First, we obtained  $e^*$  and  $e^c$  assuming that talent chooses to stay at date 1. But, one might wonder whether the decision to stay after exerting effort  $e^*$  and  $e^c$  is optimal at date 1—that is, whether the optimization during the investment phase is time consistent.

Second, we ignored the possibility that talent may also accept an organization's offer and then choose effort knowing that she will leave at date 1. In that case, talent would maximize choosing  $e^a = \arg \max\{(1 - p)S(e) - e\}$ .<sup>25</sup>

The following lemma shows that if the contract offered by the organization in equilibrium beats  $(1 - p)S(e^a) - e^a$ , then the decision to stay is time consistent, i.e. it cannot

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<sup>25</sup>To see that this may be optimal, assume that the specialist offers a contract such that  $F_s = S^*$  which talent takes. Then talent's payoff if she chooses  $e = e^*$  and then stays is  $S^* - S^* - e^*$ , obviously less than  $(1 - p)S^* - e^*$ , which in turn is less than  $(1 - p)S(e^a) - e^a$ .

happen that talent prefers to leave given that she has exerted effort with the intention to stay. Conversely, if talent maximizes  $(1 - p)S(e) - e$  with the intention to leave, then leaving is time consistent. For convenience, in what follows we denote talent's equilibrium payoff when she leaves by

$$\pi^a = (1 - p)S^a - e^a,$$

with  $S^a \equiv S(e^a)$ .

**Lemma 5.4 (Time consistent holdup).** *Suppose the specialist offers contract  $F_s$  and the corporation contract  $F_c$ . Then:*

- (i) *If  $\max\{\pi^a, \pi^*, \pi^c\} = \pi^a$  talent accepts either offer and leaves at date 1.*
- (ii) *If  $\max\{\pi^a, \pi^*, \pi^c\} = \pi^c$  talent accepts the corporation's offer and stays to execute the project*
- (iii) *If  $\max\{\pi^a, \pi^*, \pi^c\} = \pi^*$  talent accepts the specialist's offer and stays to execute the project.*

**Proof.** See Appendix B. ■

Lemma 5.4 shows an important implication of time consistency:

**Corollary 5.5.** *When either the specialist or the corporation finance in equilibrium, talent's payoff must be at least  $\pi^a = (1 - p)S^a - e^a$  in expected value.*

It follows that to finance the project the organization will have to spend at least

$$\mathcal{C}(p; I) \equiv I + \pi^a = I + (1 - p)S^a - e^a.$$

In what follows we will call  $\mathcal{C}$  the cost of financing the project. Note that it depends on the strength of property rights but not on  $v$ : decentralization does not affect the value of talent's outside option. For this reason, the cost of the project is the same for both financiers.

Now a straightforward application of the envelope theorem implies that

$$\frac{\partial \mathcal{C}(p; I)}{\partial p} = \frac{\partial \pi^a}{\partial p} = -S^a \leq 0,$$

with equality only for  $p = 1$ . In other words, weaker property rights increase the cost of financing the project.

### 5.3. Incentives, synergies and the market for talent

We can now characterize Figure 2. Roughly speaking, in regions I and IIa organizations compete: in the interior of region I the specialist can improve on any profitable offer

the corporation can make to talent and the opposite happens in region IIa, where the corporation can offer a better deal. In region III, by contrast, organizations cannot recoup their investment, and none is willing to finance. Thus, a useful starting point to analyze whether talent will be financed and, if so, by whom, is to determine how much surplus is available to pay the project's cost and the transfer to talent under each type of organization.

### 5.3.1. When will either organization finance?

The two conditions here are derived from the trivial observation that an organization cannot transfer more than the surplus that the project creates. Gross of the investment cost  $I$ , the project creates surplus  $S^* - e^*$  if financed by the specialist and  $S^c - e^c + G(v)$  if financed by the corporation. Because the financier must receive at least  $I$ , talent must receive at least  $\pi^a$ , and  $\mathcal{C}(p; I) \equiv I + \pi^a$ , it follows that if the specialist finances in equilibrium, then

$$\text{RS}^*(p; I) \equiv S^* - e^* - \mathcal{C}(p; I) \geq 0. \quad (5.2)$$

This *residual surplus* is split when choosing  $F_s$ . Similarly, if the corporation finances in equilibrium,

$$\text{RS}^c(v, p; I) \equiv S^c(v, p) - e^c(v, p) + G(v) - \mathcal{C}(p; I) \geq 0, \quad (5.3)$$

where we have made explicit the dependence of  $e^c$  on  $v$  and  $p$ . This residual surplus is split when  $F_c$  is chosen (see Figure 3).

Conditions (5.2) and (5.3) are necessary for the respective organization to be willing to participate, otherwise the project does not generate enough surplus to pay its cost  $\mathcal{C}(p; I)$ —either talent would leave or the organization would not recover  $I$ . Since the cost of financing the project  $\mathcal{C}(p; I)$  increases monotonically as  $p$  falls and  $\mathcal{C}(0; I) = S^* - e^* + I$ , so that  $\text{RS}^*(0; I) = -I < 0$ , it follows that:

**Lemma 5.6 (Strong versus weak property rights).** *There exists  $p^*$  such that  $S^* - e^* - \mathcal{C}(p^*; I) = 0$ . Moreover,  $S^* - e^* - \mathcal{C}(p; I) \geq 0$  if and only if  $p \geq p^*$ .*

Henceforth we will say that property rights are “strong” if  $p \geq p^*$ , and “weak” otherwise. Thus, by definition the specialist finances only if property rights are strong.

Because  $S^c - e^c$  increases as  $p$  falls (property rights weaken), things are slightly more complicated with the corporation. But if  $p$  is close enough to 0, the cost effect dominates and, for each  $v$ , the corporation will not finance. To see this, note that, as shown in the appendix,  $\text{RS}^c$  is strictly concave in  $p$ . Thus, for each  $v$ ,  $\text{RS}^c$  is either monotonically increasing or single-peaked in  $[0, 1]$ . But, when  $p = 0$ ,  $\text{RS}^c(v, 0; I) = G(v) - I < 0$ , since  $S^a - e^a = S^c - e^c = S^* - e^*$ ; and  $\partial \text{RS}^c(v, 0; I) / \partial p = S^* > 0$ . It follows that for each  $v$  there exists some  $\tilde{p}(v)$  such that  $\text{RS}^c[v, \tilde{p}(v); I] = 0$  and  $\text{RS}^c(v, p; I) < 0$  for all  $p < \tilde{p}(v)$ . Hence:

**Lemma 5.7.** *For each  $v$ , the corporation is not willing to finance if  $p$  is close enough to 0.*

Lemmas 5.6 and 5.7 show that region III is nonempty. Essentially, when property rights are weak and  $p$  is close enough to 0 the project becomes too expensive because talent’s outside option is too attractive.

In Appendix A.1 we fully characterize function  $\tilde{p}(v)$  using the implicit function theorem and some border values. To end this subsection, we show that when synergies are not too small, by which we mean  $G(0) > I - p^*S^a$ , then the corporation is willing to finance some projects when property rights are weak. That is, for all  $v$  in  $[0, 1)$ ,  $\tilde{p}(v) < p^*$ , and region IIb is as in Figure 2.<sup>26</sup>

We will show this with an argument that will be repeatedly used in the rest of the paper, and is illustrated in Figure 4. Because  $RS^c(v, p; I)$  is strictly concave in  $p$  for all  $v$  in  $[0, 1]$ , it is sufficient to show that  $RS^c(v, p^*; I) > 0$  for all  $v$  in  $[0, 1)$ . Then,  $RS^c(v, p; I) > 0$  for all  $p$  in the interval  $(\tilde{p}(v), p^*)$ ; and, no matter how small, the interval exists.<sup>27</sup>

Note that because  $e^c = e^a$  when  $v = 0$ , it follows that  $\pi^c = \pi^a = (1 - p)S^a - e^a$  and  $RS^c(0, p^*; I) = G(0) - (I - p^*S^a) > 0$ . Moreover,  $RS^c(1, p^*; I) = RS^*(p^*; I) = 0$ . The signs are sufficient to conclude that  $RS^c(v, p^*; I) > 0$  for all  $p$  in the interval  $[0, 1)$  and that it must reach a maximum in the interior of that interval.

### 5.3.2. Competition between organizations

We now study competition between the specialist and the corporation (regions I and IIa).

**Perfect property rights ( $p = 1$ )** It is useful to begin with the benchmark case of perfect property rights, that is  $p = 1$ . As can be seen in Figure 2, the corporation will finance if  $v$  is close enough to 1, but the specialist will prevail when  $v$  is small enough. Why?

To begin, note that talent obtains nothing if she leaves when  $p = 1$ , thus  $\pi^a = 0$  and  $\mathcal{C}(0; I) = I$ . Then, as is proven in the appendix, it is sufficient for the specialist to finance if

$$S^* - e^* - I > S^c(v, 1) - e^c(v, 1) + G(v) - I. \quad (5.4)$$

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<sup>26</sup>When  $G(0) \leq I - p^*S^a$ , the scope for corporate financing is smaller, but still there will be an area with weak property rights where the corporation will finance. This case is examined in section 5.5 and Appendix C below.

<sup>27</sup>This argument simply uses the fact that by continuity and concavity, we can deduce the existence and location of “zeros” (i.e. points where either the function’s value or its derivative is zero) by analyzing the sign on two extremes and sometimes using additional information about the sign of the derivative at one of those extremes.

which, rewriting, yields

$$(S^* - e^*) - [S^c(v, 1) - e^c(v, 1)] > G(v). \quad (5.5)$$

Intuitively, synergies are not large enough to pay for the reduction in effort due to centralization. Hence the project creates a larger residual surplus if financed by the specialist, which can thus match any profitable offer that the corporation can make.

On the other hand, if

$$S^* - e^* - I < S^c(v, 1) - e^c(v, 1) + G(v) - I \quad (5.6)$$

holds, then the corporation will finance. Rewriting (5.6) gives:

$$(S^* - e^*) - [S^c(v, 1) - e^c(v, 1)] < G(v). \quad (5.7)$$

That is, synergies are large enough to compensate the disincentive to effort caused by centralization.

Which condition holds depends on  $v$ , so one can study how residual surplus  $RS^c$  varies with it. Again the analysis is greatly simplified by the observation that  $RS^c$  is strictly concave in  $v$ . This implies that  $RS^c(v, 1, I)$  is either monotonic or single-peaked in  $[0, 1]$ , and a simple examination of the function and the sign of its partial derivatives at the extremes suffices to fully characterize it.

At one extreme, if the corporation is fully centralized and  $v = 0$  talent would exert no effort. The reason is that the corporation would manipulate surplus with probability 1 and, in addition, talent's outside option is worth nothing because  $p = 1$ . Thus  $RS^c(0, 1; I) = G(0) - I < 0$  by assumption, and it is clear that the specialist will finance (see Figure 2). At the same time, note that

$$\frac{\partial RS^c(v, 1; I)}{\partial v} = [S'(e^c) - 1] \times \frac{-1}{v^2 S''(e^c)} + G'(v),$$

so that  $\lim_{v \rightarrow 0} \partial RS^c(v, 1; I)/\partial v = \infty$ .<sup>28</sup>

At the other extreme, if  $v = 1$ , the corporation and the specialist are identical and  $RS^c(1, 1; I) > 0$ . But  $\partial RS^c(1, 1; I)/\partial v = G'(1) < 0$ : because  $e^c = e^*$  when  $v = 1$ , the effect on effort of slightly reducing  $v$  is second-order small, and only the first-order effect on synergies matters. Hence, the corporation will finance if  $v$  is close enough to 1. Thus, the following results follow from the concavity of  $RS^c$ :

**Proposition 5.8 (Perfect property rights).** (a) *There exists  $v_h < 1$  such that  $RS^c(v_h, 1; I) = RS^*(1; I)$ .*

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<sup>28</sup>When  $v = 0$ ,  $e^c = 0$ . Moreover,  $\lim_{e \rightarrow 0} S'(e) = \infty$ .

- (b) The corporation finances for all  $v \in (v_h, 1)$ ; the specialist finances for all  $v \in [0, v_h)$ .  
(c) There exists  $v^* \in (v_h, 1)$  such that  $RS^c(v, 1; I)$  is maximal.

The economics of Proposition 5.8 reflects the central trade off between synergies and effort incentives. When the corporation is sufficiently decentralized it can take advantage of synergies without affecting incentives too much—decentralization makes credible its claim to make talent the residual claimant. But as the corporation becomes centralized, the incentive cost becomes increasingly important, and at some point dominates the benefits from synergies. From then on, the specialist can offer a better deal to talent.<sup>29</sup>

Interestingly, part (c) indicates that if the corporation could freely choose its level of decentralization, it would optimally sacrifice incentives ( $v^* < 1$ ) and yet offer talent a better deal than the specialist. This is just the consequence of the trade-off being weak when  $v$  is large enough so that the gain in synergies outweighs the loss of effort incentives, and foreshadows a more general result in section 5.4.

**Competition with  $p < 1$**  Because  $RS^c$  is concave in  $v$  for all  $p$ , competition works similarly whenever  $p < 1$ . Nevertheless, as can be deduced from Figure 2, weaker property rights enlarge the scope of corporate financing. Why? Consider  $v$  such that

$$S^* - e^* - \mathcal{C}(p; I) = S^c(v, p) - e^c(v, p) + G(v) - \mathcal{C}(p; I),$$

and then slightly decrease  $p$  to  $p' = p - dp$ . Clearly, the cost of financing the project,  $\mathcal{C}(p; I)$ , increases for both organizations at the same rate. But we know from Proposition 5.3 that  $\partial e^c / \partial p < 0$ —when property rights are weaker talent exerts *more* effort because her outside option is more valuable. Because effort increases as  $p$  falls,  $S^c - e^c$  also increases as  $p$  falls, thereby partly (but not completely) compensating for the increase in costs and

$$S^* - e^* - \mathcal{C}(p'; I) < S^c(v, p') - e^c(v, p') + G(v) - \mathcal{C}(p'; I).$$

It follows that one can distinguish two effects of weaker property rights: (i) first, projects become more expensive, regardless of who finances; (ii) second, projects financed by the corporation become relatively *less* expensive.

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<sup>29</sup>The alert reader may note that the corporation might overcome her commitment problem by making an upfront cash payment to talent in period  $t = 0$ , so as to beat the specialist ex ante. We rule out such cash payments. Following Hellmann (2002), this assumption can be justified if upfront payments create an adverse selection problem.

To see why, assume that there is one and only one individual who can obtain the skill at cost  $I$ , but a measure  $m$  look like her and there is asymmetric information: while each individual knows her ability at date 0, financiers do not. If individuals neither obtain utility from being financed nor divert funds during the investment phase, talent will self-select provided that the financier does not pay anything beyond  $I$  at date 0 or 1. On the contrary, if such an additional payment is made, it would attract a lemon with probability one.

This yields the following central result:

**Result 5.1 (Property rights and the incentive-synergies tradeoff).** *Weak property rights reduce the incentive cost of synergies and enlarge the scope of corporate financing.*

Result 5.1 has the additional implication that weaker property rights make the corporation strictly better off whenever it competes with the specialist. To see why, assume that the corporation finances. Because of competition, talent must receive at least her outside option plus all the residual surplus she could receive if financed by the specialist, viz.  $\pi^a + \text{RS}^*(p, I)$ —otherwise talent would choose the specialist. Hence, competition increases the cost for the corporation of executing the project by  $\text{RS}^*(p, I)$  and it will finance only if

$$S^c - e^c + G(v) - \mathcal{C}(p; I) - \text{RS}^*(p, I) = S^c - e^c + G(v) - (S^* - e^*) \geq 0$$

It is clear that this expression increases as  $p$  falls because weaker property rights strengthen incentives and increase  $S^c - e^c$ . Hence, the part of residual surplus that can be appropriated by the corporation increases:<sup>30</sup>

**Proposition 5.9.** *As long as there is competition, the corporation’s profit increases as property rights weaken.*

Proposition 5.9 may seem surprising in view of the widespread belief that weaker property rights hurt financiers. What is the logic behind it? The first part is that competition effectively makes the cost of financing the project independent of  $p$  because talent’s outside option is no longer restrictive. With strong property rights, the cost for the corporation of attracting talent changes to the surplus that talent would obtain in a stand-alone project financed by the specialist. The second part we have already discussed: the outside option is more valuable when property rights are weaker, so incentives to exert effort increase.

**Competition and efficiency** Return to the case of perfect property rights ( $p = 1$ ). Conditions (5.5) and (5.7) suggest that the outcome of competition is influenced by the following efficiency comparison: roughly speaking, the corporation finances when synergies compensate for lost incentives, and the converse occurs when they don’t. In what follows, we show that financing by the specialist may occur even when the corporation is more efficient, but the opposite case cannot occur—that is, we will now show that

$$S^* - e^* > [S^c(v, p) - e^c(v, p)] + G(v) \tag{5.8}$$

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<sup>30</sup>As mentioned before, we do not model the bargaining game between talent and the financier, but in any case our claim is valid as long as the corporation’s payoff is increasing in  $S^c - e^c + G(v) - (S^* - e^*)$ .

is *sufficient* for the specialist to finance, whereas the converse,

$$S^c(v, p) - e^c(v, p) + G(v) \geq S^* - e^* \quad (5.9)$$

is only *necessary* for the corporation to finance.

To see why (5.8) is sufficient, note that by choosing  $F_s = I$  the specialist can transfer all residual surplus  $RS^*(p, I)$  to talent. Hence, whenever (5.8) holds, the specialist can beat the best offer that the corporation could possibly make.

Like the specialist, the corporation would like to set  $T(F_c; v, p)$  close to  $I$  whenever (5.9) holds and competition is strong enough. Nevertheless, because  $T(F_c; v, p) = vF_c + (1-v)pS^c$  and  $F_c \geq 0$ , the corporation is constrained by non-verifiability to keep no less than  $(1-v)pS^c$  in expected value. Hence, if the corporation is sufficiently centralized or property rights are strong enough, talent cannot receive all residual surplus  $RS^c(v, 1; I)$  because  $(1-v)pS^c > I$ . For this reason, it may happen that despite of significant synergies, the corporation may not be able to transfer enough surplus to talent despite being more efficient.

To formally study this transfer problem and its consequences, note that

$$\pi^c(0; v, p) = S^c - e^c - T(0; v, p) \geq S^* - e^* - I = \pi^*(I) \quad (5.10)$$

must hold in addition to (5.9) for the corporation to finance. In Appendix A.2 it is shown that there exists a convex and increasing function  $t : [0, 1] \rightarrow [p^*, 1]$  such that

$$\pi^c[0; v, t(v)] = \pi^*(I)$$

for  $v \leq v_t$  (see Figure 5). For each  $v$ ,  $t(v)$  is the largest possible  $p$  such that the corporation can transfer enough to beat the best possible offer of the specialist. Essentially, when  $v < v_t$  property rights are too strong beyond some point  $t(v)$ , so that talent's outside option is not worth enough.

At the same time, in Appendix A.2 we show that there exists a strictly concave and increasing function  $h : [0, 1] \rightarrow [p^*, 1]$  such that

$$S^c[v, h(v)] - e^c[v, h(v)] + G(v) - (S^* - e^*) = 0$$

for all  $v \leq v_h$  (see Figure 5). For each  $v$ , this function indicates the maximum  $p$  such that the corporation is more efficient than the specialist—as we have already seen, stronger property rights weaken incentives in the corporation because the outside option is worth less.

Now the following lemma is proven in Appendix A.2:

**Lemma 5.10.** *If  $G(0) > I - p^*S^a$ , then  $t(0) > p^*$  and region Ib in Figure 5 is nonempty.*

That is, if synergies are large enough, inefficient financing cannot be ruled out. This yields the following result:

**Result 5.2 (The efficiency of corporate financing).** *Corporate financing is efficient when observed, but specialist financing may not be.*

Result 5.2 is just a consequence of assuming that corporate financing is affected by a distortion, whereas specialist financing is not. The distortion stems from the limited ability of the corporation to make talent residual claimant. Specifically, the corporation cannot directly transfer the synergy to talent (technically, this implies that function  $t$  is independent of the synergy  $G$ ), which creates the inefficiency.

The efficiency of corporate financing might seem surprising since corporations, not specialists, are often associated with inefficient outcomes. But the point is that Result 5.2 should be expected to obtain in any equilibrium analysis. That is, if one believed that specialist financiers offered first best incentives to talent, then it follows that whenever corporate financing is observed, it must be more efficient. Conversely, for observed corporate financing to be inefficient, as is often claimed, it must be because of some (typically unmodeled) distortion specific to specialist financing.

In practice, Result 5.2 suggests that there is a strong presumption that corporate financing is efficient whenever observed, precisely because corporations are subject to more distortions than specialists!

## 5.4. Endogenous organizational forms

### 5.4.1. Endogenizing decentralization and the strength of property rights

So far we have assumed that  $v$  and  $p$  are exogenous. In many settings, this makes sense: corporations do not routinely adjust their existing internal organizational structure to accommodate the marginal project, and the strength of property rights often depends on factors beyond the control of a single firm. That said, one should also expect organizations to adapt. In what follows we examine the cases when corporations could freely choose the level of centralization and the strength of property rights. The central results are that the corporation would never choose to mimic the specialist, and would choose property rights to be weak.

**Endogenous decentralization** Suppose the corporation can choose the level of decentralization  $v$  for a given  $p$ . We already know that it will not mimic the specialist when property rights are weak because it could not pay talent's outside option. By centralizing the project the corporation takes advantage of synergies which can then be used to pay for talent's outside option. Beyond a certain amount of centralization however, the gains from synergies are outweighed by the incentive cost of centralization, and residual surplus

RS<sup>c</sup> falls. A similar argument holds when property rights are strong. The only difference is that talent's outside option is now the specialist's offer, which does not change with centralization.

Formally, if the corporation could choose decentralization  $v$ , it would maximize  $\Delta(v, p, I)$  where

$$\Delta(v, p, I) = \begin{cases} \text{RS}^c(v, p, I) & \text{if } p \leq p^* \\ \text{RS}^c(v, p, I) - \text{RS}^*(p, I) & \text{if } p > p^* \end{cases} \quad (5.11)$$

Function  $\Delta(v, p, I)$ , defined for convenience to unify the weak and strong property rights cases, is the same as in section 5.3 when property rights are strong, and is equal to the corporation's residual surplus when property rights are weak. By defining  $\Delta(v, p, I)$  in this way, and ignoring the transfer problem, we know that the corporation will finance if and only if  $\Delta(v, p, I) \geq 0$ . The following lemma implicitly characterizes optimal decentralization as a function of the strength of property rights.

**Lemma 5.11.** *Optimal decentralization can be represented by a continuous and strictly increasing function  $g_v : [0, 1] \rightarrow [0, 1]$  in  $p$  with  $g_v(1) = v^* < 1$ .*

**Proof.** Fix  $p = 1$ . Then between the  $\max\{v_h, v_t\}$  and 1, the corporation's utility function is positive (and concave) and thus the optimal centralization level  $g_v(1) = v^*$  lies between those values. Both with weak and strong property rights, the first order condition is the same and is given by

$$\frac{\partial \Delta}{\partial v} = \frac{\partial e^c}{\partial v} [S'(e^c) - 1] + G'(v) = 0.$$

Thus,  $g_v(p)$  is implicitly defined by

$$\frac{\partial \Delta}{\partial v} [g_v(p), p] = 0.$$

Totally differentiating we have

$$\left\{ [S'(e^c) - 1] \frac{\partial^2 e^c}{\partial v^2} + \left( \frac{\partial e^c}{\partial v} \right)^2 S'' + G'' \right\} dg_v + \left\{ [S'(e^c) - 1] \frac{\partial^2 e^c}{\partial v \partial p} + \frac{\partial e^c}{\partial v} \frac{\partial e^c}{\partial p} S'' \right\} dp = 0$$

and using the signs calculated in Appendix A we know that the first expression in brackets is strictly negative and the second is strictly positive. It follows that  $\frac{dg_v}{dp} > 0$ . ■

Figure 6 characterizes the inverse of the  $g_v$  function with the properties described above; that is,  $g_v$  is the function that, for any given  $v$ , characterizes the  $p$  that yields that particular  $v$  to be optimal.<sup>31</sup>

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<sup>31</sup>Note that the inverse is defined only for  $v \leq v^*$  because  $v > v^*$  will never be an optimum. See Proposition 5.8.

With endogenous  $v$ , it should not be surprising that the corporation can beat out the specialist when competing for talent (Figure 6). What is surprising, however, is that in doing so, it never mimics the specialist (choosing  $v = 1$ ):

**Result 5.3 (Endogenous decentralization).** *Optimal decentralization increases with stronger property rights, but never reaches full decentralization.*

To see why the corporation would never choose to mimic the specialist, note that the first order condition is

$$\frac{\partial \Delta}{\partial v} = \frac{\partial e^c}{\partial v} [S'(e^c) - 1] + G'(v) = 0$$

At  $v = 1$   $G'(1) < 0$  and  $S^c - e^c = S^* - e^*$ . Hence, by slightly increasing centralization the corporation gains a first order increase in synergies, while the fall in surplus due to weakened incentives is second-order small.

Similarly, as  $p$  falls the corporation's ability to make talent residual claimant increases and the difference  $S'(e^c) - 1$  falls. Being less costly, the corporation would optimally decide to centralize more.

**Endogenous property rights** Now consider the problem faced by a corporation that can somehow choose the strength of property rights. Does the corporation prefer strong property rights? We already know (Proposition 5.9) as long as there is competition between financiers, the corporation is made better off by weaker property rights. Thus, if we restrict to areas I and IIa of Figure 2, the corporation would like to choose  $p^*$ . This section proves a stronger result. That is, as long as  $G(0) > I - p^* S^a$ , optimal property rights are smaller than  $p^*$ .

The mathematical problem is the same as in (5.11), but now the corporation optimizes over  $p$  given  $v$ . In the following lemma, optimal property rights are implicitly characterized as a function of decentralization  $v$ :

**Lemma 5.12.** *If  $\frac{\partial \text{RS}^c}{\partial p}(v, p^*) \geq 0$ , the optimal strength of property rights is  $p^*$ . If  $\frac{\partial \text{RS}^c}{\partial p}(v, p^*) < 0$ , the optimal strength of property rights can be represented by a continuous and strictly increasing function  $g_p : [0, 1] \rightarrow [0, p^*]$  with  $g_p(1) = p^*$ .*

**Proof.** When competition occurs, residual surplus increases monotonically as property rights weaken, thus the optimal level will be at most  $p^*$ . By definition, for weak property rights the functions  $\Delta(v, p, I)$  and  $\text{RS}^c(v, p, I)$  are the same so we will refer only to residual surplus. If  $\frac{\partial \text{RS}^c}{\partial p}(v, p^*) \geq 0$ , residual surplus falls if property rights weaken thus reaching a global maximum on  $p^*$ . If on the other hand  $\frac{\partial \text{RS}^c}{\partial p}(v, p^*) < 0$ , by concavity of residual surplus it follows that the optimal level must be strictly smaller than  $p^*$  and strictly higher than  $\tilde{p}(v)$  (residual surplus is zero on  $\tilde{p}(v)$  by definition). Now fix  $v$ . Then the first order

condition is given by

$$\left. \frac{\partial RS^c}{\partial p} \right|_{(v, g_p(v))} = \frac{\partial e^c}{\partial p} [S'(e^c) - 1] + S^a(e^a) = 0$$

Totally differentiating we have

$$\left[ [S'(e^c) - 1] \frac{\partial^2 e^c}{\partial p \partial v} + \frac{\partial e^c}{\partial p} \frac{\partial e^c}{\partial v} S'' \right] dv + \left[ [S'(e^c) - 1] \frac{\partial^2 e^c}{\partial p^2} + \left( \frac{\partial e^c}{\partial p} \right)^2 S'' + S' \frac{de^a}{dp} \right] dg_p = 0$$

and using the signs calculated in Appendix A.1 we know that the first expression in parenthesis is strictly positive and the second one is strictly negative. It follows that  $\frac{dg_p}{dv} > 0$ .

■

Thus (and as can be seen from Figure 6):

**Result 5.4 (Endogenous strength of property rights).** *If  $G(0) > I - p^* S^a$ , a more decentralized corporation would choose stronger property rights, but never above  $p^*$ .*

Last, since  $\Delta$  is concave in  $v$  and  $p$ , the optimal combination of property right strength and decentralization is found at the intersection of  $g_v$  and  $g_p$ .

## 5.5. Extensions

**Small synergies** Throughout the paper we have assumed that synergies are neither too large nor too small (i.e.  $I > G(0) > I - p^* S^a$ ). Now we comment what happens if they are small. A formal characterization is in Appendix C.

As seen in Figure 7, the scope of corporate financing decreases. This is not surprising because the corporation's residual surplus falls and consequently, specialist financing is more attractive for a larger number of cases. Nevertheless, there still exists some corporate funding when property rights are weak which, as before, is efficient.

**Competition with multiple organizations** Throughout the analysis, we have assumed that there is only one organization of each type (specialist and corporation) that competes for talent. Here, we briefly comment on the analysis when the market comprises multiple organizations of each type. The main point is that the results established thus far would not be affected by such an extension.

To see why, notice, first, that increased competition does not affect the probability of talent leaving at date 1 since  $p$  is exogenous. Thus, competition only affects who will finance talent ex-ante. Now, recall that the boundary conditions (5.4) and (5.6) determine who will finance talent in each region of Figure 2. But, along these boundaries, organizations are left with no surplus anyway—talent grabs it all.

In contrast, organizations *will* in general grab surplus within each region: as seen, residual surplus there (5.2 and 5.3, respectively) is positive. The effect of increased competition from multiple organizations of the same type, then, is only to shift bargaining power to talent within each region and thereby dissipate this residual surplus. Thus, increased competition only affects surplus sharing within each region, but not who will finance.

**Risk aversion** The model assumed that talent is risk-neutral. Incorporating risk-aversion would complicate the analysis without changing the flavor of the main results. To see why, it is useful to distinguish between ex-ante uncertainty over project surplus (at the time that organizations compete for talent, date 0) and ex-post uncertainty (at the time that talent considers leaving, date 1). First, one might argue that ex-post uncertainty is likely to have been partly resolved during the discovery stage by construction— that is, talent considers leaving only *after* she has gained some information on the viability of the idea during the discovery stage. Consequently, risk preferences should not play a central role at that stage.<sup>32</sup> Ex-ante uncertainty about project surplus, on the other hand, makes it more difficult to make talent the residual claimant – thereby tilting the advantage away from the specialist and towards corporations (who in any case, cannot commit to make talent the residual claimant). Thus, ignoring risk aversion is likely to understate the advantage of corporations in financing such projects.

## 6. Discussion: the second-best principle at work

The central mechanism at work in our model is the second-best principle. *Ceteris paribus*, synergies enlarge the size of the pie but it also creates a credibility problem: organizing to extract synergies may also make it easier to divert surplus away from the project. Weak property rights improve talent’s outside option, and force the corporation to transfer part of the residual surplus, thereby restoring credibility. Talent’s incentives improve as long as the outside option is increasing in her effort. Thus, outside options *solve* a problem: weak property rights relax the incentive-synergies trade off and many times corporate financing will be more efficient. In what follows we discuss three examples where the second-best principle seems to be at work.

**R&D** The second-best principle suggests that corporate R&D may benefit from the weak property rights described in section 2. In fact, the law seems to be designed to make the second-best principle work. Merges (1999, p. 59-62) points out, “[...] even taking account

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<sup>32</sup>In other words, the time at which the entrepreneur considers leaving (date 1) is endogenous to how much uncertainty about project surplus has been resolved. Of course, it is unlikely that all uncertainty is resolved before talent leaves. But, the key point is that project outcomes are far less uncertain ex-post than they are ex-ante. Indeed, many entrepreneurs *do* leave firms in practice, and are likely to do so *after* they have obtained some knowledge of the viability of a project.

of recent extensions, an employee is in general free to leave a firm, develop an inchoate concept, and enjoy full ownership of the resulting invention.” Moreover, in practice courts grant employees the right to leave and enjoy the fruits of what they invent, even when they have signed contracts granting ownership to former employers:

Employers typically include a ‘trailer’ or ‘holdover’ clause in employment contracts which provides that inventions made or conceived within a certain period after the end of employment belong to the employer. Although sweeping on their face, these contracts are not fully enforced: courts universally apply a reasonableness or public policy limitation to them. Their effective scope is therefore much narrower than might appear at first.<sup>33</sup>

[...Indeed] the legal policy behind trailer clauses, and the law of employee exit generally, tends to favor employee departure. Firms have responded with corporate venture funds, on the theory that if an employee is going to leave anyway the firm might as well try to profit from it. And even beyond this, with an (often implicit) exit option lurking in the background, firms have been forced to improve the lot of those employees who choose to stay. Internal invention reward programs in particular appear designed to offer at least some invention-specific rewards to employees who make significant inventions.

The second-best principle may also shed light and partly explain why so much R&D is financed by corporations and not VCs. It is tempting to conclude that the spectacular success of some venture-capital backed firms in the last two decades makes venture capital the normative benchmark for R&D governance. High-powered incentives, contract structures that prevent conflicts between the financier and the entrepreneur (e.g., staged finance, syndication, carried interest for general partners, various covenants and restrictions), the benefits afforded by the typical limited partnership structure that VCs employ, and the separate governance employed for each project that VCs invest in (e.g., separate boards and limited liability for each project) should make them more efficient financiers.<sup>34</sup> But while the evidence is quite conclusive in that VCs can better choose contracts and structure organizations to sharpen incentives, the second best-principle suggests that corporations are better suited to confront threats of misappropriation and holdup.<sup>35</sup> Essentially, syner-

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<sup>33</sup>Merges (1999, p. 61-62) also notes that: “One line of cases completely voids agreements that last too long after employment, e.g., one year. [...] Another line of cases holds that trailer clauses cover only inventions made using the ex-employers’ trade secrets. Trailer clauses have limited effect. They are at best seen as particular applications of post-employment covenants not to compete, which have long represented a suspect class of obligations and are often voided under common-law restraint of trade principles.”

<sup>34</sup>See Gompers and Lerner (1999a, 2001) for a thorough account of VC finance.

<sup>35</sup>An interesting stylized fact is that financing of early-stage R&D projects—where the threat of misappropriation is likely to be highest—is, increasingly, dominated by corporations (Zider 2000); in contrast, VC financing has tended to move over time towards late-stage financing, expansion stage financing, and buyouts (Gompers and Lerner 2001).

gies enlarge the size of the pie, and the problem of corporations is how to credibly commit to transfer surplus to talent. The threat of holdup—thats manifests through competitive pressure via the *market*—therefore allows corporations to commit, provided that property rights are weak. By contrast, competitive pressure hurts VCs and more generally specialist financiers.

**IMG: synergies and weak property rights** The second-best principle helps clarify both IMG’s success, and why this success is largely unaffected by its possibly huge conflicts of interest.

As discussed in section 2, one of the distiguishing features of IMG is its deep vertical presence in the value chain. One might conclude that IMG’s expansion into different businesses was intended to diversify away its dependence on mobile talent. But, if anything, these expansions increased its dependence. For example, the most important determinant of the success of a golf event was the presence of top stars<sup>36</sup>; the profitability of course design operations was considerably higher if these courses were made host to golf events; and, investing in training academies in order to establish relationships at an early age with athletes who could eventually leave (in effect, increasing  $I$ ) only exacerbated the holdup problem. Moreover, in contrast to its competitors who were broadly diversified beyond sports, IMG’s expansions were largely limited to activities within the same sports in which they represented athletes.

As the model suggests, IMG’s advantage is synergies with talent—a high  $G(v)$ . For example, IMG created various non-standard, made-for-television golf events to showcase its golf stars<sup>37</sup>, leveraged their talent through instruction at training academies, and ensured that courses that its clients designed would host major events. Further, its entry into event hosting increased competition for talent by increasing purses offered at events: since IMG clients captured approximately fifty percent of all prize money, and the firm received ten percent of these winnings, it could afford to offer larger purses for events—thereby giving it an advantage in competing for the right to host such events. Hosting tournaments also allowed IMG to schedule favorable starting times for its athletes. In addition, IMG’s presence in television offered additional opportunities to showcase its clients and corporate sponsors. Some observers argued that IMG’s control of camera coverage ensured longer exposure of its own clients and that camera angles prominently displayed corporate logos, which, in turn, afforded IMG an advantage in negotiating corporate endorsements for its athletes.<sup>38</sup> The key point is that IMG’s expansion into various businesses was not meant to diversify away from its reliance on mobile talent, but to reinforce it.

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<sup>36</sup>Between 1998 and 2002, gate receipts at tournaments in which Tiger Woods participated doubled those at tournaments in which he did not.

<sup>37</sup>These include the *Skins* game featuring four players competing individually for large winnings in a friendly format, and the *Battle of Bighorn* featuring two-player teams in a similar format.

<sup>38</sup>See Anand and Galetovic (2004) for details.

Worth noting is that size alone cannot explain IMG's success. In contrast to other large firms in this market, IMG is neither well-capitalized (it is privately held) nor a subsidiary of a parent with deep pockets. Moreover, it has fewer than 5% of the employees of its largest competitor (Interpublic) and less than one-fourth of its revenues. This should not be surprising in view of the model, which suggests that IMG's advantage in dealing with weak property rights stems from its scope which creates synergies.

Last, as in the model, the tradeoff between synergies and conflicts of interest is relevant here as well and possibly quite severe. Typically, these concerns might be deleterious to IMG's ability to attract talent. But as in other activities studied here, high outside options and the fact that athletes can easily walk away limit expropriation. This is a reason why top athletes continue to migrate towards IMG, not away from it, despite the potential for such interest conflicts.<sup>39</sup>

**Professional service firms** In markets like consulting, law, or investment banking, firms rely on talented individuals. Of course, having many talented individuals under the same roof is an important source of synergies. But, as Wilhelm and Downing (2001) note, teamwork can undermine incentives: "A key to success [for professional service firms], then, is encouraging individuals to contribute to a common pool of intellectual capital. However, contributions to common asset pools, and teamwork more generally, are undermined by the threat of free-riding."

How can firms manage this tension? The second-best principle suggests that strong market-based incentives might substitute for weaker intra-organizational incentives. Indeed, it is well known that holdup is a concern for professional service firms. They have to discover talented individuals, who may leave or be poached by others, taking valuable relationships with them. But, more than that, Wilhelm and Downing (2001) note that these firms even *encourage* "holdup":

Encouraging knowledge workers to simultaneously contribute to proprietary and nonproprietary knowledge pools or to gain external visibility can serve a similar function. Management consulting firms that encourage consultants to publish books, or law firms that encourage certain attorneys to gain an individual high profile, use this mechanism. Obviously, external visibility and

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<sup>39</sup>Similar issues appear in the organization of agents for classical musicians. As Caves (2000) notes, although personalized relationships yield individual agents an advantage, a single large firm, Columbia Artists Management Inc. (CAMI) has dominated the agents market since the 1920s. In this case synergies stemmed from the fact that CAMI represented conductors for the Philadelphia and New York Philharmonic orchestras, and conductors in turn were "key decision makers in recruiting orchestral soloists, so (their) dominance as an agent for conductors gave leverage in representing soloists." Moreover, unlike most agent markets where interest conflicts can compromise an agent's function, CAMI "managed repeatedly to be on both sides of transactions without protest from the contracting parties."

nonproprietary knowledge production create outside opportunities for key employees. But these outside opportunities also provide heightened incentives for investment in human capital. Successful organizations maintain a healthy balance in this tension.

## 7. Conclusion: markets help corporations

Ownership of intangible assets like talent, ideas, skills, and knowledge is often elusive. A recent article succinctly summarizes why:

“In the creative economy, the most important intellectual property isn’t software or music or movies. It’s the stuff inside employees’ heads. When assets were physical things like coal mines, shareholders truly owned them. But when the vital assets are people, there can be no true ownership. The best that corporations can do is to create an environment that makes the best people want to stay.”<sup>40</sup>

This paper studies what type of organization — a specialist financier or a multi-project corporation — will finance a project that relies on a talented individual who can walk away at any time. Conventional wisdom says that talent requires strong incentives. These are typically best provided by specialist financiers who can design contract and organizational structures that prevent conflicts between the financier and talent. For example, venture capitalists use staged finance, syndication, carried interest for general partners, various covenants and restrictions to align incentives. In contrast, large multi-project corporations might be better placed than specialist financiers to exploit cross-project synergies. But, in so doing they face inherent difficulties in committing to transfer residual surpluses to pivotal individuals — creating possibilities for expropriation, conflicts of interest, and weaker incentives. Thus, one might expect that specialist financiers have an advantage *relative* to corporations in financing projects where talent is pivotal. In addition, weak property rights over talent hurt investment incentives in general because they make contracts less enforceable.

The main conclusions of this paper are quite different. The central result is that weak property rights over talent enlarge the scope of financing by corporations, by increasing both their advantage relative to specialists and their ability to finance such projects in equilibrium. The reason is that weak property rights help corporations make a credible commitment to transfer surplus by forcing them to match talent’s outside option. By doing so, weak property rights allow markets to preserve effort incentives through competition for talent—*markets* for talent substitute for *contracts* within organizations. Then, because

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<sup>40</sup> “The Creative Economy,” *Business Week*, August 28, 2000.

of their advantage in exploiting synergies, one should expect corporations, rather than specialist financiers, to have an advantage in financing projects where talent is key.

Traditional analyses of such settings focus on one of two distortions: the inability of talent to commit not to leave (weak property rights), and the inability of corporations to commit not to expropriate. Whereas the first distortion hurts investment incentives, the second hurts effort incentives. The analysis in this paper, however, points to a second-best result at work: the two distortions might cancel each other out rather than adding up. In a sense, holdup by talent reduces the possibility of holdup by corporations. This logic is consistent with the fact that, despite the apparent advantage of specialist financiers in offering strong incentives, markets for talent are still heavily skewed towards financing by corporations.

Analyses of the relationship between stronger non-compete contracts for employees and investment incentives typically confront the “California puzzle”: despite the weakest enforcement of non-compete clauses in labor contracts by any state, it enjoys the most robust entrepreneurial activity. Similarly, a growing body of work has begun to challenge the notion that stronger property rights induce innovation.<sup>41</sup> The model presented here perhaps offers a starting point by which to reconcile conventional wisdom on investment incentives with this recent evidence.<sup>42</sup>

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<sup>41</sup>See, for example, Hall and Ziedonis’ (2001) analysis of semiconductors, Sakakibara and Branstetter’s (2001) analysis of the impact of the Japanese patent reforms in 1988, and Moser’s (2003) analysis of 19th-century world fairs. Jaffe (2000) and Kortum and Lerner (2000) also question the causal link between increases in R&D spending and patenting that started in the 1980s and stronger intellectual property rights that were implemented during the same period. These findings are consistent with large-sample surveys of managers by Levin et al (1987) and Cohen et al (2000) that reveal that patents are largely irrelevant as instruments of appropriability in a broad range of industries. See also Boldrin and Levine (2003).

<sup>42</sup>The traditional lens focuses on California as a one-distortion world: the weak enforcement of non-competes. The model here suggests focus on another aspect—organizational synergies—that may perhaps shed light on the puzzle. For an exhaustive account of the culture of “community, cooperation, and collaboration” that prevailed in Silicon Valley, see Saxenian (2000).

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# Appendix

## A. A complete derivation of Figure 2

In this appendix we fully characterize Figure 2. This amounts to derive and examine functions  $\tilde{p}$ ,  $t$  and  $h$ .

### A.1. Weak property rights

We begin by deriving function  $\tilde{p} : [0, 1] \rightarrow (0, p^*]$ . For each  $(v, p)$  in  $[0, 1] \times [0, p^*]$ , the corporation will be willing and able to finance if there exists some offer  $F_c \geq 0$  such that

$$RS^c(v, p; I) \geq 0 \quad (\text{A.1})$$

and

$$S^c - e^c - T(F_c; v, p) \geq \pi^a. \quad (\text{A.2})$$

That is, the project is viable (condition [A.1]) and the corporation is able to transfer enough surplus to talent to prevent a holdup (condition [A.2]). Note that if condition (A.2) holds for some  $F_c > 0$ , then it must hold for all smaller offers because the left side is linearly decreasing in  $F_c$ . In particular, the highest possible transfer to talent is made when  $F_c = 0$ . The following lemma shows that condition (A.2) always holds when property rights are weak.

**Lemma A.1.** *When  $p < p^*$ , there always exists some offer  $F^p > 0$  such that  $S^c - e^c - T(F_c; v, p) \geq \pi^a$  for all  $F_c \in [0, F^p]$ .*

**Proof.** We know that  $S^c - e^c - T(F_c; v, p)$ , i.e. talents payoff is maximized with effort level  $e^c(v, p)$ , which is independent of  $F_c$ . In particular, for  $F_c = 0$ , talent's payoff is strictly higher than what he gets exerting effort  $e^a(v, p)$

$$\begin{aligned} S^c - e^c - T(0; v, p) &= S^c - e^c - (1-v)pS^c \\ &> S^a - e^a - (1-v)pS^a \\ &\geq S^a - e^a - pS^a \\ &= \pi^a, \end{aligned}$$

where the first inequality follows from  $e^c$  being optimal and the second inequality from the fact that  $v \leq 1$ . The result follows by defining  $F^p$  implicitly by  $S^c - e^c - T(F^p; v, p) = \pi^a$  and noting that  $S^c - e^c - T(0; v, p)$  falls as  $F_c$  increases. ■

Hence the corporation is always able to finance talent when property rights are weak. We now study condition (A.1). The following lemma shows that this function is concave.

**Lemma A.2.**  *$RS^c(v, p; I) = S^c - e^c + G(v) - \mathcal{C}(p; I)$  is strictly concave in  $v$  and  $p$ . Moreover,  $RS^c(v, 0; I) < 0$  for all  $v$ ,  $RS^c(v, p^*; I) \geq 0$  with equality only for  $v = 0$ .*

**Proof.** Recall that

$$\begin{aligned} e^c(v, p) &\equiv \arg \max\{S(e) - e - T(F_c; v, p)\}, \\ e^a(p) &\equiv \arg \max\{(1-p)S(e) - e\}, \\ e^* &\equiv \arg \max\{S(e) - e\}. \end{aligned}$$

The surplus function  $S(e)$  is increasing but marginally decreasing:  $S' > 0$ ,  $S'' < 0$ ,  $S''' < 0$  and  $S(0) = 0$ . Synergies  $G(v)$  fall with decentralization:  $G' < 0$ ,  $G'' < 0$  and  $G(1) = 0$ . The three first order conditions for optimal effort are

$$\begin{aligned} S'(e^c) &= [1 - (1-v)p]^{-1}, \\ S'(e^a) &= (1-p)^{-1}, \end{aligned}$$

$$S'(e^*) = 1.$$

We calculate first, the signs of the derivatives of  $e^c(v, p)$  for all  $(v, p) \in (0, 1)^2$ . The borders are treated separately when needed. Defining  $A \equiv 1 - (1 - v)p$  to simplify the expressions, we have

$$\begin{aligned} \frac{\partial e^c}{\partial v} &= \frac{-p}{S''[1 - (1 - v)p]^2} = \frac{-p}{S''A^2} > 0 \\ \frac{\partial e^c}{\partial p} &= \frac{1 - v}{S''[1 - (1 - v)p]^2} = \frac{1 - v}{S''A^2} < 0 \\ \frac{\partial^2 e^c}{\partial v^2} &= \frac{p}{(S'')^2 A^3} \underbrace{(AS''' \frac{\partial e^c}{\partial v} + 2pS'')}_{< 0} < 0 \\ \frac{\partial^2 e^c}{\partial p^2} &= -\frac{1 - v}{(S'')^2 A^3} \underbrace{\left[ AS''' \frac{\partial e^c}{\partial p} - 2(1 - p)S'' \right]}_{> 0} < 0 \\ \frac{\partial^2 e^c}{\partial v \partial p} &= -\frac{1}{S''A^2} + \frac{v}{(S'')^2 A^3} \left[ AS''' \frac{\partial e^c}{\partial p} - 2(1 - p)S'' \right] > 0 \end{aligned}$$

Now we can find the signs of the derivatives of  $\text{RS}^c(v, p; I)$

$$\begin{aligned} \frac{\partial \text{RS}^c}{\partial p} &= \frac{p(1 - v)^2}{S''[1 - p(1 - v)]^3} + S^a, \\ \frac{\partial \text{RS}^c}{\partial v} &= \frac{p^2(1 - v)}{-S''[1 - p(1 - v)]^3} + G'(v), \\ \frac{\partial^2 \text{RS}^c}{\partial p^2} &= [S'(e^c) - 1] \frac{\partial^2 e^c}{\partial p^2} + \left( \frac{\partial e^c}{\partial p} \right)^2 S'' + S'(e^a) \frac{de^a}{dp} < 0, \\ \frac{\partial^2 \text{RS}^c}{\partial v^2} &= [S'(e^c) - 1] \frac{\partial^2 e^c}{\partial v^2} + \left( \frac{\partial e^c}{\partial v} \right)^2 S'' + G''(v) < 0, \\ \frac{\partial^2 \text{RS}^c}{\partial v \partial p} &= [S'(e^c) - 1] \frac{\partial^2 e^c}{\partial v \partial p} + S''(e^c) \frac{\partial e^c}{\partial v} \frac{\partial e^c}{\partial p} > 0. \end{aligned}$$

We conclude that the Hessian matrix is negative definite and the function  $\text{RS}^c$  is strictly concave.

**Remark 1.** Note that this conditions hold for all  $(v, p)$  in  $(0, 1) \times (0, 1)$ .

Finally we compute the extreme values of  $\text{RS}^c$ . In a fully centralized corporation,  $v = 0$  and talent will choose,  $e^c(0, p) = e^a(p)$ ; with full decentralization she will choose first-best effort,  $e^c(1, p) = e^*$ ; and similarly if  $p = 0$   $e^c(v, 0) = e^a(0) = e^*$ . Then,  $\text{RS}^c$  is:

- Negative and decreasing in  $v$  when  $p = 0$ :

$$\begin{aligned} \text{RS}^c(v, 0; I) &= S^* - e^* + G(v) - [S^* - e^* - I] \\ &= G(v) - I \leq G(0) - I < 0 \end{aligned}$$

- When  $p = p^*$ , positive for  $v = 0$  and zero for  $v = 1$ :

$$\text{RS}^c(0, p^*; I) = S^a - e^a + G(0) - [(1 - p^*)S^a - e^a - I] = G(0) + p^*S^a - I > 0;$$

$$\text{RS}^c(1, p^*; I) = S^* - e^* + G(1) - (S^* - e^*) = 0.$$

Thus, we deduce by concavity of  $\text{RS}^c$  in  $v$ , that  $\text{RS}^c(v, p^*; I) \geq 0$  for all  $v$  with equality only in  $v = 1$ . Note also that the slope of  $\text{RS}^c$  respect to  $v$  in  $v = 1$  is  $\left. \frac{\partial \text{RS}^c}{\partial v} \right|_{v=1} = G'(1) < 0$ . ■

**Remark 2.** Concavity of residual surplus in  $v$  and  $p$  implies that the set of projects financed by the corporation,  $\mathcal{CF}_w = \{(v, p) \in [0, 1]^2 : \text{RS}^c(v, p; I) \geq 0\}$ , is a strictly convex set. Strictly convex closed sets in  $\mathbb{R}^2$  can be characterized by two separate functions, representing the “lower” and “upper” bounds of that set. Moreover, the function representing the lower bound must be strictly concave and the one representing the upper bound must be strictly convex (if not, then the set cannot be convex). In the characterizations of the bounds of corporate financing that follow (Propositions A.3, A.5 and A.6 below), we use this property of convex sets after determining whether we are on the lower or the upper bound, which is done by analyzing the sign of the partial derivative  $\partial \text{RS}^c / \partial p$  on that point. If positive, it means that we must be on a lower bound and vice versa.

The next proposition characterizes the border of the set  $\mathcal{CF}_w$  when property rights are weak.

**Proposition A.3.** Assume  $I - p^* S^a < G(0) < I$ . Then there exists a strictly convex function  $\tilde{p} : [0, 1] \rightarrow (0, p^*]$  with  $0 < \tilde{p}(0) < p^*$  and  $\tilde{p}(1) = p^*$  such that when  $p < p^*$ ,  $\text{RS}^c(v, p; I) \geq 0$  if and only if  $\tilde{p}(v) \leq p < p^*$ .

**Remark 3.** Function  $\tilde{p}(v)$  is a subset of the lower bound of the set of  $\mathcal{CF}_w$ .

**Proof.** As shown in Lemma A.2 residual surplus is strictly negative in  $(v, 0)$  and strictly positive in  $(v, p^*)$ , except for  $(1, p^*)$ , when it is exactly 0. By concavity and continuity in  $p$ , there exists a unique  $\tilde{p}(v)$  between 0 and  $p^*$  such that  $\text{RS}^c[v, \tilde{p}(v); I] = 0$ . By uniqueness of  $\tilde{p}(v)$ , we must have  $\tilde{p}(1) = p^*$  because  $\text{RS}^c(1, p^*; I) = 0$ , and  $\tilde{p}(0)$  must lie between 0 and  $p^*$  because  $\text{RS}^c(0, 0; I) < 0$  and  $\text{RS}^c(0, p^*; I) > 0$ . Continuity and strict convexity of  $\tilde{p}(v)$  follows by noting that  $\partial \text{RS}^c / \partial p$  is positive for  $p = \tilde{p}(v)$ . ■

## A.2. Strong property rights

When property rights are strong ( $p \geq p^*$ ) the specialist is always willing to finance. Hence the corporation will finance if

$$\text{RS}^c(v, p; I) \geq \text{RS}^*(p; I) \tag{A.3}$$

and

$$\pi^c(0; v, p) = S^c - e^c - T(0; v, p) \geq S^* - e^* - I = \pi^*(I) \tag{A.4}$$

jointly hold. As we saw in the text, condition (A.3) just says that the corporation finances only if more efficient. Condition (A.4) says that the corporation must be able to transfer enough surplus to talent.

We begin by finding the set of pairs  $(v, p)$  such that (A.3) holds with equality. The following lemma is a preliminary necessary result:

**Lemma A.4.**  $\Delta(v, p; I) \equiv \text{RS}^c(v, p; I) - \text{RS}^*(p; I) = S^c - e^c + G(v) - S^* - e^*$  is strictly concave in  $v$  and  $p$  in  $[0, 1] \times [p^*, 1]$ .

**Proof.** >From the previous section we know that  $\partial \Delta^2 / \partial v^2 = \partial^2 \text{RS}^c / \partial v^2 < 0$  and  $\partial^2 \Delta / \partial v \partial p = \partial^2 \text{RS}^c / \partial v \partial p > 0$ . Hence, it remains to be shown that

$$\frac{\partial^2 \Delta}{\partial p^2} = \frac{\partial^2 (S^c - e^c)}{\partial p^2} = S'' \left( \frac{\partial e^c}{\partial p} \right)^2 + (S' - 1) \frac{\partial^2 e^c}{\partial p^2} < 0,$$

which follows from the concavity of  $S$  and  $\partial^2 e^c / \partial p^2 < 0$ . ■

Concavity of  $\Delta(v, p; I)$  implies that the set  $\mathcal{CF}_s = \{(v, p) \in [0, 1]^2 : \text{RS}^c(v, p; I) \geq \text{RS}^*(p; I)\} = \{(v, p) \in [0, 1]^2 : \Delta(v, p; I) \geq 0\}$  is convex.<sup>43</sup> The next proposition characterizes the border of the set  $\mathcal{CF}_s$ .

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<sup>43</sup>Note that the definition of the set  $\mathcal{CF}_s$  is different from the one used above ( $\mathcal{CF}_w$ ) because the conditions for corporate financing with strong property rights change. But the analysis is analogous because  $\mathcal{CF}_s$  is still a strictly convex set.

**Proposition A.5 (Characterization).** *There exists a concave and increasing function  $h : [0, 1] \rightarrow [p^*, 1]$ , with  $p^* < h(0) \leq 1$  and  $h(v) = 1$  for all  $v \geq v_h$  such that  $\Delta(v, p; I) \geq 0$  if and only if  $p^* \leq p \leq h(v)$ .*

**Remark 4.** *Function  $h(v)$  is a subset of the upper bound of the set of  $\mathcal{CF}_s$ .*

**Proof.** Define  $v_h$  implicitly by  $\Delta(v_h, 1; I) = 0$ , which exists and is unique because  $\Delta(v, p; I)$  is concave and must change signs once:  $\Delta(0, 1; I) < 0$ ,  $\Delta(1, 1; I) = 0$  and  $\frac{\partial \Delta}{\partial v} \Big|_{(1,1)} = G'(1) < 0$ . For all  $v \geq v_h$ , both  $\Delta(v, 1; I)$  and  $\Delta(v, p^*; I)$  are positive and thus  $\Delta(v, p; I) > 0$  for all  $p$  between  $p^*$  and 1 (by concavity in  $p$ ). We conclude that  $h(v) = 1$  for all  $v \geq v_h$ . In a similar way, for all  $v < v_h$  we have that  $\Delta(v, 1; I) < 0$  and  $\Delta(v, p^*; I) > 0$  and thus, it exists a unique  $h(v)$  between  $p^*$  and 1 such that,  $\Delta[v, h(v); I] = 0$ . Clearly,  $\Delta(v, p; I) > 0$  for all  $p < h(v)$  and  $\Delta(v, p; I) < 0$  for all  $p > h(v)$ . Continuity and strict concavity of  $h(v)$  when  $v < v_h$  follows by noting that  $\partial \Delta / \partial p$  is negative for  $p = h(v)$ . Note that  $h(v)$  is strictly concave in  $[0, v_h]$  and constant if  $v > v_h$ . ■

Now we characterize the frontier of the set of pairs  $(v, p)$  such that (A.4) holds.

**Proposition A.6.** *There exists a continuous, strictly convex and increasing function  $t : [0, 1] \rightarrow [p^*, 1]$  with  $t(0) = p^*$  and  $t(v) = 1$  for all  $v \geq v_t$ , such that  $\pi^c(v, p) \geq \pi^*$  if and only if  $p \leq t(v)$ .*

**Proof.** Define  $\mathcal{CT}_s$  as the set of combinations of  $v$  and  $p$  where the corporation is able to transfer as much as the specialist. Recalling that the highest possible transfer by the corporation is achieved by setting  $F_c = 0$ , we can write  $\mathcal{CT}_s = \{(v, p) \in [0, 1]^2 : \pi^c(v, p) \geq \pi^*\}$ , where we have omitted the dependence of  $\pi^c(v, p)$  on  $F_c$  because is evaluated on  $F_c = 0$ . Our aim is to characterize its frontier. First note that the specialist's maximum transfer  $\pi^*$  is constant and the corporation's maximum transfer is strictly concave:

$$\begin{aligned} \frac{\partial \pi^c}{\partial p} &= -(1-v)S^c < 0 \\ \frac{\partial \pi^c}{\partial v} &= pS^c > 0 \\ \frac{\partial^2 \pi^c}{\partial p^2} &= -(1-v)S' \frac{\partial e^c}{\partial p} < 0 \\ \frac{\partial^2 \pi^c}{\partial v^2} &= pS' \frac{\partial e^c}{\partial v} > 0 \\ \frac{\partial^2 \pi^c}{\partial v \partial p} &= S^c + pS' \frac{\partial e^c}{\partial p} > 0. \end{aligned}$$

Applying the same argument used twice before we conclude that  $\mathcal{CT}_s$  is a strictly convex set and we'll be able to characterize its frontier as some strictly convex or concave function. Now we calculate the border values to see if  $t(v)$  belongs to the upper (resp. lower) border of  $\mathcal{CT}_s$ , to establish the convexity (resp. concavity) of that function.

Since  $e^c = e^a$  when  $v = 0$  it follows that  $\pi^c(0, p) = (1-p)S^a - e^a$ . Moreover we know that  $p^*$  is defined to be the limit value of property rights such that the specialist is willing and able to finance, i.e.  $S^* - e^* - I = (1-p^*)S^a - e^a$ . Thus we have that  $\pi^c(0, p^*) = \pi^*$  and necessarily  $t(0) = p^*$ . Since  $\pi^c$  is increasing in  $v$ ,  $\pi^c(v, p^*) > \pi^*$  for all  $v$ , except when  $v = 1$  in which case the corporation is indistinguishable from the specialist. Now for  $p = 1$  and  $v = 0$ ,  $e^c = 0$  thus  $\pi^c(0, 1) = 0 < (S^* - e^* - I) = \pi^*$ ; for  $p = 1$  and  $v = 1$ ,  $e^c = e^*$  thus  $\pi^c(1, 1) = S^* - e^* > S^* - e^* - I = \pi^c$ . We conclude that there must exist some  $v_t \in (0, 1)$  such that  $\pi^c(v_t, 1) = \pi^*$ . For all  $v < v_t$  the corporation will not be able to transfer enough surplus to talent. For all  $v > v_t$ , the corporation is able to transfer the necessary surplus for all relevant  $p$ 's, so  $t(v) = 1$ . Nevertheless, if  $v < v_t$ , and because  $\frac{\partial \pi^c}{\partial v} > 0$ , there must exist a unique  $t(v) \in [p^*, 1)$  such that  $\pi^c(v, t(v)) = 0$ . The convexity of  $t(v)$  follows from the fact that those points lay on the upper border of the set  $\mathcal{CT}_s$  because  $\frac{\partial \pi^c}{\partial p} < 0$ . Last, using the implicit function theorem in  $[0, v_t)$ ,

$$\frac{dt}{dv} = -\frac{\partial \pi^c / \partial v}{\partial \pi^c / \partial p} = \frac{t(v)}{1-v} > 0$$

which completes the proof. ■

## B. Proof of Lemma 3.4

(Only (i) and (ii). (iii) is proven similarly.) Optimal effort in the three alternatives is determined as before. We must only show that talent cannot increase her payoff by changing her stay-or-leave decision.

(i) Suppose  $\max\{\pi^a, \pi^*, \pi^c\} = \pi^a$  and talent optimally chooses  $e^a$ . We have to show that she will leave independently of the contract being accepted. If she accepts the specialist's offer, then

$$\begin{aligned} (1-p)S^a - e^a &\geq S^* - e^* - F_s \\ &> S^a - e^a - F_s, \end{aligned}$$

where the first inequality holds by hypothesis and the second because  $e^* = \arg \max\{S(e) - e - F_s\}$ . It follows that  $(1-p)S^a > S^a - F_s$ , i.e. the payoff from staying in stage 2 with the specialist is less than the payoff from leaving. Analogously, if she accepts the corporation's offer then

$$\begin{aligned} (1-p)S^a - e^a &\geq S^c - e^c - T(F_s; v, p) \\ &> S^a - e^a - T(F_s; v, p), \end{aligned}$$

where again, the first inequality holds by hypothesis and the second because  $e^c = \arg \max\{S(e) - e - T(F_s; v, p)\}$ . It follows that  $(1-p)S^a > S^a - T(F_s; v, p)$ , so the payoff from staying in stage 2 with the corporation is less than the payoff from leaving. Thus the decision is time consistent.

(ii) Similarly, we have to show that  $S^c - F_c \geq (1-p)S^c$ . Suppose  $\max\{\pi^a, \pi^*, \pi^c\} = \pi^c$  and talent chooses  $e^c$ . Then

$$\begin{aligned} S^c - e^c - T(F_c; v, p) &\geq (1-p)S^a - e^a \\ &> (1-p)S^c - e^c, \end{aligned}$$

where the first inequality holds by hypothesis and the second because  $e^a = \arg \max\{(1-p)S(e) - e\}$ . Recalling that  $T(v, p; F_c) = vF_c + (1-v)pS^c$ , it follows from the inequality that

$$\begin{aligned} S^c - vF_c - (1-v)pS^c &= v(S^c - F_c) + (1-v)(1-p)S^c \\ &> (1-p)S^c \\ &= v(1-p)S^c - (1-v)(1-p)S^c. \end{aligned}$$

It follows that  $S^c - F_c > (1-p)S^c$  (talent's outside option) and her decision to stay is time-consistent. ■

## C. Small synergies

**Lemma C.1 (Small synergies).** *If  $G(0) < I - p^*S^a$ , there exists some  $v_0 > 0$  such that  $\tilde{p}(v) = h(v) = p^*$  for all  $v$  in  $[0, v_0]$ . The remaining convexity and monotonicity properties of  $\tilde{p}(v)$ ,  $h(v)$  and  $t(v)$  still hold for  $v \geq v_0$  but the particular shapes may change.*

**Proof.** Function  $t(v)$  doesn't change at all because it does not depend on synergies  $G(v)$ . But now residual surplus is negative in  $(0, p^*)$ :

$$RS^c(0, p^*; I) = G(0) + p^*S^a - I < 0$$

It is still zero in  $(1, p^*)$  and decreasing in  $v$ :

$$RS^c(1, p^*; I) = S^{vc} - e^{vc} + G(1) - (S^{vc} - e^{vc}) = 0$$

$$\left. \frac{\partial RS^c}{\partial v} \right|_{(1, p^*)} = G'(1) < 0$$

We conclude, by concavity of  $\text{RS}^c$  in  $v$ , that there exists some  $v_0 > 0$  such that  $\text{RS}^c(v, p^*) < 0$  for all  $v < v_0$  and  $\text{RS}^c(v, p) > 0$  for all  $v > v_0$ . Clearly, by the definitions of  $\tilde{p}(v)$  and  $h(v)$ , we have that  $\tilde{p}(v) = h(v) = p^*$  for all  $v \leq v_0$ . The rest of the characterization (when  $v > v_0$ ), is analogous to Propositions (A.3) (for  $\tilde{p}[v]$ ) and (A.5) (for  $h[v]$ ). ■

Figure 1: Timeline

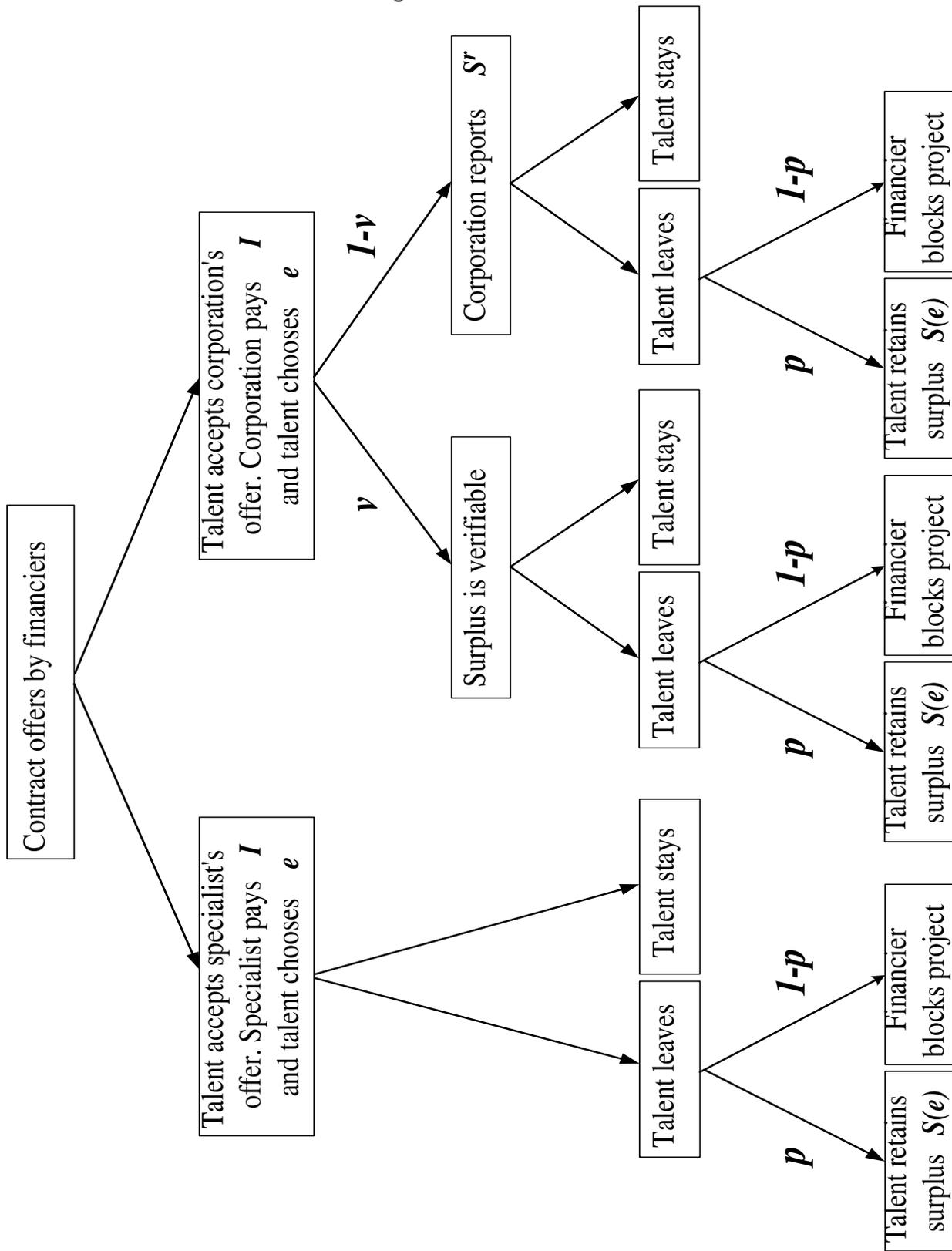


Figure 2: Talent financing

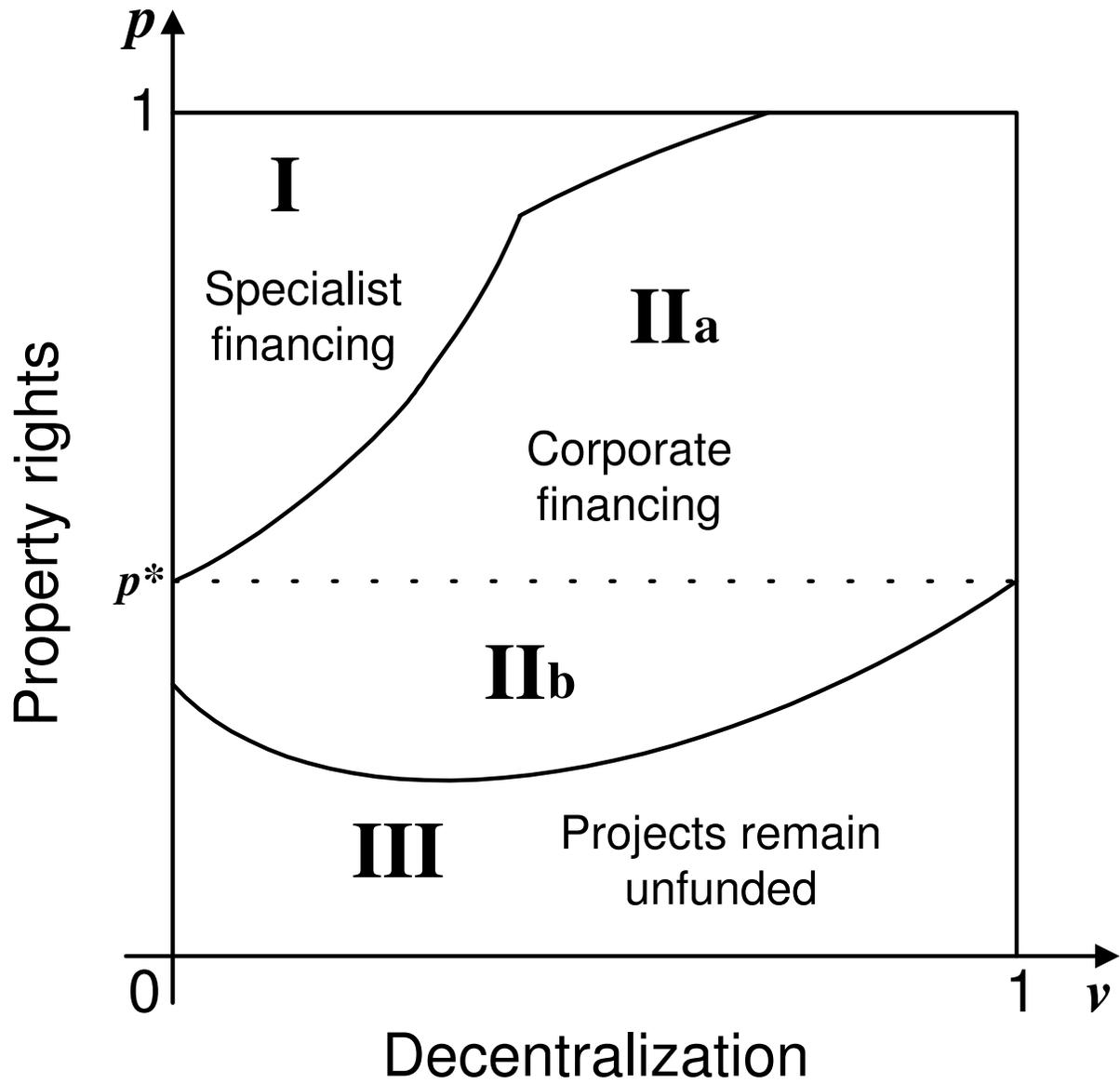


Figure 3: Residual surplus

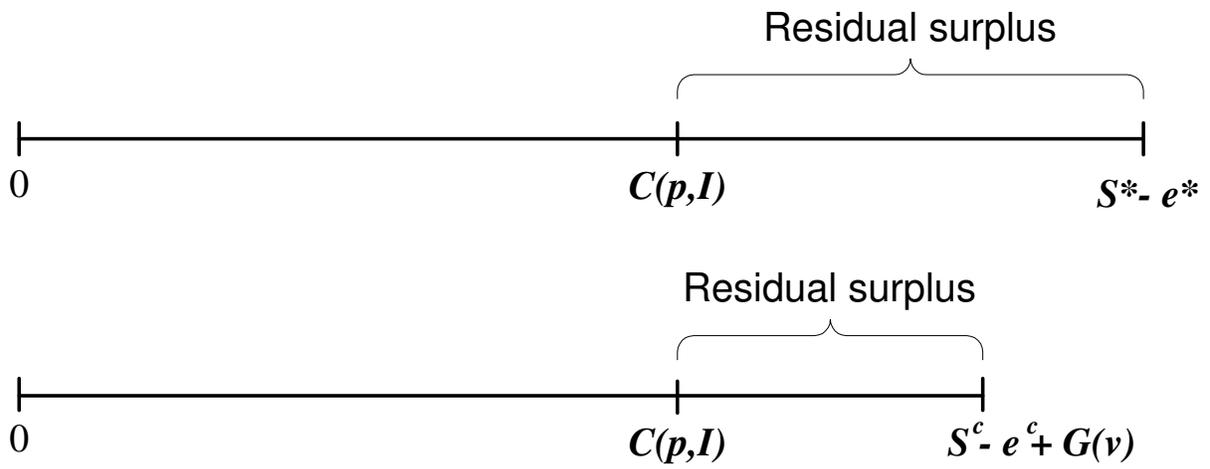


Figure 4: Corporation's residual surplus for a fixed  $p$

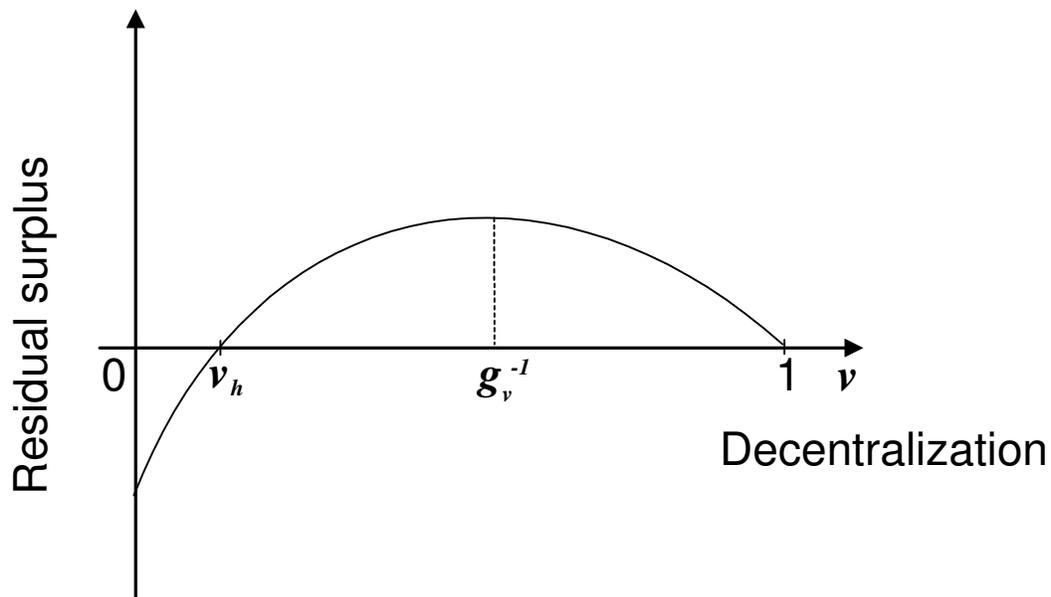


Figure 5: Efficiency with strong property rights

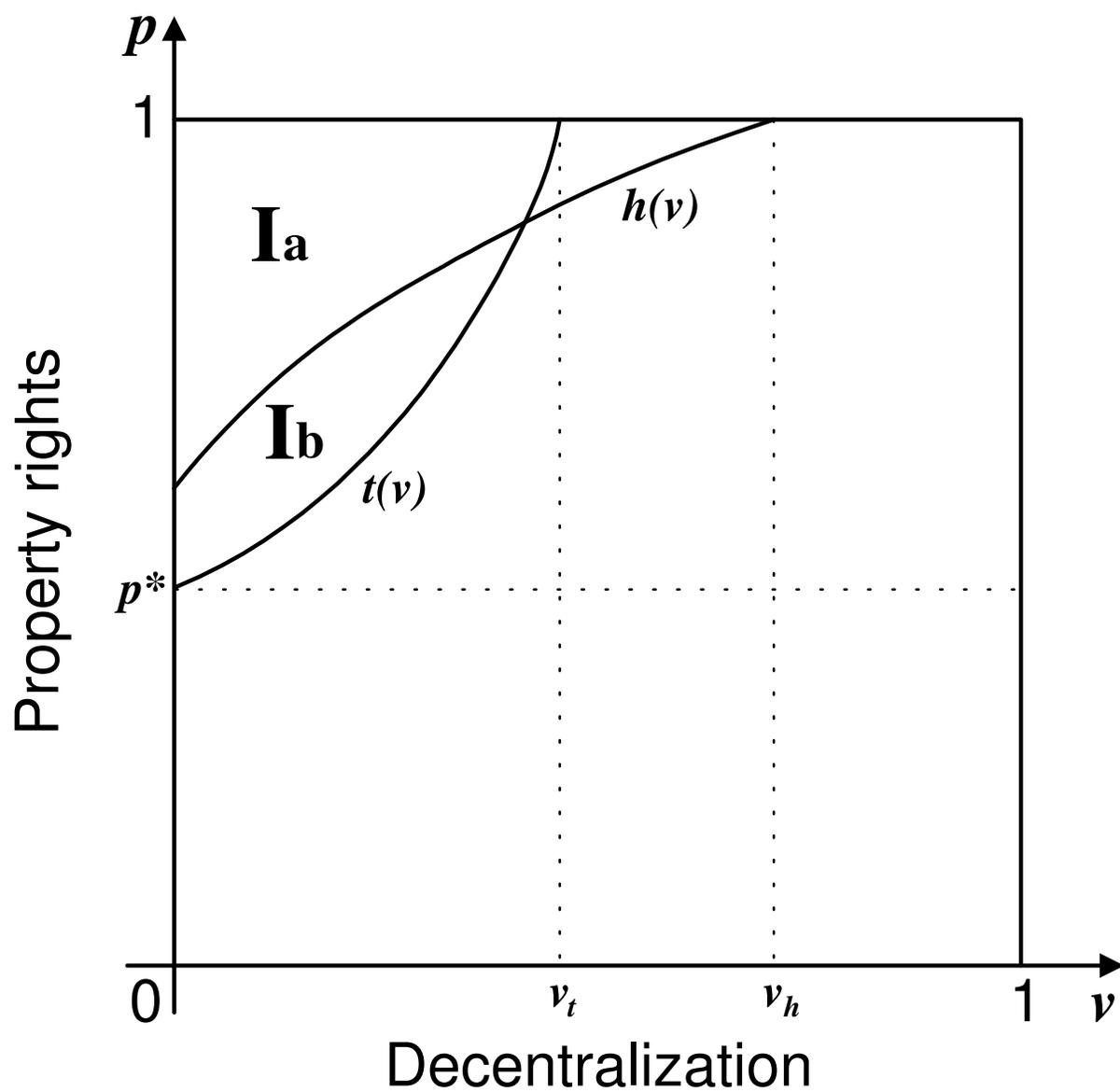


Figure 6: Optimal centralization and property rights

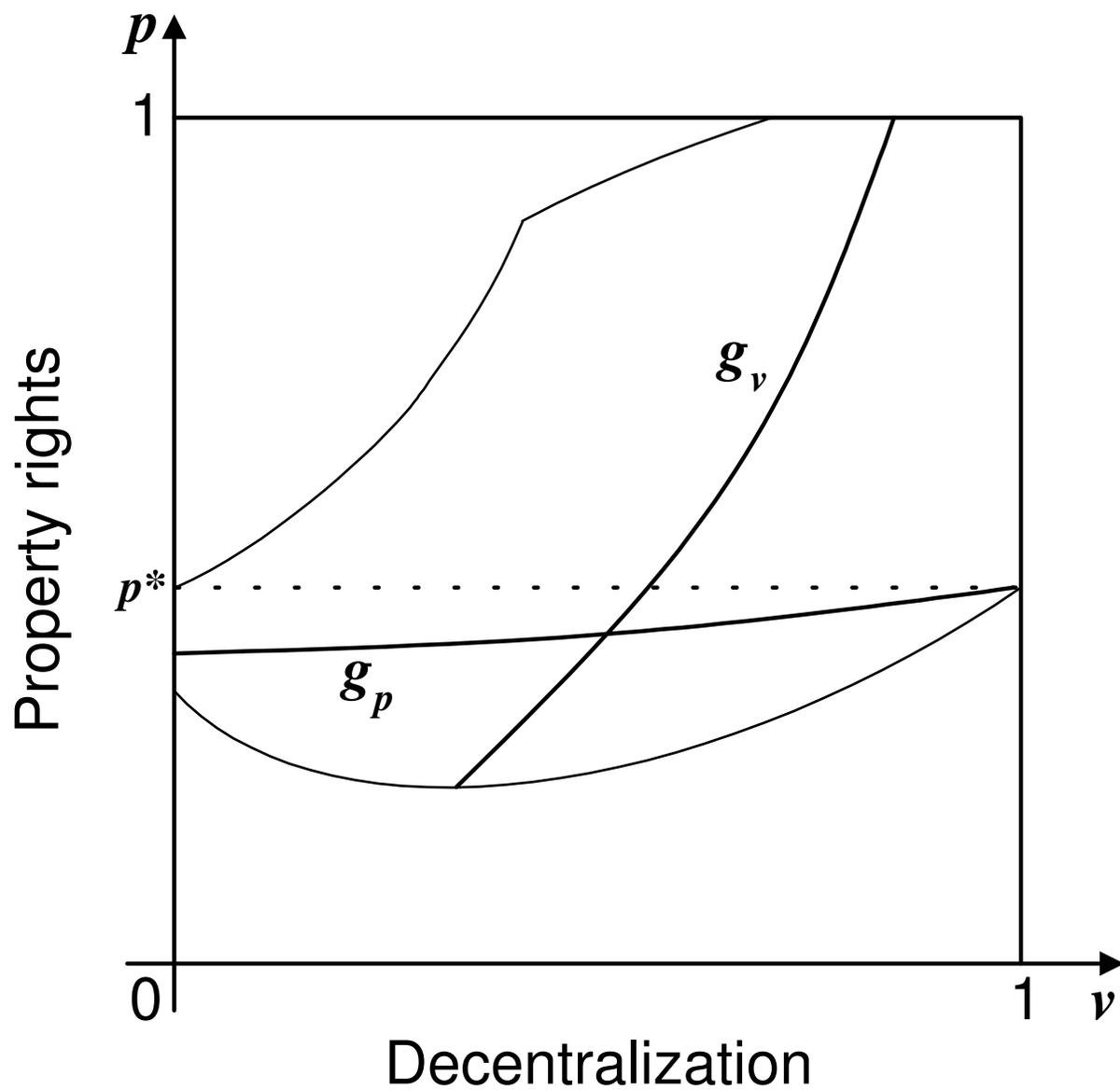


Figure 7: Financing when synergies are small

