Trilateral Contracts in Long Term Financing

Antonio Mello
Wisconsin School of Business

Erwan Quintin*
Wisconsin School of Business

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Abstract

We describe a view of intermediate seniority finance in which junior financiers are "back-up quarterbacks" of sorts who stand ready to replace the original operator when the project underperforms. In our model, involving skilled financiers in the capital structure enables senior lenders to mitigate agency frictions more efficiently. In some instances, capital structures that feature skilled back-up operators are critical to the launching of the project, which otherwise would have a negative NPV. The optimal contract we describe can be implemented using the mezzanine finance arrangements that are ubiquitous in industries such as commercial real estate where foreclosing on senior finance is especially costly. Mezzanine lenders are industry specialists while senior lenders tend to be traditional intermediaries, a division that constitutes evidence that mezzanine finance provides an inseparable package of operating expertise and capital, exactly as our model suggests it should.

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*Email: amello@bus.wisc.edu and equintin@bus.wisc.edu.

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1 Introduction

In most modern companies control rests in the hands of managers and is separate from ownership. With direct command over operations, managers have the opportunity to divert the firm's earnings for their own benefit. As a result, investors demand protection via covenants and collateral, or provide incentives to managers via performance-based rewards and penalties.[1]

Recent work by DeMarzo and Fishman (2007), DeMarzo and Sannikov (2006) and Biais et. al. (2007) combines the firm's choice of capital structure with a contract that provides incentives for the manager to operate the firm's assets with the interests of the investors in mind. DeMarzo and Fishman (2007) and DeMarzo and Sannikov (2006) describe a model where the optimal contract between the principal and the manager can be implemented with straight debt, equity, and a line of credit used for temporary liquidity shortages. Biais et. al. (2007) show that cash reserves can play the same role as the line of credit in those papers. A key feature of this class of models is that with limited commitment on the part of the manager the principal may decide to liquidate the firm after a sequence of bad earnings report. This occurs even when all parties recognize that the reports are genuine and liquidation is inefficient ex-post.

In this paper we analyze how in the same context optimal bilateral arrangements between investors and managers can be improved upon. We focus on the potential role of a third party – a back-up manager – and show that its presence creates both an interesting degree of organizational complexity and a role for an elaborate capital structure. A back-up agent who brings both financial capital and human capital to the project enhances the project's expected surplus by taking over operations when the project underperforms thus making it cheaper to discipline the original operator.

DeMarzo and Fishman, 2007 (see Proposition 6) have pointed out that the option to replace the initial manager with an identical agent following termination makes the threat of termination renegotiation proof. That simple observation also holds in our model. But we say more.

First, bilateral contracts can be improved upon *whether or not* they feature a positive probability of termination. Even if termination never occurs at the best bilateral contract,

[1] These incentives include future funding contingencies as in Bolton and Scharfstein (1990), the threat to extinguish the firm as in Hart and Moore (1994, 1998), or the threat to replace the manager as in Spear and Wang (2005).

a better termination option improves the principal's surplus and consequently facilitates the funding of the investment. Having a back-up manager in place raises the principal's net present value (NPV) by making it cheaper to provide incentives to the original operator.

Second, we find that waiting to hire a new manager only after the project underperforms – the option considered by DeMarzo and Fishman (2007) – is generally suboptimal.[2] Instead, it is typically optimal for the back-up manager to fund a part of the original investment in exchange for a financial claim that is junior to that of the principal and senior to that of the current manager. This commitment of capital at inception is not motivated by the need to plug a financial gap: senior lenders could entirely finance the venture in our model. Neither is complicating the capital structure an attempt to cater to investors with different preferences as in Allen and Gale (1988): all our investors are risk neutral. The capital contribution allows the principal to provide the needed incentives more cheaply to new operators when they do take over. In short, optimally, the back-up agent must be part of the original capital structure.

We also consider the case of different senior investors (principals) competing for the services of back-up managers. In that case, having managers commit capital at inception becomes optimal for the entire parameter space. Early capital commitments by skilled operators not only help the principal mitigate moral hazard problems more cheaply, they also help deter other principals from poaching the operating capabilities of other projects' managers.

In light of these results, contracts that contain a blend of upfront capital and the provision of back-up human capital should be especially common in industries where premature project termination is costly and where moral hazard issues are significant. One industry that fits that description is Commercial Real Estate (CRE). Most capital in CRE ventures is provided by mortgage loans issued by banks and other financial intermediaries with little to no operating capacities. CRE owners and operators have superior information about the project's performance and a direct impact on that performance. Mortgage lenders' main tool to provide operators with the right incentives is the threat of foreclosure but mortgage laws make that solution highly onerous. In this context, our model would suggest that a back-up operator can create a lot of value from the point of view of senior lenders. And the evidence bears this out. In addition to a senior secured loan, many CRE ventures feature mezzanine financing. Mezzanine loans – as we document in this paper – are usually provided by skilled

[2] This holds even though we fully abstract from the practicalities associated with a search under time constraints. Those practicalities would only make an early commitment by the back-up operator even more valuable.

operators whose rights are protected not by specific assets but, instead, by foreclosure rights on a holding company. When the original operator fails to meet loan payments, mezzanine lenders have the right to become the owners and operators of the project. Unlike common senior and junior mortgages, the foreclosure rights of mezzanine debt are governed by the Uniform Commercial Code, which considerably eases administrative and resolution delays. Not surprisingly, mezzanine debt has replaced junior mortgages as the primary source of junior finance in commercial real estate (see e.g. Stein, 1997). The frequency of mezzanine finance in the typical CRE capital structure suggests that, in many instances, asset collateralization is not a sufficient condition to obtain financial capital. If senior creditors have no skills to run a complex project, and the pool of available substitute managers is not easy to locate, collateral can lose much of its value in the event of failure. When this is the case, trilateral contracts become indispensable.

Much more broadly, trilateral contracts structured along the lines suggested by our model exist in virtually every modern corporation. To see this, consider one of the most important responsibilities of the board of directors of a company: designing the succession plan for the CEO. This plan often includes back-up successors (often publicly identified) with the needed skills and in many cases with significant financial resources tied into the company by virtue of stocks and option plans. Sound corporate governance cannot dispense with well designed succession plans which mimic the nature of the trilateral arrangements described in this paper.

Our model builds on the literature that emphasizes the complementarity between the provision of capital and managerial expertise. For example, Holmstrom and Tirole (1997) build a model where firms with low net worth feature junior financiers that help monitor the firm. In their model, like in ours, investors with skills have capacity limits and cannot invest in all firms. Whereas Holmstrom and Tirole focus on monitoring skills, junior financiers in our model provide back-up managerial skills.

Repullo and Suarez (2004) analyze the case of a project that requires the simultaneous effort of an entrepreneur and the advice of a venture capitalist. With unobservable effort and advice, double moral hazard shapes the design of the venture capital contract. Casamatta (2003) analyzes the optimal capital structure when the efforts of the venture capitalist and the entrepreneur are substitutes. While these models deal with the problem of security design when entrepreneurs and capitalists with different preferences and information work together in a team, in our model the capitalist does not interfere at all as long as the operator/entrepreneur performs satisfactorily. Our focus is on the optimal contract for a capitalist that resorts to a backup replacement to the operator/entrepreneur to ensure that continuation occurs with minimal disruption.

A lack of seamless continuation (or effective liquidation) is particularly costly in complex projects. Complex projects involve a multitude of different interconnected tasks and activities that need to be managed with a high level of technical precision, accomplished under tight deadlines and in a changing and often ambiguous environment.[3] In such projects the managerial skills of the entrepreneur/manager are most important for success. Having an effective manager is critical, and although there are methods for assessing the manager's quality, these methods are far from perfect.

When the human capital of the operator is a key ingredient in the generation of earnings and when it is difficult to search and find replacements ex-post, the design of the capital structure must consider the parties' anticipation of a possible failure followed by the removal of the manager. Realistically, sourcing additional financial capital after significant underperformance presents great difficulty. After reporting poor earnings a more indebted firm faces the problem of debt overhang analyzed by Myers (1977) and the adverse selection problem studied in Myers and Majluf (1984). The way to circumvent ex-post contracting problems is to have a two-way commitment between the senior creditors and mezzanine investors: senior creditors agree not to collect debt and enforce liens (i.e., they commit to continue the project), and mezzanine investors commit to step in and run the project upon the removal of the designated manager by the senior creditors. The efficiency of the solution lies in the fact that with limited commitment, it is important to simplify or even avoid renegotiation and liquidation. With mezzanine finance, existing claimholders do not agree to restructure the debt after default; instead, they agree to "restructure" the management team and keep the senior debt virtually intact.

The rest of the paper is organized as follows. Section 2 introduces the contractual problem. Section 3 defines bilateral contracts while section 4 characterizes optimal bilateral arrangements. Section 5 explains why introducing a back-up manager generally improves principal surplus while section 6 provides conditions under which it is optimal for back-up agents to participate in the original capital structure. Section 7 shows that when principals compete for the services of back-up agents, early commitments of capital by these agents become even more necessary. Section 8 applies our model to the context of commercial real estate projects where the use of mezzanine finance is pervasive. Section 9 concludes the paper.

[3]See Regmington and Pollack (2008).

2 The environment

Consider a world with three dates $t = 0, 1, 2$ hence two periods, three agents, and a risky investment project that must be activated at date 0 in order to be productive. Agents 1 and 2 have an endowment $\epsilon \geq 0$ of the unique good at date 0 while agent P, the principal, has a unit endowment of the same good at date 0. All agents can store their endowment and earn a risk-free gross return $R \geq 0$ at date 2.

The risky project requires an investment of one unit of the good at date 0 and needs to be operated either by agent 1 or by agent 2 in order to generate some output with positive probability. Agent P, on the other hand, cannot run the project. The project can be continued at date 1 at no additional capital cost but it can also be scrapped at that point for deterministic value S. Because we think of this value as including any and all transaction costs associated with early termination, S could be negative and all our results allow for this possibility.

If activated and operated by agent 1, the project yields $y_L = 0$ if the project fails at date 1 or, if successful, positive output $y_H > 0$. The same process governs project output at date 2 provided it hasn't been scrapped. Payoffs are i.i.d across periods and we let π be the time-invariant probability of success in a given period.

When operated by agent 2 instead of agent 1, the project yields θy_H instead of y_H when the project is successful, where $\theta \in [0, 1]$ to allow for the possibility that the two agents have different productivity. One interpretation for productivity differences is that the project is an idea that occurred to agent 1 and which agent 2 needs time to learn. Alternatively, it may be that transferring the operations and property rights from agent 1 to agent 2 consumes resources and adds costs that reduce the profitability of the project under agent 2.

Agents 1 and 2 have an outside option that generates utility $V_O \geq 0$ in any period where they are not operating the project. All agents have linear preferences and do not discount the future.

Contracting between agents, which is described in details in the next section, is limited by several fundamental frictions. First and foremost, only the agent who operates the project observes its output. In addition, the operator has the option to consume output unbeknownst to anyone, at a proportional cost $\phi \in [0, 1]$. In other words, when he chooses to secretly consume part y of the project's output in any period he enjoys a payoff $(1 - \phi)y$. The cost proxies for the time and resources the operating agent has to spend in diverting funds.

Holmstrom and Tirole (1997) propose a theory for the essentiality of junior financing where the providers of junior finance directly mitigate moral hazard issues, i.e., in the context of our model, make the cost ϕ of embezzlement higher. Our paper is also based on the idea of expert capital, but our financiers bring contingent operating skills to the table rather than ongoing monitoring skills.

The final friction is that agent 1 cannot commit ex-ante to operating the project at date 2 hence he must expect at least $V_O \geq 0$ in remaining payoff from any arrangement in order for the project to survive past date 1. The principal, for her part, can commit to any two-period arrangements.

If $\epsilon \geq 1$ agent 1 can operate the project alone and, in fact, it is optimal for him to do so. To focus on the more interesting case where the principal's contribution is needed, we assume throughout that $2\epsilon < 1$ so that even if they team-up and cooperate, the two agents cannot fund the project without the principal.

3 Bilateral contracts

Let's assume first that the principal can only enter into a contract with one agent and gets to make a take it or leave it offer to that one agent. Since the two agents are identical except for the operating skills, the principal is at least weakly better off dealing with agent 1 than with agent 2, strictly so if $\theta < 1$. Because the principal cannot observe output directly, she must rely on reports from the agent. A standard appeal to the revelation principle tells us that we can concentrate our attention on direct revelation contracts without any loss of generality. Formally, a bilateral contract is the following list of objects:

1. An amount $k_1 \leq \epsilon$ of capital contributed by agent 1 and an amount $k_P \leq 1$ of capital contributed by the principal;

2. A payment schedule $\{w(h) \geq 0\}$ from the principal to agent 1 for all possible histories h of cash-flow messages at dates 1 and 2;

3. Scrapping probabilities $s(0)$, $s(y_H)$ that depend on the two possible output realizations in period 1.

Let $\mathcal{C}$ be the space of contracts $C = \{k_1, k_P, \{w(h) \geq 0\}, s\}$ so defined. Note that we require all payments to the agent to be non-negative. This amounts to assuming that all capital contributions to the project by the agent are made at date 0, which is without loss of generality since both parties are equally patient and the principal has the ability to commit to any payment arrangement, including the exchange of actuarially fair intertemporal transfers. The key observation here, and it will play a role in our main arguments below, is that the agents have finite resources and any monetary punishment is bounded above by the present value of these resources.

If $k_1 + k_P < 1$ then the project does not get off the ground and we will impose that in that case all payments to the agent are zero. Given a contract $C \in \mathcal{C}$ such that $k_1 + k_P \geq 1$, i.e. such that the principal does choose to activate the project, let:

$$V_2(y) = (1 - s(y))\left[\pi w(y, y_H) + (1 - \pi) w(y, 0)\right] + s(y) V_0$$

denote the utility promised to the agent as of date 2 when output message $y \in \{0, y_H\}$ is issued at date 1. The payment to agent 1 may depend on the two output messages received by date 2. This expression for V_2 reflects the fact that if agent 1 does not operate the project, he enjoys his outside option, and nothing more.[4] For the agent to participate, we need:

$$2V_O + k_1 R \leq \pi\left[w(y_H) + V_2(y_H)\right] + (1 - \pi)\left[w(0) + V_2(0)\right], \tag{3.1}$$

where, as stated in our definition of a contract, $w(y)$ is the payment to the agent at date 1 and depends on the first message $y \in \{0, y_H\}$. For direct revelation to be incentive compatible, we need:

$$w(y_H) + V_2(y_H) \geq w(0) + V_2(0) + (1 - \phi) y_H. \tag{3.2}$$

Indeed, the agent has the option to lie and divert output, hence he must be rewarded for telling the truth. When the project is continued with positive probability in period 2, i.e. for all $y \in \{0, y_H\}$ such that $s(y) < 1$, remaining expected payoffs must once again meet participation constraints:

$$V_O \leq V_2^c(y) \tag{3.3}$$

and incentive compatibility constraints

$$V_2^c(y_H) \geq V_2^c(0) + (1 - \phi) y_H \tag{3.4}$$

where for $y \in \{0, y_H\}$,

$$V_2^c(y) = \pi w(y, y_H) + (1 - \pi) w(y, 0)$$

[4] This is without loss of generality. Any post-scrap payment can be folded into $w(0)$.

is the payoff to agent 1 given continuation.

Finally the principal's net payoff associated with the specific contract

$$C = \{k_{1,}k_P, \{w(h) \geq 0\}, s\} \in \mathcal{C}$$

is, in long form:

$$\begin{aligned} W(C) = \pi\left[(y_H + s(y_H)S - w(y_H)\right] &+ (1-\pi)\left[0 + s(0)S - w(0)\right] \\ +(1-\pi)^2(1-s(0))[0 - w(0,0)] &+ \pi(1-\pi)(1-s(y_H))[0 - w(y_H, 0)] \\ +\pi^2(1-s(y_H))\left[y_H - w(y_H, y_H)\right] &+ (1-\pi)\pi(1-s(0))\left[y_H - w(0, y_H)\right] \\ &- k_P R \end{aligned}$$

The first six terms of the above expression correspond to each of the six possible nodes at which the contract calls for a message from the agent to the principal and are weighted by the corresponding probabilities. For concreteness, we will focus our attention on a specific part of the Pareto set, namely feasible contracts that maximize the principal's payoff *ex-ante* where we call a contract feasible if it satisfies conditions $(3.1 - 3.4)$. We now turn to characterizing those optimal bilateral contracts.

4 Optimal bilateral arrangements

Maximizing the principal's objective is best done recursively. To that end, assume that the project hasn't been scrapped at date 1 and that the operator enters the final period with promised utility $V_2 \geq V_O$. Write the highest payoff the principal can generate as of date 2 given V_2 and if she commits to continuing the project as $W_2^c(V_2)$, where the superscript "c" emphasizes the fact that the payoff is conditional on continuation. This maximum conditional payoff solves:

$$W_2^c(V_2) = \max_{w_2^L, w_2^H} \pi(y_H - w_2^H) + (1-\pi)(-w_2^L)$$

subject to:

$$\pi w_2^H + (1-\pi)w_2^L = V_2 \text{ (promise keeping)},$$

$$w_2^H \geq w_2^L + (1-\phi)y_{H.} \text{ (truth telling)},$$

and

$$w_2^H, w_2^L \geq 0 \text{ (limited liability)},$$

where w_2^H and w_2^L respectively denote payments when the project succeeds and fails at date 2.

Note, critically, that we write the promise-keeping condition as a strict equality. In principle, the principal could always choose to deliver a higher date 2 payoff than any particular V_2. In fact, doing so may increase her own payoff ex-post as we will see below. But writing the promise as a strict equality recognizes that the principal has the ability to commit to inefficient promises and actions at date 2. As will become clear when we look at the ex-ante version of the problem, doing so can make it cheaper to provide the right incentives to the agent over the life of the arrangement.

The optimal solution to this second period problem is easy to describe. In terms of expected payoff, the agent is willing to trade a decrease in w_2^L of, say, $\delta > 0$ for an increase of $\frac{\pi}{1-\pi}\delta$ in w_2^H. The principal's payoff is, likewise, unchanged. But doing such transfers weakens the truth-telling constraint. It follows that, optimally, $w_2^L = 0$. This implies that $w_2^H = \frac{V_2}{\pi}$ is optimal if that turns out to be enough to meet the truth-telling constraint, i.e. provided

$$\frac{V_2}{\pi} \geq (1-\phi)y_H.$$

Otherwise, the feasible set is empty. This appears to suggest that if she wishes to continue the project, the principal cannot commit to delivering less than $\pi(1-\phi)y_H$ in terminal utility following period 1's announcement. But, in fact, she has a broader set of options.

Recall that the principal has the option to scrap the project for a payoff of S at the end of period 1. The associated value function is $W_2^S(V_2) = S + V_O - V_2$ since the principal gets S from scrapping the project but must pay $V_2 - V_O$ to the agent since he was promised V_2 but only gets V_O from his outside option. If $S + V_O \geq \pi\phi y_H$ then scrapping is always optimal at date 2. Henceforth, we will focus on the more interesting case where $S + V_O < \pi\phi y_H$, so that scrapping is ex-post inefficient. In that case, scrapping only makes sense if the principal has committed to deliver less than $\pi(1-\phi)y_H$ to the agent.

For $V_2 \in (V_O, \pi(1-\phi)y_H)$ it is optimal for the principal to randomize between scrapping and not scrapping. More precisely, in the closure of that interval, the optimal scrapping probability is:

$$s(V_2) = \frac{\pi(1-\phi)y_H - V_2}{\pi(1-\phi)y_H - V_O},$$

while it is zero everywhere else. The agent for his part gets a payoff of V_O if the project is scrapped but $\pi(1-\phi)y_H$ otherwise. As a result, the overall remaining payoff to the principal following the first output announcement is:

$$W_2(V_2) = s(V_2)S + (1 - s(V_2))W_2^c\left(\max\left\{V_{2,}\pi(1-\phi)y_H\right\}\right).$$

This value function is concave, strictly increasing in the range $[V_O, \pi(1-\phi)y_H]$ and thereafter strictly decreasing with a slope of -1, as depicted in figure 1.

This analysis also implies that if $\phi = 0$, it is not possible for the principal to profitably operate the project in the second period. In fact, and as pointed out in a different context by Bulow and Rogoff (1989), this would still be true in the two-period case, and the project could not possibly get off the ground if ϕ were zero. Some direct punishment of default is necessary to support debt contracts when the principal and the agent are equally patient.

Now consider the recursive formulation of the principal's maximization as of date 1 given a promised utility $V_1 \geq 2V_O$. Given the initial investment $k_P \geq 0$, the principal's maximal payoff solves:

$$W_1(V_1|k_P) = \max_{w_1^L, w_1^H, V_2^L, V_2^H} \pi\left[y_H - w_1^H + W_2(V_2^H)\right] + (1-\pi)\left[-w_1^L + W_2(V_2^L)\right] - k_P R$$

subject to:

$$\pi\left[w_1^H + V_2^H\right] + (1-\pi)\left[w_1^L + V_2^L\right] \geq V_1 \text{ (promise keeping)},$$

$$w_1^H + V_2^H \geq w_1^L + V_2^L + (1-\phi)y_H \text{ (truth telling)},$$

$$w_1^L, w_1^H \geq 0 \text{ (limited liability)},$$

and

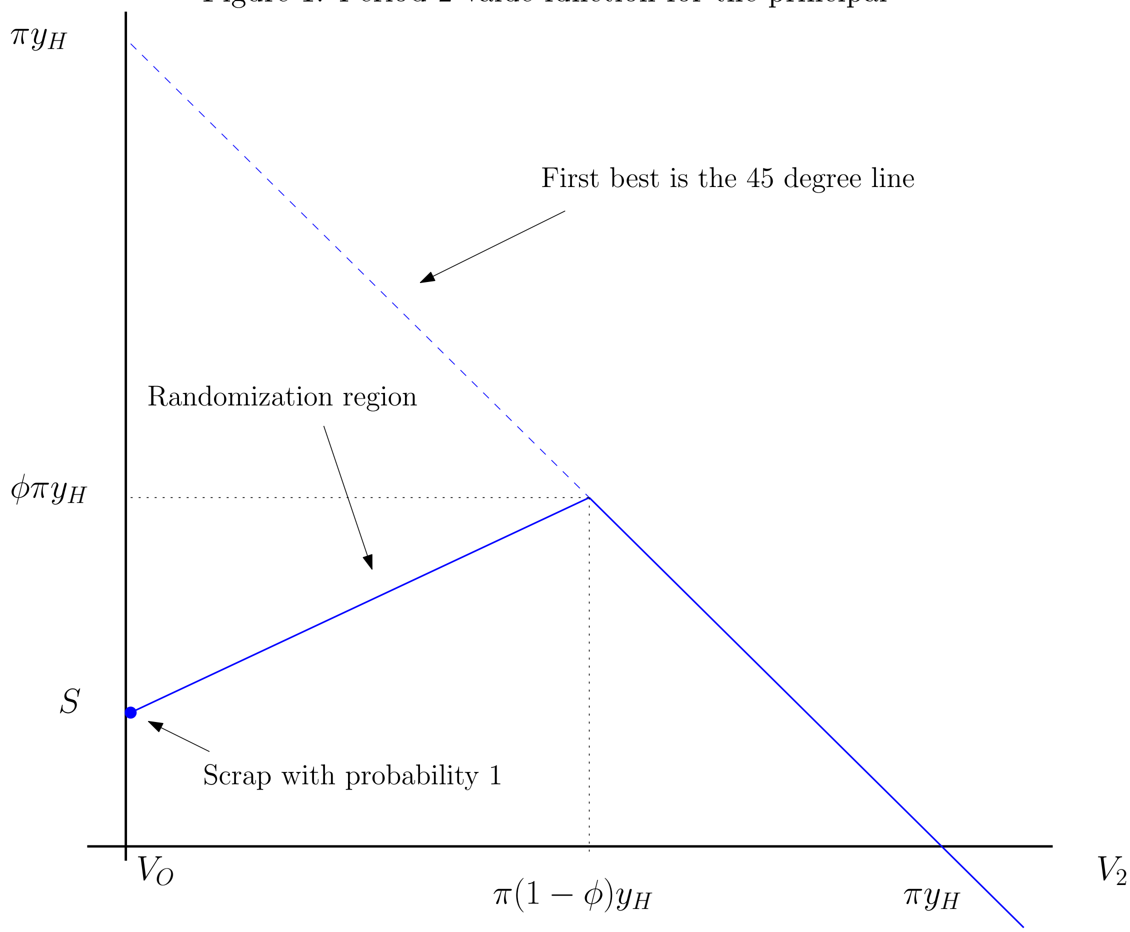
$$V_2^L, V_2^H \geq V_O \text{ (lower bound on agent payoff at date 2)},$$

where (w_1^L, w_1^H) are date 1 payments to the agent, while (V_2^L, V_2^H) are the payoffs the principal commits to deliver at date 2 as a function of whether the output realization is low or high in the first period.

Now assume that the project is continued (=not scrapped) with probability one, regardless of the earnings announcement, so that, in particular, $V_2^L \geq \pi(1-\phi)y_H$. Truth telling implies that

$$w_1^H + V_2^H > \pi(1-\phi)y_H + (1-\phi)y_H,$$

Figure 1: Period 2 value function for the principal



so that, in turn, the expected payoff of agent 1 must satisfy:

$$\pi\left[w_1^H + V_2^H\right] + (1-\pi)\left[w_1^L + V_2^L\right] \geq \pi(1-\phi)y_H + \pi(1-\phi)y_H.$$

To preview the nature of the general solution to the principal's problem, assume further that

$$V_0 = \epsilon = 0 \leq \pi(1-\phi)y_H + \pi(1-\phi)y_H$$

so that the agent needs only to be promised $V_1 = 0$ to participate. Then, given the inequality above, the principal's surplus under the policy of continuing no matter what earnings announcement is made is:

$$W_1^c(V_1 = 0|k_P = 1) = \pi y_H + \pi y_H - [\pi(1-\phi)y_H + \pi(1-\phi)y_H] - R. \tag{4.1}$$

One alternative policy is to scrap the project when a bad earnings announcement is made at date 1. The principal's highest surplus, in that case, is:

$$W_1^S(V_1 = 0|k_P = 1) = \pi y_H + \pi^2 y_H + (1-\pi)S - \pi(1-\phi)y_H - R. \tag{4.2}$$

To understand this expression note that if the principal commits to scrapping following a bad announcement, she can set $w_1^L = 0$, $V_2^L = V_O = 0$ and $s(0) = 1$ which means that truth telling only requires making $w_1^H + V_2^H = (1-\phi)y_H$. On the other hand of course, expected output is lower since the project is now scrapped following a bad message.

When π is sufficiently close to 1 so that committing to scrapping following a bad message is not too costly, the second policy dominates the first. The principal would commit to shutting down the project in period 2 even though that destroys value ex-post. Of course, these two polar policies are just two options the principal has at her disposal. She can also threaten the agent with scrapping with positive but not full probability. The following result provides a complete characterization of the bilateral contracts that maximize the principal's surplus.

Proposition 4.1. *The set of solutions to the principal's problem satisfies:*

1. *If and only if $W_1(V_1|1-\epsilon) < 0$ for all $V_1 \geq 2V_O + \epsilon R$ then the project is not funded, the principal simply stores the agent's contribution and the agent collects his outside option throughout;*

2. *Otherwise, a solution to the principal's problem exists such that* $k_1 = \epsilon$*,* $k_P = 1 - \epsilon$ *and* $V_1 = 2V_O + \epsilon R$*;*

3. *If and only if*

$$2V_O + \epsilon R < \pi(1-\phi)y_H + \pi(1-\phi)y_H$$

then all solutions satisfy $k_1 = \epsilon$ *and* $k_P = 1 - \epsilon$*;*

4. *The project is scrapped with positive probability if and only if*

   (a) $2V_O + \epsilon R < \pi(1-\phi)y_H + \pi(1-\phi)y_H$*, and,*

   (b) $\pi - (1-\pi)\frac{\phi\pi y_H - S}{\pi(1-\phi)y_H - V_O} > 0$ *.*

Proof. These results follow almost directly from the preceding discussion, with the exception of three important issues. First, the proposition states that it is at least weakly optimal for the agent to commit his endowments to the project. This is because the principal can always store that endowment at the same rate as the agents and, furthermore, the principal can time the return to that investment is such a way as to make it as cheap as possible to provide truth-telling incentives to the operator.

Second, why does $2V_o + \epsilon R < \pi(1-\phi)y_H + \pi(1-\phi)y_H$ imply that $k_1 = \epsilon$ is necessary? Optimally, the principal seeks to promise as little as possible to the agent. If the contract calls for a continuation with probability one, she must offer $\pi(1-\phi)y_H + \pi(1-\phi)y_H$ anyway hence the principal can claim the agent's endowment and offer him an effective return that exceeds storage. Since raising k_1 lowers k_P strictly, the principal's payoff is strictly higher.

If, on the other hand, the solution calls for scrapping with positive probability following a bad announcement then raising the agent's contribution allows for a one-for-one reduction in the principal's cost. The principal can deliver the additional ex-ante utility by raising V_2^H and V_2^L by the same amount. This, alone, would exactly offset the cost decrease in terms of the principal's payoff, but the increase in V_2^L results in a lower probability of scrapping, hence a higher total surplus, leaving the principal strictly better off.

Third, the final item of the proposition says that scrapping is never optimal if the agent expects a utility level in excess of what is needed to run the project twice without the incentive compatibility constraint ever binding. When, on the other hand, the participation threshold is low, in the sense made precise in condition (4a), threatening to scrap with positive probability is efficient when the slope of the randomization region is sufficiently shallow and the probability of a bad output realization in date 1 is sufficiently remote.

To see why it is so, note first that we can set $w_1^H = w_1^L = 0$ in period 1 without loss of generality since the agent and the principal discount the future at the same rate. Then recall that continuing the project no matter what requires $V_2^L \geq \pi(1-\phi)y_H$ and, in turn,

$$\pi\left[w_1^H + V_2^H\right] + (1-\pi)\left[w_1^L + V_2^L\right] \geq \pi(1-\phi)y_H + \pi(1-\phi)y_H.$$

This means that, given condition (4a), the participation constraint has slack. Hence, at the most, $V_2^L = \pi(1-\phi)y_H$ since the principal has no reason to go above that. But does she have an incentive to lower V_2^L further? Doing so enables the principal to lower both V_2^H and V_2^L without violating the incentive compatibility constraint. Furthermore, this raises $\pi W_2(V_2^H) + (1-\pi)W_2(V_2^L)$ strictly, as long as condition (4b) is met. Indeed, the left-hand derivative of W_2 is $\frac{\phi\pi y_H - S}{\pi(1-\phi)y_H - V_O}$ at $\pi(1-\phi)y_H$ while it is -1 at any $V_2 > \pi(1-\phi)y_H$. This completes the proof. □

Condition 3 of the proposition says that it is always optimal for the principal to require some skin-in-the-game on the part of the operator, strictly so when the incentive compatibility constraints bind with positive probability as the contract unfolds. When condition (4a) holds, some scrapping is always optimal when π is near one. The threat to scrap if a bad message is issued is cheap to include in the contract in that case, because bad messages are unlikely. When (4a) holds but (4b) doesn't, no scrapping ever occurs along the contract path, but the principal is constrained to leave some surplus on the table and allow the agent participation to be slack.

The back-up quarterback option – agent 2 on stand-by – we introduce in the next section will create value for the principal either by erasing the risk of scrapping when both (4a) and (4b) hold, or by removing the participation slack when (4a) holds but (4b) doesn't, as long as their operating skills are sufficiently high. In either case, the principal's expected payoff strictly rises. In particular, back-up operators create value for the principal even when the optimal bilateral contract makes scrapping a zero-probability event.

5 Back-up operators are essential

Following the previous section, having a ready-replacement on stand-by once the project is activated makes intuitive sense: it becomes cheaper for the principal to provide truth-telling incentives. To formalize this, define trilateral contracts as the following set of objects:

1. An amount $k_1 \leq \epsilon$ of capital contributed by agent 1, an amount $k_2 \leq \epsilon$ of capital contributed by agent 2, and an amount $k_P \leq 1$ of capital contributed by the principal;

2. An operator name $\{\kappa(h) \in \{1, 2\}\}$ for all possible histories h of messages at dates 0 and 1, with the convention that $h = \emptyset$ at date 0 and the understanding that if an agent is not called upon to operate the project in a particular period, he generates his outside option utility;

3. A payment schedule $\{w^j(h) \geq 0 : j = 1, 2\}$ for all possible histories h of cash flows at dates 1 and 2, and for each agent;

4. Scrapping probabilities $s(0)$, $s(y_H)$, depending on the two possible output announcements in period 1.

Given the bigger contract space, the principal's payoff can only increase. The question we take on in this section is whether trilateral contracts strictly dominate bilateral contracts. The bottom line is that they do in essentially all cases of interest provided agent 2 is sufficiently productive. Trilateral contracts strictly dominate bilateral contract unless incentive compatibility constraints are always slack at the optimal bilateral arrangement. In other words, unless there is effectively no moral hazard friction, trilateral contracts dominate bilateral contracts.

To establish this, observe first that the principal is always better off starting with agent 1 at the helm, since he is the most efficient operator. In addition, it is at least weakly optimal to set $k_1 = k_2 = \epsilon$, and uniquely so if an incentive compatibility may bind at some point in the contract. This capital commitment by both agents at date 1 is one of the key distinguishing features of our model, as we will emphasize below.

Let $V_1 = 2V_O + \epsilon R$ be the participation threshold of the two agents as of date 0. Having the second agent available affords the principal a new option, namely firing agent 1 at the end of date 1 if a bad announcement is issued and putting agent 2 in his place. One cost of doing so is that agent 2 is not as productive as agent 1 and therefore it is not surprising that our main result below shows that the gap in operating skills is a key determinant of whether trilateral contracts create value. For instance, if θ is such that $\phi\pi\theta y_H \leq S$ then involving agent 2 does not expand the set of options for the principal. More generally, expected output when the back-up option is used is

$$\pi y_H + \pi^2 y_H + (1 - \pi)\pi\theta y_H,$$

which is below the expected output $\pi y_H + \pi y_H$ the project generates when the principal commits to continuing the project with the initial operator regardless of the first message but, as long as $\pi\theta y_H > S$, exceeds the output the project generates when scrapping occurs following a bad message. The key result of this section is that as long as the incentive compatibility constraint binds with positive probability at the optimal bilateral constraint and θ is sufficiently close to 1, trilateral contracts dominate bilateral contracts.

Proposition 5.1. *The maximal payoff the principal can generate with a back-up operator in place - i.e. a trilateral contract - strictly exceeds all payoffs she can generate with bilateral contracts if and only if:*

1. $2V_O + \epsilon R < \pi(1-\phi)y_H + \pi(1-\phi)y_H$*, and*

2. θ *is sufficiently close to* 1.

Proof. As discussed in the previous section, when $2V_O + \epsilon R \geq \pi(1-\phi)y_H + \pi(1-\phi)y_H$ the principal can commit to let the project run for two periods, and incentive compatibility constraints have slack. In that case:

$$\begin{aligned} W_1^c(V_1|k_P = 1-\epsilon) &= \pi y_H + \pi y_H - [2V_O + \epsilon R] - (1-\epsilon)R \\ &= \pi y_H + \pi y_H - 2V_O - R, \end{aligned}$$

and that cannot be improved upon since whoever the operator is has to get at least the value of his outside option and the opportunity cost of his investment in the project, if any. Therefore, in that case, a back-up operator is not essential.

So consider now the case where

$$2V_O + \epsilon R < \pi(1-\phi)y_H + \pi(1-\phi)y_H. \tag{5.1}$$

We will show that the results holds for $\theta = 1$, an assumption we will maintain for the rest of the proof. That it remains true for θ sufficiently close to 1 follows directly from the continuity of the principal payoff in θ.

The above inequality implies $V_0 < \pi(1-\phi)y_H$. If the optimal bilateral contract features scrapping with positive probability then the principal can replace any scrapping with hiring agent 2 with an expected payoff of $\pi(1-\phi)y_H$ which gives the principal a net surplus of $\pi\phi y_H > S$ without changing any other aspect of the principal payoff. Having a back-up operator in place thus raises the principal's payoff strictly. This only leaves the case where at the optimal bilateral contract the principal commits to operating the project in period 2 regardless of the message received at date 1.

When the project is operated by the original agent throughout regardless of early performance and given (5.1), the principal's payoff is

$$\pi y_H + \pi y_H - [\pi(1-\phi)y_H + \pi(1-\phi)y_H] - (1-\epsilon)R. \tag{5.2}$$

We will consider two subcases. Assume first that $V_O + \epsilon R \geq \pi(1-\phi)y_H$ which is a possibility even when (5.1) holds. In that case, the principal can simply hire agent 1 for period 1 and promise him $V_O + \epsilon R$ in expected terms, then replace him in all cases by agent 2 at the start of period 2 and offer this second operator the same promise. This yields a total payoff of $\pi y_H + \pi y_H - 2V_O - R$ for the principal which exceeds (5.2) when condition (5.1) holds. This is in fact the maximal feasible payoff for the principal. In this case, the principal is able to write two separate one-period contracts in which the incentive compatibility constraint does not bind, hence moral hazard issues can be fully eliminated.

Assume now that $V_O + \epsilon R < \pi(1-\phi)y_H$. If the principal commits to replacing agent 1 with agent 2 if a bad message is issued at date 1, she can make $V^L = V_O$ following a bad message in period 1 and, as a result, satisfying the truth-telling constraint only requires making $w^H = 0$ and

$$V^H = (1-\phi)y_H + V_O.$$

Since

$$\pi V^H + (1-\pi)V^L = \pi(1-\phi)y_H + V_O > 2V_O + \epsilon R,$$

the participation constraint of agent 1 is met. When agent 2 is called upon to operate the property, which occurs with probability π, he can be promised $\pi(1-\phi)y_H$ against an investment of ϵ (as our next proposition will show, the planner could do even better by requiring a capital commitment before then) while otherwise they enjoy their outside utility plus the return from storing ϵ. From the point of view of the principal, the net payoff is

$$\pi y_H + \pi y_H - [\pi(1-\phi)y_H + \pi V_O + (1-\pi)\pi(1-\phi)y_H] - (1-\epsilon-(1-\pi)\epsilon)R$$

which exceeds (5.2) since $V_O < \pi(1-\phi)y_H$. This completes the proof. □

The proposition states that unless incentive compatibility constraints are never binding at the optimal bilateral contract, the principal is better off adding a back-up quarterback at date 0 provided the operating skills of the second agent are sufficiently high. When the best bilateral contract involves scrapping with positive probability, this should come as no surprise. Replacing all scrapping actions with activating agent 2 raises the principal's payoff as long as $S < \pi\phi y_H$.

But the proposition is much more general: adding agent 2 raises the principal's payoff even when the bilateral contract calls for no ex-post inefficient termination. Specifically, when

$$2V_O + \epsilon R < \pi(1-\phi)y_1 + \pi(1-\phi)y_1$$

but

$$\pi - (1-\pi)\frac{\phi\pi y_1 - S}{\pi(1-\phi)y_1 - V_o} < 0$$

the principal is constrained to leave agent 1 with an excessive share of surplus under bilateral arrangements. The threat of replacement by agent 2 enables the principal to make agent 1's participation constraint slack. Even when optimal bilateral contracts involve no inefficient termination hence maximize total surplus, having a back-up operator in place can transform negative-NPV projects from the principal's point of view into positive-NPV projects. The threat, of course, has to be credible, which brings in the requirement that agent 2's operating skills are sufficiently comparable to agent 1's.

6 Back-up operators in the capital structure

A critical question proposition 5.1 leaves unanswered is the timing of agent 2's involvement. Can the principal wait to discover whether a back-up operator will be needed after agent 1 fails, or is it essential that the second agent's capital contribution to the contract be made before that uncertainty is realized? One possible reason to wait until date 1 uncertainty is realized is that when the back-up operator is called upon and $V_O + \epsilon R < \pi\phi\theta y_H$, his participation constraint has slack and it seems, therefore, that the principal is needlessly giving up some surplus. But the key point of proposition 5.1 is that this dilution of surplus is lower than the surplus lost in a bilateral arrangement. And given that it is generically optimal to rely on back-up operators, it turns out to be efficient to front-load agent 2's commitment to the contract. Indeed, doing so enables the principal to allocate promised payoffs to agent

2 to when they are most needed. Formally,

Proposition 6.1. *If $\epsilon > 0$ then all contracts with a back-up operator involve $k_2 > 0$. Furthermore, if and only if*

$$V_O + \epsilon R < \pi(1 - \phi)y_H$$

then a strictly positive fraction of the capital commitment k_2 must take place BEFORE date 1 uncertainty is resolved.

Proof. A back-up operator is part of the optimal contract if and only if $2V_O+\epsilon R < \pi(1-\phi)y_H+\pi(1-\phi)y_H$. But this implies $V_O < \pi(1-\phi)y_H$. Should $k_2 = 0$ then agent 2's participation constraint has slack so that the principal can request a strictly positive commitment of capital from agent 2 at date 0 without changing any of the subsequent payoffs. If

$$V_O + \epsilon R < \pi(1 - \phi)y_H$$

then, even if they make $k_2 = \epsilon$ once uncertainty is resolved, the participation constraint still has slack. In that case, the principal is strictly better off requesting at least part of k_2 before uncertainty is resolved and exchanging those promises for a payoff $\pi(1-\phi)y_H - (V_O + \epsilon R)$ if and only if agent 2 is called upon. □

From the point of view of this argument there is a key distinction between the two elements of agent 2's outside option, V_O and ϵR. The principal would like agent 2 to commit both pieces early to the contract so that they can be allocated to the node where the participation constraint has slack. But the first part is inalienable and can't be transferred to the principal early on, whereas agent 2's endowment of capital can. The contract takes full advantage of that second portion.

It is possible – although unlikely – for $V_O + \epsilon R \geq \pi(1-\phi)y_H$ even when $2V_o + \epsilon R < \pi(1-\phi)y_H + \pi(1-\phi)y_H$. There are situations therefore where back-up operators are essential but no early commitment to the contract is needed. The next section, however, will show that when back-up operators can be poached, early commitments are a critical part of all optimal arrangements even in that parametric case.

Several interesting, testable implications for the optimal capital structure follow from the two propositions we have stated in this section.

Corollary 6.2. *The minimal contribution by the original owner to the project (that is the lowest k_1 in the set of optimal allocations) and the minimal contribution of capital by the* *back-up agent increases strictly with the project quality (π), and falls strictly with the value of the outside option (V_0) or the cost of misreporting (ϕ).*

Proof. Contributions by agents increase until either ϵ is exhausted or their incentive compatibility constraints do not bind anymore. The original operator's constraints cease to bind when

$$2V_O + \epsilon R \geq \pi(1-\phi)y_H + \pi(1-\phi)y_H$$

while for agent 2, this happens when $V_O + \epsilon R < \pi(1-\phi)y_H$. The result follows. □

Put another way, more reputable (higher ϕ) operators of the project need to provide less skin-in-the-game, which makes intuitive sense. Likewise, if operators expect more compensation, incentive compatibility constraints are less likely to bind. Less intuitive is the impact of project risk (π) on the skin-in-the-game requirement. To understand why safer project require more own equity injection in the optimal arrangement, note that it is only when the project is successful that incentives to be truthful must be provided. The safer the project, the more frequently the operator has an incentive to lie.

7 Co-investment by back-up operators as a buyout deterrent

We have shown how having a back-up operator in place can transform negative NPV projects into positive NPV projects. The switch does not come from altering the fundamental value of the projects but from limiting the discretion of the project's operator to make misleading reports to investors. Furthermore and when $V_O+\epsilon R < \pi(1-\phi)y_H$ it is strictly optimal to have the back-up operator invest some of his own capital in the project before knowing whether he will be called upon, because providing him with the right incentives becomes ex-ante cheaper for the principal.

The parametric restriction guarantees that the incentive compatibility constraint is binding once the back-up operator takes over, so that satisfying it implies that agent 2's participation constraint has slack. This section will argue that when there is a risk that agent 2 might be poached by other principals, a date 0 commitment becomes absolutely necessary in all optimal contracts, regardless of whether $V_O + \epsilon R < \pi(1-\phi)y_H$. The commitment of capital is a guarantee that the back-up agent will be available to take over when needed.

Why would such a commitment be necessary? When the option to work for several principal exists, there is a clear incentive for agent 2 to offer his services to more than one principal. Under the optimal trilateral contract, agent 2 only gets a potentially higher payoff when he is called upon. Multiplying contracts is a way for these agents to increase the odds that their services will be required, boosting their future expected payoff. If different projects fail in different states of the world, principals are not directly affected by this potential multiplication of commitments. In fact, to the extent that allowing agent 2 to enter into more than one contract weakens their participation threshold, principals would encourage such diversification by agent 2.

But a conflict between principals arises the moment different projects have risks that are not perfectly negatively correlated. To make this stark, assume that a second principal has found an agent identical to agent 1 – call him agent 1' – with the ability to operate an identical project so that, in particular, outcomes of the two projects at date 1 are perfectly correlated. Assume further that the second principal is given the option to make an offer to agent 2 after the first principal has offered a contract to agents 1 and 2. We will show that under those circumstances, the first principal will always require a positive commitment from agent 2 when the contract is signed.

Formally, we model this possibility as a sequential game involving the two principals and agent 2. Agent 1 and agent 1' accept any contract that gives them at least the value of their outside option, so their presence merely amounts to additional constraints on the two principals. For simplicity, we do not consider the possibility that the second principal could attempt to poach agent 1 for the purpose of having him serve in the role of back-up operator on the project run by agent 1'. One way to think of this is that agent 1 and agent 1' are tied up with their respective project, whereas agent 2 is endowed with some versatility and can operate either project although possibly not as productively as the two original operators. The same key results would emerge from a game where both agents 1 and 2 can be poached.

The poaching game we have in mind consists of four stages:

1. Principal 1 moves first and has the option to offer a contract with characteristics

$$(k_{11}, k_{12}, V_{11}, V_{12})$$

to agents 1 and 2 where (k_{11}, k_{12}) are the capital commitments required by principal 1 from agents 1 and 2, respectively, V_{11} is the expected payoff of agent 1 under principal

1's proposal, while V_{12} is the expected payoff of agent 2 if called upon following a project failure;[5]

2. Agent 2 decides whether to accept or reject the offer. Accepting implies making the required capital commitment to the project;

3. Principal 2 either offers a contract with characteristics$(k_{21'}, k_{22}, V_{21'}, V_{22})$ to agents 1' and 2, or makes no offer;

4. Agent 2 accepts or reject principal 2's offer. Once again, accepting means making the required capital commitment to the project;

Agent 2 does not have the ability to commit to showing up when called upon by principal 1, making room for poaching by principal 2. Commitments of capital to the contract, however, are irreversible.

The only parametric restriction we impose in this section and solely for concreteness is that no positive-NPV bilateral contract exists but that a positive trilateral contract does exist. The case where projects are viable even with one agent in place is not especially difficult to deal with, but it would require considering the possibility that principal 2 activates the project held by agent 1' with a bilateral contract. Ruling this out parametrically thus makes the exposition quicker.

Under the assumption that no bilateral contract has positive NPV, projects can be activated only if principals can secure the services of agent 2. This also means, as we argue below, that principal 1 offers a contract at stage 1 in all subgame perfect equilibrium of the game. Furthermore, and this is the key point we want to make in this section, the contract requires a minimum commitment of capital by agent 2.

Proposition 7.1. *All subgame perfect equilibrium of the poaching game described in steps 1-4 above are such that* $k_{12} \geq \frac{\epsilon}{2}$ *in the contract proposed by the first principal.*

Proof. If $\epsilon = 0$ the statement above holds trivially, so we will assume $\epsilon > 0$. In particular, agent 2 does have the ability to contribute a strictly positive amount to projects.

To begin the backward induction search for equilibrium, start with agent 2's last move, following the proposal at stage 3, if any, by principal 2. Agent 2's optimal strategy at that

[5] To economize on notation we do not list all the stipulations of the trilateral contract but only its key characteristics from the point of view of the upcoming argument.

node is to take the contract with the strictly highest payoff, if a contract happens to be available. From the point of view of agent 2, the contracts offered by either principals are two-dimensional objects: a request for a commitment of capital and a payoff if called upon to work as back-up operator. Without loss of generality, for the purpose of this proof, we can assume that any offer by principal 2 requires all the capital agent 2 has at this stage, since that is at least weakly optimal. In the case where two contracts are on the table – one from each principal – there are two possibilities. When the two payoffs are the same, agent 2 can assign any weight to either choice. When, on the other hand, one contract is strictly better ex-ante, agent 2 obviously selects the better contract. Selecting a contract at this stage means both making the required commitment, but also choosing which project to take over if failure occurs at date 1.

At stage 3, principal 2's contract choice set is constrained by the contract already on the table. Specifically, they can only ask for a commitment of $\epsilon - k_{12}$ from agent 2 when he has already committed k_2 to principal. In addition, principal 2 must offer at least the promise V_{12} made by principal 1 to agent 2 in the event of failure at date 1. Given this, if the contract offered by the first principal is such that no positive NPV can be generated by principal 2, principal 2 is better off offering no contract. In the event that a contract with exactly zero value is available, principal 2 can randomize between offering that contract and not. If a contract with strictly positive NPV exists, then principal 2 offers the best possible contract.

At stage 2, agent 2 must decide whether to accept the offer made by principal 1, and, in particular, commit the capital k_{12} requested by the first principal. If he turns down the offer, then the second principal will simply offer the trilateral contract described in the previous section which, since the principal is making a take-it-or-leave it offer at that time, cannot be better and is typically worse than the contract offered by principal 1. So we will simplify the analysis by immediately assuming that, at this second stage, agent 2 accepts any offer that satisfies their basic participation constraint.

This brings us to the node of interest: the initial contract offer by principal 1 at stage 1. One option on the table at this stage is to request all of agent 2's capital. If so, principal 1 forces principal 2 to work with no capital contribution from agent 2. Under this circumstance, let V_{22}^{max} be the maximum promise to agent 2 by principal 2, compatible with non-negative NPV to principal 2. If principal 1 offers $V_{12} < V_{22}^{max}$, the offer will be trumped by principal 2, since he can generate strictly positive NPV when stage 3 comes around. On the other hand, setting any $V_{12} > V_{22}^{max}$ secures agent 2's services by principal 1. What is more, since $\epsilon > 0$, for contracts with V_{12} sufficiently close to V_{22}^{max}, principal 1's contract, if accepted, generates strictly positive NPV for the principal. Indeed, if a promise of V_{22}^{max} to agent 2 leads to zero NPV with no commitment of capital, the same promise is associated with a strictly positive NPV and a strictly positive commitment of capital.

From these considerations it follows immediately that any subgame perfect equilibrium must feature an offer by principal 1 that is accepted with probability 1 by agent 2, and provides a way to construct one such equilibrium, establishing existence as a by-product.[6] There only remains to argue that none of the subgame perfect equilibria can be such that $k_{12} < \frac{\epsilon}{2}$. If such an offer was on the table and generated strictly positive NPV (again, we just argued that generating strictly positive NPV is possible for principal 1) then the same contract exists for principal 2, since at least the same capital commitment is feasible and, therefore, they would preempt principal 1's offer, which contradicts the fact that all equilibria must feature contract offers by principal 1 that are accepted. This completes the proof. □

Setting $k_{12} > \frac{\epsilon}{2}$ is necessary and sufficient for principal 1 to make sure that principal 2 will not preempt her offer. It may also be that all sequential equilibria feature $k_{12} = \epsilon$, but the conditions that guarantee this are exactly those discussed in the previous section, rather than the poaching frictions introduced in this section. The point we are making here is that when principals are competing, an early commitment of capital by agent 2 is necessary, regardless of whether $V_O + \epsilon R < \pi(1 - \phi)y_H$, i.e regardless of whether their incentive compatibility constraint is expected to bind.

While this is not the main point of this section, the proof of this result also makes it clear that the expected payoff of back-up operators goes up when poaching is a possibility. Note in addition that a commitment of capital acts effectively as a binding buyout clause by making the poaching of skilled operators by competing employers more expensive.

8 An application to Commercial Real Estate

"If you've never owned and operated properties, you probably shouldn't be a mezzanine lender, because you're really not well positioned to take over properties."

[6] As is standard in sequential games where some action sets are continuous (the principals') while some (agent 2's) are discrete, it is also easy to argue that no equilibrium features mixing by agent 2 between contract offers that leave him indifferent. Mixing would cause a discontinuity in principal 1's payoff function and his best-response set would be empty. In all sequential equilibrium of this poaching game, agent 2 accepts principal 1's offer with probability 1.

Bruce Batkin, CEO of Terra Capital Partners.

Mezzanine finance is ubiquitous in commercial real estate in the United States where the typical capital structure involves a senior lender – often a large financial intermediary, pension fund or life insurance company – an entrepreneur and primary operator who provides the junior-most, common equity injection, and a mezzanine lender whose stake ranks between the senior lender and the owner. Mezzanine has become the primary form of intermediate (neither juniormost nor seniormost) finance in commercial real estate, and its growth has fast outpaced that of second mortgages or preferred equity.

This application section has three distinct objectives. First, we argue that commercial real estate transactions are a natural interpretation of our model since: 1) they feature significant asymmetric information such as unobservable effort on the part of the owner; 2) the foreclosure process that protects the senior claim is slow, onerous, prone to disputes and usually results in heavy losses for the lender; and 3) senior lenders tend to be institutions such as banks and insurance companies with limited expertise and operating capacities.

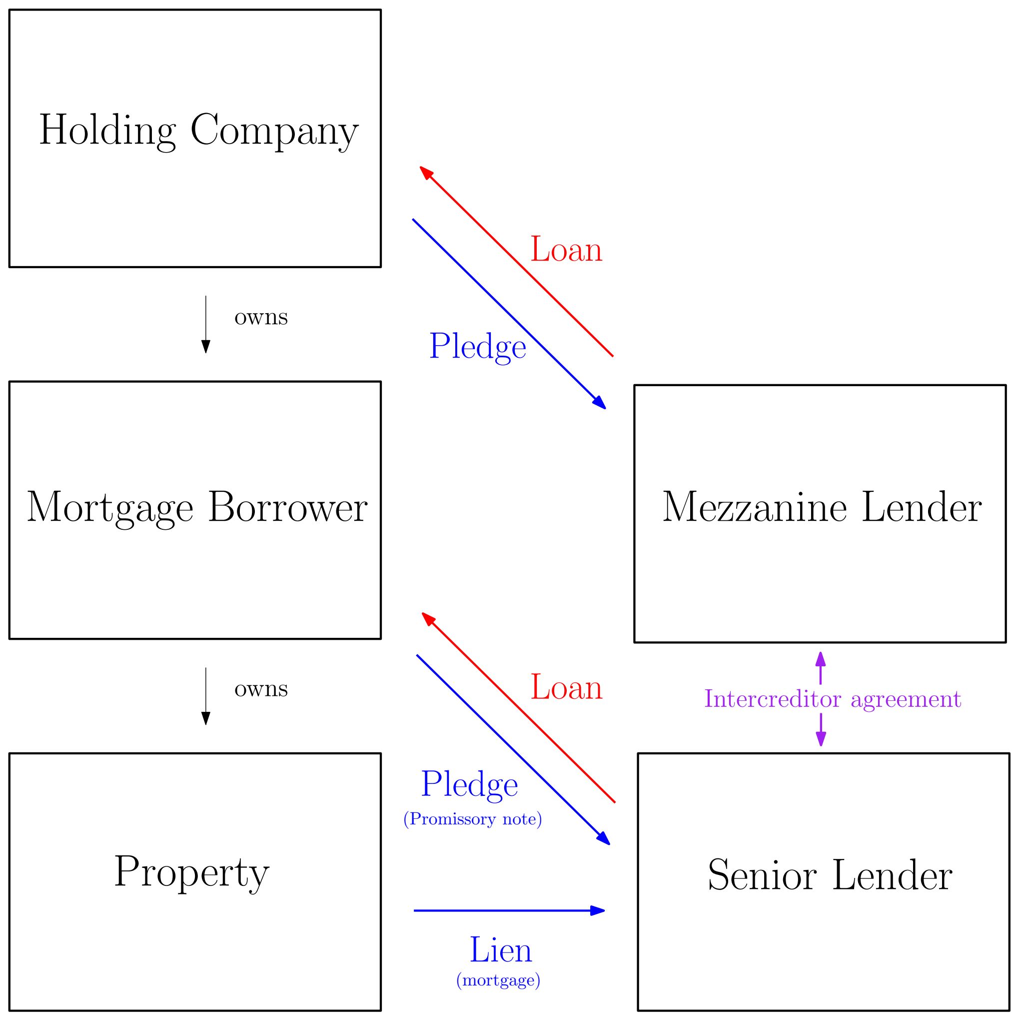
Second, we show that the most standard mezzanine contract in real estate is structured exactly according to how our model suggests it should be. The contract, in other words, implements the optimal trilateral arrangement that emanates from our model. In particular, it provides for the expeditious conversion to property ownership in the event of poor performance. This special feature is the key distinction between mezzanine and other intermediate finance options available in commercial real estate.

Third, we provide direct evidence that, unlike senior lenders, mezzanine finance is provided by real estate specialists with operating capabilities.

Figure 8 shows a schematic representation of a property purchase in real estate that involves mezzanine finance. Capital here comes from three different sources: equity from the mortgage borrower and owner of the property, a loan from a senior lender to the borrower and a mezzanine loan. Note that the mezzanine loan is issued not to the mortgage borrower but to a holding company that owns the mortgage borrower. The relation between the senior lender and the mortgage borrower is governed by two distinct documents. First, a promissory note stipulates loan payments and all subsidiary obligations of the borrower, such as commitments to keep the property in good shape ("good repair clauses") or enter into insurance contracts for standard property hazards. Default occurs when any of the contracting clauses is violated.

In the event of default, the promissory note contains acceleration clauses that give the

Figure 2: Mezzanine Finance in Commercial Real Estate



senior lender the right to demand the entire loan balance by initiating a foreclosure sale process. The foreclosure on commercial real estate collateral is governed by specific mortgage laws that differ across states, but typically provide for mandatory redemption periods and other borrower protections that make the acceleration process costly. As Gertler et. al. (2007, pp 398-99) discuss, it is not unusual for the foreclosure process to exceed one year, legal expenses alone can reach ten percent of the loan balance, and the borrower has limited incentives to spend on maintenance during the lengthy foreclosure process causing the property to deteriorate at a fast rate. These direct costs alone can amount to over thirty percent of the outstanding loan balance at the time of default.

Mezzanine contracts in real estate usually stipulate specific payment obligations but, unlike mortgages, they are secured not by the property but by an equity interest in the entity or holding company that owns the real estate.[7] One key implication is that the mezzanine lender's collateral is usually treated as personal property rather than a general tangible claim under the relevant law, which results in the mezzanine lenders taking possession of the collateral under article 8 of the Uniform Commercial Code, an action that is markedly more expeditious (the process usually takes a few weeks at the most) and less costly than foreclosures under state mortgage laws. Furthermore, an intercreditor agreement between mezzanine lenders and senior lenders typically and explicitly stipulates that in the event of payment difficulties, mezzanine lenders have the option to take over the property as long as they commit and manage to meet the remaining payments owed to senior lenders.

The efficiency of collateral repossession distinguishes mezzanine finance no just from senior mortgages but also from other forms of intermediate claims. For example, preferred equity owners do not have any foreclosure rights or specific collateral claims. In their case, recourse is so limited that promised dividend can be suspended by a vote of the board of directors without any risk that the holding company will be sued. Remedies for junior mortgage owners, for their part, fall under the same onerous mortgage laws as senior mortgages. Much worse from the viewpoint of senior lenders, junior lenders can trigger the highly costly foreclosure process when the borrower is delinquent regardless of the status of the first loan. Their presence further complicates and lengthens the default process and renders non-litigious dispute resolutions more difficult to achieve and subject to holdup problems.[8] From that point of view, mezzanine lenders are highly preferable since their foreclosure rights do not alter the

[7]See Berman, 2013, for a detailed discussion of the legal framework that governs mezzanine finance in real estate.

[8]See Stein, 1997, for a detailed discussion.

senior lenders' resolution rights in any way.

The junior mortgage alternative is typically not even available for senior lenders who want to sell their loans to securitizers. Precisely because of the associated risks for senior loans, rating agencies require additional subordination for senior tranches in collateral mortgage back securities (CMBS) pools of loans that are encumbered by second (junior) liens. Since securitizers seek to maximize the quantity of investment-grade securities they can extract from mortgage pools, the underwriting standards they impose on conduit lenders usually prohibit junior loans. Even banks who intend to maintain loans in their books want the option to sell the loans in the secondary market when the need arises hence must abide by those underwriting requirements. As a result, the volume of junior loans has fallen drastically since the mid-1990s in the United States. In sharp contrast and consistently with our model, underwriting standards for conduit loans usually do not prohibit mezzanine loans since their presence does not affect the collateral rights of senior lenders in a significant way.

Not surprisingly, and as Rubock (2007) has explained, as junior mortgage volumes have fallen, mezzanine volumes have risen. Whereas different mortgage liens interact and affect the value of each other's collateral claims, the foreclosure rights of mezzanine loans and senior loans do not intersect. As we discussed at length in the previous section, the presence of mezzanine loans actually protects the expected value of the senior loans in a number of fundamental ways.

The linchpin of our model is the fact that the optimal contract calls for intermediate-seniority claim-holders with the ability to operate the property if the original owner under-performs. As the quote above illustrates, operating capacities are in fact viewed as a *sine qua non* feature of mezzanine providers. To document this more systematically, we compiled a list of the most prominent private providers of mezzanine financing in the United States.[9] Since these are private corporations it is not possible to know for sure that the list contains all the largest private providers of mezzanine loans but conversations with top managers at prominent Mezzanine firms suggest that the list does in fact cover the immense majority of private mezzanine lending in the United States.[10]

The key question for us is whether these firms tend to have in-house or easy access to

[9] The set of publicly traded providers of mezzanine finance in real estate comprises mostly listed Real Estate Investment Trusts – REITs – and those obviously have operating capacities. In fact, by law, most REIT assets must be real estate assets the lion share of their income must come from real estate.

[10] We are especially grateful to Tom McCahill, Managing Principal for Mezzanine Finance at EverWest Real Estate Partners for his help in this respect.

Table 1: Prominent private mezzanine lenders in the United States

Firm	Real Estate specialist	Owns properties	Sponsors equity funds	Operating capacity	Top Management has operating background
AEW Capital Management	✓	✓	✓	✓	✓
Apollo Commercial	✓		✓		✓
ARC Realty Finance Trust	✓				✓
Ares	✓		✓		✓
Artemis Realty Capital	✓				✓
Clarion Partners	✓	✓	✓	✓	✓
Cornerstone Real Estate Advisers	✓	✓	✓	✓	✓
Dominion Mortgage Corporation	✓				✓
Everwest Real Estate Partners	✓	✓	✓	✓	✓
Federal Capital Partners	✓	✓	✓	✓	✓
George Smith Partners	✓				✓
Harbor Group	✓	✓	✓	✓	✓
Jefferies - LoanCare			✓		
KKR-Real Estate	✓	✓	✓		✓
Ladder Capital	✓				✓
LEM Capital	✓	✓	✓	✓	✓
Lowe Enterprises Investors	✓	✓	✓	✓	✓
Mack Real Estate Group	✓	✓		✓	✓
Mesa West Capital	✓				✓
NorthStar Realty Finance	✓	✓	✓	✓	✓
Pearlmark Real Estate Partners	✓	✓	✓	✓	✓
Related-Real Estate Fund Management	✓	✓	✓	✓	✓
Redwood-Kairos	✓	✓		✓	✓
Rockwood Capital	✓	✓	✓	✓	✓
Square Mile Capital Management	✓	✓	✓		✓
Stonebeck Capital	✓				✓
Starwood Property Trust	✓	✓	✓		✓
Strategic Realty Capital LLC	✓	✓	✓	✓	✓
Terra Capital Partners	✓				✓
Torchlight Investors	✓				✓
W Financial	✓				✓
Witkoff Group	✓	✓	✓	✓	✓
Wrightwood Financial	✓	✓			✓

operating capacities. To answer that question we searched through the documentation those private firms make available online for direct evidence that 1) they operate properties, 2) top management has some background in real estate operations, 3) they own properties directly, which implies that, at the very least, they have relationship with operating partners in place, 4) they manage equity funds which, again, implies ties with operators or, finally, 5) that they are Real Estate specialists, unlike the typical financial intermediary that provides senior funding. As table 1 shows, all mezzanine providers on our list are Real Estate specialists and all are managed by executives that have some experience in operations.[11] Most own properties directly or sponsor equity funds and majority of mezzanine lenders actually provide operating services to other investors. Mezzanine lenders, unlike senior lenders, are highly skilled investors.

9 Conclusion

This paper establishes an alternative to the threat of inefficient and unnecessary liquidation in a canonical bilateral financing problem. We focus on a solution that brings on board agents with the expertise to run the project in case the initial manager fails to perform. Optimally, these back-up managers must co-invest in the project and this contribution works as a commitment mechanism. Their presence increases the pledgeable income and facilitates the financing of the investment not only because it avoids costly liquidation but, as importantly, because it makes incentivizing existing operators cheaper. In short, funding complex projects is cheaper for senior lenders when back-up managers participate in the original capital structure.

Our analysis explicitly addresses the issue of moral hazard between investors and operators. It would be straightforward to analyze the case of adverse selection in an environment where entrepreneurs/owners market different "ideas" to creditors. In such an environment, junior financiers with operating skills may be called to perform an additional role, that of screening.[12] While we have abstracted from this friction in our analysis, it should be obvious that financiers with operational capabilities help mitigate both adverse selection and moral hazard problems.

This is the core idea of our paper: some stakeholders create value by providing skills in

[11] The online appendix provides specific documentation for each lender in the table. See http://erwan.marginalq.com/index_files/table.pdf.

[12] Of course, that analysis would have to take into account the fact that rating agents suffer from incentive problems as well, as the recent financial crises has shown. In February 2015, S&P agreed to pay $1.4 billion to settle charges that it issued inaccurate credit ratings on investments tied to mortgages between 2004 and 2007.

a delegated fashion to generalists stakeholders. It is then optimal to package those skills with financial capital. This provides a good explanation for the fact that mezzanine lenders often provide insignificant slivers of capital in a deal (it's not unusual for mezzanine funds to account for less than 5% of all capital.) What they bring to the table is their skills as much as if not more so than their capital.

We also believe that the idea of trilateral contracts can be useful in describing succession plans for senior officers in corporations, when it would be very expensive to find a new manager after the current manager fails or vanishes. Companies devote significant resources to properly train and prepare back up managers who remain on stand-by and ensure that they remain in the firms as long as they might be needed.

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