A Back-up Quarterback View of Mezzanine Finance

Antonio Mello
Wisconsin School of Business

Erwan Quintin*
Wisconsin School of Business

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Abstract

A significant number of real estate transactions involve the use of mezzanine finance. One obvious purpose of mezzanine debt is to plug financing gaps left by other forms of financing. In this paper, we formalize a complementary role of mezzanine finance in a simple model with moral hazard on the part of operators. According to our theory, mezzanine financiers serve as substitute operating agents -- back-up quarterbacks of sorts -- ready to replace the original operator when the project underperforms. The presence of skilled mezzanine investors in the capital structure makes it cheaper to provide incentives to incumbent operators.

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1 Introduction

"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." *Bruce Batkin, CEO of Terra Capital Partners.*

A significant number of real estate transactions involve the use of mezzanine finance. As documented for instance by Stein (1997) or Rubock (2007), mezzanine loans appear to have gained importance at the expense of junior mortgages in the United States over the past three decades, and were particularly popular during pre-crisis years. Mezzanine finance plays the key role of plugging a financial gap when funds available from mortgage lenders and operators' own equity are insufficient.

In this paper, we make the case that mezzanine finance also plays the complementary role of alleviating moral hazard frictions between senior lenders and operators. In the stylized theory we propose, mezzanine investors provide an optimal blend of capital and operating skills to commercial real estate investments. We model moral hazard as a hidden effort choice by property operators. To mitigate the resulting friction, senior lenders can threaten operators with a foreclosure when the property underperforms. Including mezzanine investors in the capital structure makes it cheaper to provide the necessary incentives to incumbent operators as long as those investors are sufficiently skilled. We show that it is also optimal to require a capital contribution from them because doing so gives these investors built-in skin-in-the-game when they take over operations.

In practice, mezzanine contracts are ideally suited to generate the desired incentives because, unlike traditional junior mortgages, they provide for the expeditious assumption of ownership rights by mezzanine lenders when incumbent owners are unable to meet their payment obligations. Second, as we document in this paper, mezzanine investors tend to be skilled real estate specialists. These features motivate the view of mezzanine finance we develop in this paper.

The complementarity between the provision of capital and managerial expertise has also been emphasized by Holmstrom and Tirole (1997) in a different context.[1] They build a model where firms with low net worth feature junior financiers that help monitor the firm. Whereas Holmstrom and Tirole focus on monitoring skills, our mezzanine investors provide back-up operating skills.

Our model also shares several features with the work of DeMarzo and Fishman (2007), DeMarzo and Sannikov (2006) and Biais et al. (2007). These papers combine the firm's choice of capital structure with a contract providing incentives for a manager to operate a project with the interests of the investors in mind. In DeMarzo and Fishman (2007) and DeMarzo and Sannikov (2006) 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 project after a sequence of bad earnings report. This occurs even though all parties clearly see that the manager's reports are genuine and liquidation is ex-post inefficient. Commercial real estate often features the key frictions that motivate this literature. In particular, mortgage laws afford borrowers myriad protections making the foreclosure process especially onerous. Our main point is that this makes for an environment where adding skilled operators to the capital structure is likely to be valuable.

DeMarzo and Fishman (2007, section 4) also consider the possibility of replacing the incumbent manager with a new manager, which makes the threat of termination renegotiation-proof in their environment. This same observation holds in our model, but we obtain different, additional results. First, making the back-up operator part of the contract before their services are needed is typically optimal. In other words, it is optimal for back-up operators to be part of the original capital structure. Second, back-up operators may be essential even when

[1]Hart and Moore (1994) also emphasize the inalienability of human capital provided by entrepreneurs as a key element of the optimal capital structure of a business venture.

optimal two-party contracts feature zero probability of termination. A better termination option can improve investors' surplus even in that case by reducing the slack in operators' participation constraints and thus contributes to the financial feasibility of the project.

In order to focus our theoretical analysis on incentive issues, we fully shut down practical issues associated with the supply of funds. In our simple model, the mezzanine investor's capital at inception is not motivated by the need to plug a financial gap. Senior lenders could finance the venture on their own. Neither is complicating the capital structure an attempt to cater to investors with different preferences as in Allen and Gale (1988): all investors in our setup are risk neutral. The capital contribution makes it cheaper to provide the right incentives to the stand-by operator if and when he takes over the project. Simply put, incentives, not capital shortages, justify the presence of mezzanine investors in the capital structure of the project in our model. We fully abstract from traditional rationales for junior financing not because we deem them unimportant – they obviously play the primary role in operators' interest in mezzanine finance. We do so to focus the analysis on the complementary role mezzanine finance plays in potentially mitigating moral hazard issues.

In practice, moral hazard frictions between senior lenders and operators are also mitigated by direct consequences of poor performance by the operator. First, when a property fails, operators' reputation suffer, which has negative consequences on the present value of their future income. For simplicity, we study the optimal contracting problem between operators and investors in a finite horizon model. This means that we can only incorporate reputational concerns in a reduced-form fashion by interpreting the private benefits associated with shirking as net of reputational consequences. Second, most commercial loans feature carve-out provisions which broaden the lender's recourse if various contract violations such as gross negligence or rent misappropriation can be documented. The critical assumption we make is that moral hazard frictions are not fully erased at the property levels by these considerations. This is more likely to be true for transactions considered more complex in commercial real estate such as those involving hotels or retail properties. Moral hazard is less likely to be a concern for more standardized transactions involving, say, apartments or warehouses.

The corporate finance literature contains many papers that study the role of junior financing in firm's capital structures. Among recent papers, Repullo and Suarez (2004) consider 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 manager performs satisfactorily. Our focus is on an optimal contract that purposely includes a backup manager to ensure both better pre-turnover performance and smooth continuation when turnover occurs. Roberts and Sufi (2009) and Rauh and Sufi (2010) show that firms tend to have elaborate capital structures, with different layers of debt and quasi-equity securities and find that riskier firms have more complex debt structures. Our model provides one broad reason for capital structure complexity, and does so while explaining the logic for mezzanine finance, an intermediate source of financial capital that is inalienable from the unique role human capital plays in the project.

Despite its growing importance, mezzanine finance has received surprisingly little attention to date in the real estate literature. As Pagliari (2017) explains, a likely reason for this gap is the lack of data on the volume and risk-return characteristics of mezzanine debt. Mezzanine debt typically trades privately and the fact that contracts are tailored to each set of investors (as our theory implies they should be) makes aggregation difficult even when the data is available. Growing demand from investors has led to the recent introduction of indices that track the performance of junior commercial real estate debt, including mezzanine loans (see, e.g., Giliberto, 2018).

As more data on mezzanine performance become available, we expect this gap in the literature to be quickly filled and view our contribution as a step in that direction. Our goal in this paper is to establish the potential role of skilled junior investors in mitigating moral hazard frictions in the simplest possible environment. To that end, we make a number of stark assumptions. A precise quantification of the importance of the mechanism we describe will require a much richer model, particularly a higher number of periods and cash-flow states.

The rest of the paper is organized as follows: Section 2 documents the distinguishing characteristics of mezzanine contracts and mezzanine investors in commercial real estate. Section 3 describes an environment that features the fundamental frictions that characterize commercial real estate transactions, namely moral hazard on the part of operators and costly termination options for senior lenders. Section 4 characterizes the optimal bilateral arrangement between senior lenders and operators. Section 5 establishes the essential role of mezzanine investors. Section 6 describes ways to implement the resulting optimal contract using financial arrangements that are standard in commercial real estate. Section 7 considers the case where senior lenders are in charge of designing contracts. Section 8 discusses the main testable implications of our theory. Section 9 concludes.

2 Mezzanine finance in commercial real estate

Commercial real estate (CRE) transactions feature moral hazard frictions such as unobservable effort on the part of owners and operators. In addition, the foreclosure process that protects the rights of senior lenders is slow, onerous, prone to disputes and usually results in heavy ex-post losses. Our primary point in this paper is that this combination of frictions create an environment where skilled, junior contributors to the capital structure may play an essential role beyond simply plugging a financial gap.

In real estate transactions, it is not uncommon for capital to come from three different sources: equity from a mortgage borrower and owner of the property, a loan from a senior lender to the borrower, and a mezzanine loan. Often, 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: a promissory note and a mortgage (or deed of trust). The promissory note stipulates loan payments and all subsidiary obligations of the borrower, such as commitments to keep the property in good shape 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 deed of trust contains acceleration clauses that give the senior lender the right to demand the entire loan balance by initiating a foreclosure sale process. Foreclosure on commercial real estate collateral is governed by 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 can be secured by an equity interest in the entity or holding company that owns the mortgage borrower.[2] One key implication is that the mezzanine lender's collateral is 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 is less costly than foreclosures under state mortgage laws. Furthermore, an intercreditor agreement between mezzanine lenders and senior lenders usually 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 not just from senior mortgages but also from other forms of intermediate claims. For example, preferred

[2]See Berman (2013) for a detailed discussion of the legal framework that governs mezzanine finance in real estate. Not all mezzanine contracts involve a holding company. Our point is that they can be structured in such a way that foreclosure is cheaper than for standard mortgage contracts.

equity owners do not have any foreclosure rights or specific collateral claims. In their case, recourse is so limited that a promised dividend can be suspended by a simple 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.[3] From that point of view, mezzanine lenders are preferable since their foreclosure rights do not alter the senior lenders' resolution rights in any way.

Precisely because of the associated risks for senior loans, rating agencies penalize the presence of subordinated debt such as second mortgages more heavily than they penalize the presence of mezzanine financing when rating first mortgages.[4] Not surprisingly, as junior mortgage volumes have fallen, mezzanine volumes have risen as the importance of mortgage-backed securitization has grown. Whereas different mortgage liens interact and affect the value of senior lenders' claims to collateral assets, the foreclosure rights of mezzanine loans and senior loans do not intersect.

In our model, the optimal contract calls for junior claim-holders with the ability to operate the property if the original owner underperforms. As the paper's opening quote illustrates, operating capacities are in fact viewed as a highly desirable feature of mezzanine finance providers. To document this more systematically, we compiled a list of the most prominent private providers of mezzanine financing in the United States.[5] Since these are private corporations it is not possible to know for sure that the list contains all the largest private providers

[3]See Stein (1997) for a detailed discussion.

[4]As Rubbock (2007) explains, "this reduced penalty [on mezzanine loans] became for lenders one incentive to cast additional leverage as mezzanine debt rather than as a B-note, so as to minimize the negative credit impact on the rated senior loan. CRE mezzanine debt placed into CRE CDOs increased from $25.6 million in 2004 to approximately $3.22 billion in 2006, and is on a dramatic upward swing."

[5]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.

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	✓	✓	✓	✓	✓
KKR-Real Estate	✓	✓	✓		✓
Ladder Capital	✓				✓
LEM Capital	✓	✓	✓	✓	✓
LoanCore Capital Markets	✓		✓		
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	✓	✓			✓

of mezzanine loans but conversations with top managers at prominent mezzanine firms suggest that the list does in fact cover the majority of private mezzanine lending in the United States.[6]

The key question for our purposes is whether these firms tend to have in-house or easy access to operating capacities. To answer that question we searched through the documentation those private firms make available online for direct evidence that 1) they are real estate specialists, unlike the typical financial intermediary that provides senior funding, 2) they own properties or 3) sponsor equity funds, which implies that, at the very least, they have relationships with operating partners, 4) they directly operate properties or, finally, 5) that they are managed by top executives that have some experience in operations.[7] As table 1 shows, all mezzanine providers on our list are real estate specialists and all but one are managed by executives that have some experience in operations. Most own properties directly or sponsor equity funds and a majority of mezzanine lenders actually provide operating services to other investors. The bottom line is that mezzanine lenders are highly skilled investors, as our model predicts they should be.

3 The environment

We consider an environment where, as is the case in complex commercial real estate transactions, 1) invoking foreclosure rights is costly for senior lenders and, 2) there are agency frictions between operators and capital providers. To capture those frictions in a parsimonious fashion, consider an economy with three dates $t = 0, 1, 2$. A property can be built or purchased at date 0 at a capital cost we normalize to one unit of the unique good.

There are two potential operators for the property each endowed with a quantity $\omega < \frac{1}{2}$ of the unique good at date 0. Because $2\omega < 1$, operators cannot finance the purchase without

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

[7] The online appendix (available for download at (blinded)
provides specific documentation for each lender in the table.

outside financing even it they pool their resources. The economy contains a risk-neutral agent with deep pockets – the senior lender, henceforth – who can provide the needed financing.

In each period, the operator in charge of the property has the option to shirk in which case he enjoys a private benefit η but the property generates no rental income. One interpretation of this private benefit could be that at date 1 and at date 2, operators receive a high-value outside offer with positive probability and that unless operators can be dissuaded from devoting time to that outside activity, the odds of locating a tenant or enforcing rents are low. A mathematically equivalent interpretation is that operator may have the opportunity to divert rents at a cost.

In practice, moral hazard concerns are mitigated by direct costs to the operator such as the reputational consequences of failure and the potential application of carve-out provisions. We think of η as benefits net of those costs. The critical assumption we make is that moral hazard frictions are not fully erased by there direct costs. Assuming that rental income is zero when the operator shirks is a mere normalization, our results only require that rental income be lower when the operator shirks.

When operator 1 is in charge and does not shirk, the property generates net rental income $R > 0$ with probability π and no income otherwise, say because he failed to find a suitable tenant. If $\eta > \pi R$ incentives not to shirk cannot be profitably delivered to the operator. We will assume throughout this paper that the opposite condition holds.

The second operator also has the ability to run the property but may not be as efficient as operator 1 at generating net rental income. For one interpretation of this gap in productivity, it may be that operator 2 is less familiar with local market conditions and less well-connected than operator 1. Formally, when operator 2 is at the helm and he does not shirk, the project yields θR instead of R when successful, where $\theta \in [0, 1]$. One could instead model operator heterogeneity as differences in success rates or in shirking benefits without affecting our key findings. When they do not operate the property, the expected value of the best alternative use of each operator's time is $V_o \geq 0$ in each period.[8]

[8]In the interpretation of the private benefit of shirking as the arrival in a given period of a high-value

After rents are observed at date 1 the property can be sold or repurposed for a net value of S. We will assume

$$S < \pi R - \eta$$

which implies that early termination is always ex-post inefficient. One reason S may be low is that senior lenders lack the operating skills to operate the property themselves, which is likely to be the case in practice for complex projects involving, say, hotels or retail properties, as opposed to more standardized transactions involving multi-family or industrial properties. But we also think of S as including any and all transaction costs associated with the foreclosure process. In fact, S may well be negative in some cases for senior lenders and all our results allow for this possibility.

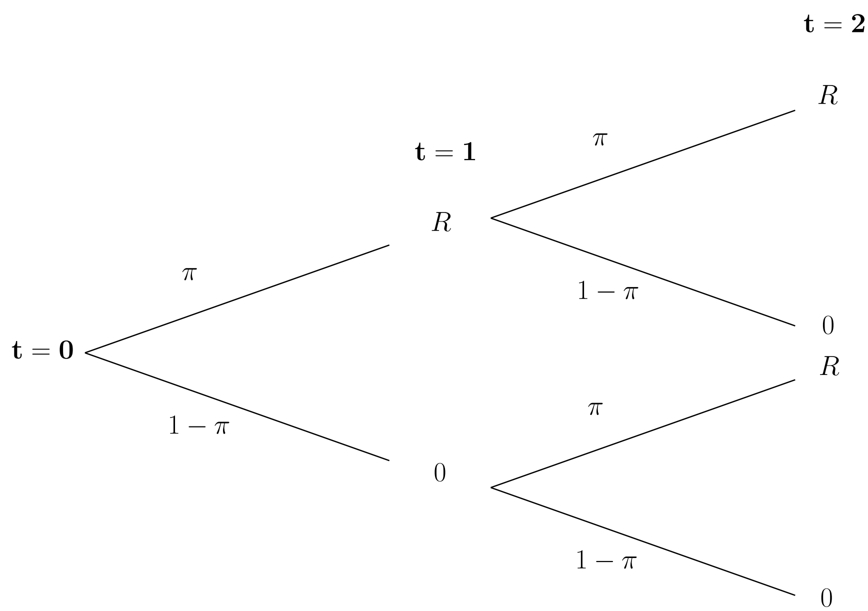
If the property remains managed by operator 1 at date 2 and operator 1 does not shirk, it once again yields rents R with probability π when effort is exerted, and nothing otherwise. Rent outcomes are i.i.d across periods, although no result of substance would change if property performance was correlated across periods. Figure 1 summarizes the pattern of cash-flows under the assumption that the property is operated in both periods by operator 1. This project structure results in two possible histories of cash flows at date 1 and four histories of cash-flows at date 2.

All agents have linear preferences and have access to a risk-free technology that earns net return $r \geq 0$ at date 2 on any storage investment made at date 0. In order to obtain the necessary financing from the senior lender, operators must offer her a contract which covers this opportunity cost in expected terms. To economize on notation, we assume that the intra-period storage return is zero so that agents do not discount date 2 payoffs relative to date 1 payoffs.

Operators cannot commit ex-ante to managing the project at date 2 hence they must

outside offer with some probability p, one can set $\eta = V_o + \epsilon_H$. With probability $(1-p)$ the value of the operator's outside option at that time is only $\eta_L = V_o - \epsilon_L$. Then impose $\epsilon_H = \frac{(1-p)\epsilon_L}{p} > 0$ so that $V_0 = p\eta + (1-p)\eta_L$ and $\eta > V_0$. Parameters can then be selected so that unless operators pass on pursuing the high-value offer, the property cannot be profitable.

Figure 1: Property cash-flows when managed at full effort by operator 1



expect at least the value $V_o \geq 0$ of their outside option in remaining payoff from any arrangement. Lenders, for their part, can commit to any two-period arrangements, including ex-post inefficient actions if needed.

4 Optimal two-party contracts

Consider first the case in which operator 2 is not available, so that operator 1 and the senior lender must contract exclusively with one another. A two-party contract must stipulate a mortgage loan $m \leq 1$ contributed by the senior lender and an amount $e_1 = 1 - m \leq \omega$ of equity contributed by the operator. Second, it must specify a mortgage payment schedule $\{q(h) \leq R\}$ for all possible histories h of rents at dates 1 and 2. Finally, the contract states termination probabilities $(\tau(0),\ \tau(R))$ that depend on the two possible rent realizations at

Table 2: Timing of two-party contract

$t = 0$	$t = 1$	$t = 2$
• Operator 1 pays $e_1 \leq \omega$ • Senior lender pays $m = 1 - e_1$ • Property is purchased	• Operator makes effort choice • Rental income $y_1 \in \{0, R\}$ is realized • Operator pays $q(y_1) \leq R$ to lender • Property is shut down with probability $\tau(y_1)$	If property is still in operation: • Operator makes effort choice • Rental income $y_2 \in \{0, R\}$ is realized • Operator pays $q(y_1, y_2) \leq R$ to lender • Investment project ends

date 1. Table 2 summarizes the sequence of events associated with two-party contracts.

While we refer to the financing contributed by the senior lender as a mortgage and we refer to the operator's share as equity, those labels are purely mnemonic at this level of generality. The contract above is fully general in that it stipulates transfers between the contracting parties at each of the six nodes of the cash-flow tree displayed in figure 1. We will discuss implementation more carefully in section 8.[9]

Formally, termination is an action selected by the lender. The operator may choose/agree to include acceleration/termination clauses in the contract he proposes because their presence optimally mitigates moral hazard frictions hence make it easier to satisfy the lender's participation constraint. Because the lender cannot observe effort directly, she may need to rely on the threat of termination to provide the needed incentives.

We require mortgage payments to be below rents which is equivalent to assuming that all capital contributions to the project by the operator are made at date 0. This is without loss of generality since both parties are equally patient and the lender has the ability to commit to any payment arrangement, including the exchange of actuarially fair intertemporal transfers. Given a contract, let

[9] In effect, the contract features an acceleration clause which says that if the operator is unable to make mortgage payment $q(R)$, the senior lender then has the right to request that the property be sold. The termination process is therefore triggered by failure to pay on the part of the borrower, as is the case in practice. Typically, at the optimal contract, it will turn out that $\tau(0) < 1$ so that failure to pay is necessary but not sufficient to trigger termination.

$$V_2(y_1) = (1 - \tau(y_1))V_2^c(y_1) + \tau(y_1)V_0$$

denote the utility expected by the operator as of date 2 when rental income $y_1 \in \{0, R\}$ is generated at date 1, where

$$V_2^c(y_1) = \pi(R - q(y_1, R)) + (1 - \pi)(0 - q(y_1, 0))$$

is the operator's expected payoff in period 2 conditional on continuation and no shirking.

The mortgage payment at date 2 may depend on the two rent realizations observed by the senior lender by that time. The expression for V_2 reflects the fact that if the operator does not manage the property, he enjoys his outside option, and nothing more. Turning now to the onset of the project, the value of the contract to operator 1 is:

$$V_1 = \pi \left[R - q(R) + V_2(R)\right] + (1 - \pi)\left[0 - q(0) + V_2(0)\right] + (\omega - e)(1 + r), \tag{4.1}$$

where $q(y_1)$ is the mortgage payment at date 1 and depends on the first realization $y_1 \in \{0, R\}$ of rents. Operator 1's objective is to make V_1 as high as possible subject to incentive compatibility (no shirking) and the fact that the contract must cover the senior lender's opportunity cost.

For incentive compatibility at date 1, we need:

$$\begin{aligned} \pi\left(R - q(R) + V_2(R)\right) + (1 - \pi)\left(-q(0) + V_2(0)\right) &\geq -q(0) + V_2(0) + \eta \\ \Longleftrightarrow \qquad R - q(R) + V_2(R) &\geq -q(0) + V_2(0) + \frac{\eta}{\pi} \end{aligned} \tag{4.2}$$

Indeed, if and only if effort is exerted by the operator the property generates positive rents with probability $\pi > 0$. But the operator can also choose to shirk in which case the property generates zero rental income almost surely.

Note that even if effort is performed, it remains possible (though a lower probability event) that the property fails. So the senior lender cannot fully distinguish bad luck from low effort simply by observing cash-flows. The optimal contract has to deliver a higher payoff when cash-flows are high to induce the operator to work towards raising the probability of success. Inside the optimal arrangement, the operator never shirks and bad performance is not their fault. But the lender must nonetheless commit to punishing the operator following a bad cash-flow realization to induce effort.

For all $y_1 \in \{0, R\}$ such that $\tau(y_1) < 1$, remaining expected payoffs when the property is continued at date 2 must meet participation constraints:

$$V_o \leq V_2^c(y), \tag{4.3}$$

and incentive compatibility constraints

$$R - q(y_1, R) \geq -q(y_1, 0) + \frac{\eta}{\pi}. \tag{4.4}$$

The senior lender's expected payoff, in long form, equals

$$W_1 = \pi \left[q(R) + \tau(R)S\right] + (1-\pi)\tau(0)S + \pi^2(1-\tau(R))q(R,R) + (1-\pi)\pi(1-\tau(0))q(0,R) - m(1+r).$$

The first four terms of the above expression correspond to each of the nodes at which the contract calls for a mortgage payment from the operator to the senior lender, and are weighted by the corresponding probabilities. Participation on the part of the senior lender boils down to

$$W_1 \geq 0. \tag{4.5}$$

The operator seeks to maximize his expected payoff subject to conditions (4.1−4.5). Since this amount to maximizing an objective (4.1) which varies continuously with contract terms over a compact set of feasible contracts, a solution to this problem exists. Let V^N be the resulting expected utility for the operator, where the superscript stands for no mezzanine. This value varies continuously with the set (R, π, η, r) of parameters that define our environment. In fact, it should be clear that V^N rises continuously with R and π but falls continuously as η or r rise. A profitable contract exists – hence an investment in the property is made – if and only if

$$V^N(R, \pi, \eta, r) \geq 2V_o + \omega(1 + r).$$

To characterize optimal contracts in details, we proceed recursively. Assume that the property was not scrapped at the end of date 1 and that, under the contract, the operator enters the final period with an expected utility level $V_2^c \geq V_o$. Given V_2^c, the maximum payoff the senior lender can expect is:

$$W_2^c(V_2^c) = \max_q \pi q$$

subject to:

$$\pi(R - q) = V_2^c \text{ (promise keeping)},$$

$$R - q \geq \frac{\eta}{\pi} \text{ (no shirking)},$$

and

$$q \leq R \text{ (limited liability)}.$$

In principle, the operator could attempt to build a contract that delivers more than V_2^c in expected utility as of date 2. But the senior lender has the ability to commit to any promises and actions at date 2. Contracts that commit the senior lender to potentially ex-post inefficient actions can make it cheaper to provide the right incentives to the operator over the life of the arrangement, as we will establish below. The operator may agree to stipulations which they know they would like to eventually renegotiate because doing so potentially makes the set of contracts that satisfy conditions $(4.1 - 4.5)$ larger. In fact, there may exist no contract that satisfy lender participation without termination at date 0, even though termination is ex-post inefficient.[10]

This statement of the second period problem anticipates on the fact that it is optimal for the senior lender not to make a transfer to the operator when the project fails. Making such a transfer would make it more costly to give the operator the incentives he needs to opt not to shirk. This immediately implies that $q = R - \frac{V_2^c}{\pi}$ is optimal provided this makes q low enough to meet the incentive compatibility constraint, which holds as long as

$$\frac{V_2^c}{\pi} \geq \frac{\eta}{\pi} \Longleftrightarrow V_2^c \geq \eta.$$

Otherwise, the feasible set is empty. This appears to imply that if he wishes to continue the project, the operator cannot propose contracts that delivers him less than η in remaining utility following period 1's rent announcement. But, in fact, he has a broader set of options.

To see this, let V_2 be the expected remaining value under the contract following the first period's rent realization but before a termination decision has been made. If the project is terminated at the end of period 1, the expected remaining value to the lender is

$$W_2^S(V_2) = S + V_o - V_2.$$

Indeed, the operator must receive a payoff of $V_2 - V_o$ since he expects V_2 under the contract but only gets V_o from his outside option. If $S + V_o \geq \pi R - \eta$ interruption is always optimal for both parties prior to date 2. Henceforth, we will focus on the more interesting case where $S + V_o < \pi R - \eta$, so that termination is ex-post inefficient. In that case, exercising the early termination option only makes sense if the contract delivers less than effort cost η to the operator after first-period rents are realized.

But how can a contract feasibly deliver the operator less than η in expected terms following

[10]In practice, this corresponds to financial institutions invoking their foreclosure rights even in cases where transaction costs are so high that renegotiation would clearly be the profitable option ex post. If operators know that foreclosure is too costly to be invoked ex post and without commitment, the threat of foreclosure has no effect on incentives. When moral hazard frictions are strong enough, commitment to ex post inefficient actions becomes the only option.

the first rent realization when that promise is the lowest possible promise consistent with incentive compatibility at date 2? The optimal solution is to randomize between termination and no termination when $V_2 \in (V_o, \eta)$. More precisely, in the closure of that interval, the optimal termination probability is:

$$\tau(V_2) = \frac{\eta - V_2}{\eta - V_o},$$

while it is zero everywhere else. The operator gets a payoff of V_o if the project is terminated but η otherwise.

As a result, for any $V_2 \geq V_o$, the operator's payoff conditional on continuation is

$$V_2^c = \max\{V_{2,}\eta\}$$

and the overall remaining payoff to the senior lender under the contract proposed by the operator and following the first output announcement is:

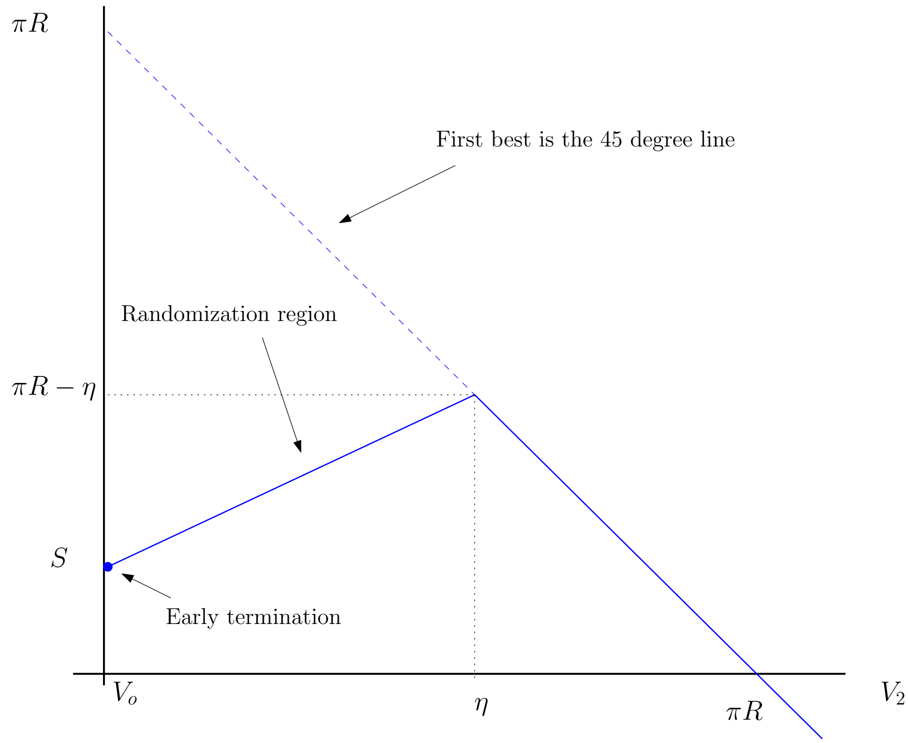
$$W_2(V_2) = \tau(V_2)S + (1 - \tau(V_2))W_2^c\left(\max\{V_{2,}\eta\}\right).$$

This value function is concave, strictly increasing in the range $[V_o, \eta]$ and thereafter strictly decreasing with a slope of -1, as drawn in figure 2. The fact that W_2 decreases in the range $[V_o, \eta]$ means that scrapping is ex-post inefficient. Yet, termination may well be part of the ex-ante optimal contract because threatening the operator with termination may be necessary to provide him with the right incentives in period 1.

Formally, consider the senior lender's expected value as of date 1 given an expected utility V_1 for the operator under the proposed contract. Given the initial investment $m \geq 0$, the senior lender's payoff is, at best:

$$W_1(V_1|m) = \max_{q, V_2^L, V_2^H} \pi\left[q + W_2(V_2^H)\right] + (1 - \pi)W_2(V_2^L) - m(1 + r)$$

Figure 2: Senior lender's remaining value function (W_2) following date 1's rent realization



subject to:

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

$$R - q + V_2^H \geq V_2^L + \frac{\eta}{\pi} \text{ (no shirking)},$$

$$q \leq R \text{ (limited liability)},$$

and

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

where (V_2^L, V_2^H) are the payoffs the contract delivers the operator at date 2, as a function of whether the output realization is low or high in the first period.

Given the nature of the no-shirking condition, it is optimal all else equal to make V_2^H as high as possible and V_2^L as small as possible. In particular, it cannot be optimal to make the probability of termination positive following a good rent realization at date 1. This would make the no-shirking condition harder to meet and would lower the objective function. It follows that if termination ever happens, it happens only when the property underperforms at date 1.

The following result provides a complete characterization of the two-party contracts that maximize the operator's surplus given the senior lender's participation constraint.

Proposition 4.1. *Optimal two-party contracts satisfy the following properties:*

1. *If and only if* $W_1(V_1|1-\omega) \geq 0$ *for some* $V_1 \geq 2V_o+\omega(1+r)$ *then the property is purchased and an optimal contract exists such that* $e = \omega$, $m = 1 - \omega$ *and* $W_1(V_1|1-\omega) = 0$*;*

2. *The contract is terminated with positive probability at date 1 if and only if*

$$V^N < 2\eta;$$

3. *If* $V^N < 2\eta$ *then all optimal contracts satisfy* $e = \omega$ *and* $m = 1 - \omega$*.*

Proof. It is at least weakly optimal for the operator to commit his endowment to the project since the senior lender can (if nothing else) store that endowment at the same rate as operators. The first item of the proposition follows. To establish the second item of the proposition, assume that $V^N < 2\eta$ but, by way of contradiction, that the probability of termination is zero. This requires that $V_2^L \geq \eta$. But truth telling then implies that

$$R - q + V_2^H > \eta + \frac{\eta}{\pi},$$

so that, in turn, the operator's expected payoff must satisfy:

$$V^N > \pi \left[R - q + V_2^H\right] + (1 - \pi)V_2^L \geq \eta + \eta,$$

which is the contradiction we sought. If on the other hand $V^N \geq 2\eta$ then the contract can deliver an expected payoff higher than η in both periods so that the project can be operated in both period without violating any incentive compatibility constraint.

To establish the final item simply note that if $V^N < 2\eta$ but that, by way of contradiction, $e < \omega$. A higher equity commitment could be required from the operator which would enable the contract to make V_2^L higher without lowering the senior lender's surplus. Since this lowers the probability of termination strictly without changing the senior lender's payoff, the operator's payoff must rise. □

To see that the case $V^N < 2\eta$ is possible, so that termination can be part of optimal two-party contracts, assume by way of example that $\omega = V_o = 0$. At expected payoff $V_1 = 2\eta$ for the operator, the senior lender's payoff is

$$\pi R + \pi R - 2\eta - (1 + r). \tag{4.6}$$

Indeed, the senior lender must provide all the needed financing but, on the other hand and as established in the previous proposition, the property can be operated with probability one in both periods since $V^N \geq 2\eta$ making gross expected surplus from operating the property equal to $\pi R + \pi R$.

Instead, a contract can always be written so that the property is shut down no matter what following a bad performance in period 1. The senior lender's surplus, in that case, is

$$\pi R + \pi^2 R + (1 - \pi)S - \eta - (1 + r). \tag{4.7}$$

To understand this expression, note that in that case the lender can set $V_2^L = 0$ so that no shirking in period one only requires setting

$$R - q(R) + V_2^H = \frac{\eta}{\pi} \tag{4.8}$$

which can be done by setting $q(R) = R$ and $V_2^H = \frac{\eta}{\pi}$. This level of V_2^H is enough to meet truth telling in the second period following success in period 2. Putting all this together implies that $V_1 = \eta$ at this alternative contract.

As long as π is sufficiently close to one, payoff (4.6) is lower than payoff (4.7). In fact, we can choose parameters so that payoff (4.6) is negative while payoff (4.7) is positive. In other words, incentive compatibility requires too high a payoff for the operator to be compatible with participation by the lender unless the threat of termination at date 1 is part of the contract. When π is close to one, that threat is cheap to invoke (little total surplus is destroyed in ex ante terms) but effective in discouraging shirking by the operator in period 1. When (4.6) is negative while (4.7) is positive, we must have $V^N \in [\eta, 2\eta)$ and, therefore, termination must be a positive probability event at the optimal contract.

5 Mezzanine contracts

Termination is an ex-post inefficient outcome which operators may make a part of the optimal contract because moral hazard frictions cannot be sufficiently mitigated otherwise. The same incentives can be provided more cheaply by inviting a mezzanine investor with operating skills into the capital structure, as we establish in this section. We will also show that when mezzanine investors are part of the optimal contract, it is optimal to request a capital contribution from them. Mezzanine finance, in this sense, is an optimal blend of capital and operating skills.

To formalize this, consider contracts that stipulate that, if no rents are generated in the first period, the incumbent operator may be replaced by operator 2 with positive probability. This tri-party contract must now stipulate an original contribution to the capital structure by both operators and, like in the previous section, mortgage payment schedules for every possible history.[11] Recall that that $2\omega < 1$ so that even if they team up and pool their funds,

[11] Bringing a third agent into the contract allows in principle for other contingencies as well but if mezzanine investors create value, it must be by taking over following a bad announcement in the first period.

Table 3: Timing of mezzanine contract

$t = 0$	$t = 1$	$t = 2$
• Operator 1 pays $e_1 \leq \omega$ • Operator 2 pays $e_2 \leq \omega$ • Senior lender pays m • Property is purchased	• Operator 1 makes effort choice • Rental income $y_1 \in \{0, R\}$ is realized • Operator 1 pays $q(y_1) \leq R$ to lender and $\kappa(y_1) \leq R$ to operator 2 • Operator 2 assumes control with probability $\tau(y_1)$	• Operator in charge makes effort choice • Rental income $y_2 \in \{0, \theta R, R\}$ is realized • Operator pays $q(y_1, y_2) \leq y_2$ to lender, $\kappa(y_1, y_2) \leq y_2 - q(y_1, y_2)$ to operator 2, and retains $y_2 - q(y_1, y_2) - \kappa(y_1, y_2)$ • Investment project ends

the two operators still need the senior lender to get the project started. We will assume that when drafting a tri-party contract operator 1 retains all the bargaining power so that they only need to make sure that operator 2 gets an expected payoff at least as high as the value of his outside option.

The optimal two-party contract we described in the previous section provides the senior lender with an acceleration clause that allows them to foreclose the project if no payment is made in period 1. In the three-party contract we now describe, the mezzanine lender is given the right to assume ownership of the property when no cash-flows are generated in period 1. In addition, the mezzanine contract stipulates a contribution $e_2 \leq \omega$ by operator 2 to the initial investment and payments $\kappa(h) < R - q(h)$ from operator 1 to operator 2 when operator 1 is in charge of running the property, for every possible history h of cash-flows.

The operator in charge at date 2 gets additional payoff $y_2 - q(y_1, y_2) - k(y_1, y_2)$ following rent history $h = (y_1, y_2)$. Note that while the first rent realization is either 0 or R, date-2 rent may be θR when operator 2 is in charge. Table 3 summarizes the timing of events when a mezzanine contract is adopted.

When the mezzanine investor becomes the operator, his remaining payoffs must satisfy the same no-shirking condition as when operator 1 is in charge since operator 2 enjoys the same private benefits from shirking as operator 1 once he is in charge. Likewise, the value of his remaining payoffs must at least equal the value of his outside option. Because the senior lender can always store the operators' endowment on their behalf,[12] it is at least weakly optimal for the contract to stipulate $e_1 = e_2 = \omega$ in which case the value of operator 2's outside option is simply V_o at date 2. We will begin by restricting our attention to mezzanine contracts that feature $e_1 = e_2 = \omega$ for the purpose of establishing conditions under which they create value. At the end of the section, we will also provide conditions under which it is strictly optimal that $e_2 > 0$.

Because operator 1 is at least as productive as generating rents as operator 2, it is optimal to have operator 1 play the role of the incumbent operator whereas operator 2 plays the role of the back-up operator. As in the previous section we continue to assume that operator 1 selects the contract that maximizes their surplus subject to participation constraints for the the senior lender and operator 2, although this can easily be altered as we will discuss in section 7.

Because our environment is stylized, it does not provide a deep explanation for why different investors assume different roles in the capital structure. We assume that if the senior lender takes over ownership following failure, the resulting payoff S is low whereas operator 2 can extract more surplus when they become owners. As we have already mentioned, a practical reason for this gap is that senior lenders typically require a mortgage lien on the underlying tangible property and the resulting foreclosure rights are fraught with transaction costs. Another potential reason is that the senior lender may lack the skills to operate the property in cases where the real estate is complex. A more complete model would endogenize why some investors select into the role of senior lender while others specialize in mezzanine lending. Such a model would need to explain why senior lenders require a direct, mortgage claim to the underlying collateral and why they do not have the ability to efficiently run all the projects in which they invest.

In practice, there are direct costs associated with complicating the contract to add a new

[12] Any increase in e_1 makes it possible to scale back all payments from operator 1 to the senior lender which makes both operator 1's participation and no-shirking constraints easier to meet. Similarly, raising e_2 as much as possible can only weaken operator 2's constraints.

party. We will write $c \geq 0$ for those costs. Including mezzanine investors in the capital structure is only profitable if doing so raises operator 1's surplus by more than this cost, as we will discuss in the next section. Our next result provides conditions under which operator 1's gross surplus increases when they involve operator 2 in the financing contract.

Proposition 5.1. *The maximal payoff V^M operator 1 can generate with a mezzanine investor in place exceeds the maximal payoff V^N he can generate with two-party contracts if and only if:*

1. $V^N < 2\eta$, *and*

2. θ *is sufficiently close to* 1.

Proof. When $V^N \geq 2\eta$ the senior lender can commit to letting the property run for two periods, and incentive compatibility constraints have slack. If, on the other hand, $V^N < 2\eta$ then the optimal contract features termination with positive probability. A contract which instead of selling the property following bad performance in period 1 replaces the original operator with operator 2 gives the senior lender a surplus of at least $\pi\theta R - \eta$ while operator 2 expects no more than η. As long as θ is sufficiently close to one this gives the senior lender a strictly higher expected payoff than the optimal two-party contract. In turn, this means that all mortgage payments can be strictly lowered without violating participation by the senior lender or incentive compatibility for the operator, which means that operator 1's expected payoff goes up strictly as well, and completes the proof. □

Unless incentive compatibility constraints are never binding at the optimal two-party contract, the incumbent operator is better off adding a back-up operator to the capital structure at date 0, provided the operating skills of the second manager are sufficiently high. In other words, making the termination option cheaper to invoke for the senior lender enables operator 1 to extract more surplus from the contract. When a better termination option becomes available, the original contract remains incentive feasible but the senior lender's surplus increases. This means that at the original contract, the senior lender's participation constraint has slack. Operator 1 can turn this slack into lower mortgage payments at every contingency when they control the property and owe a payment.

The proposition states that gross surplus increases with a back-up operator in the contract. However, bringing a third party into the contract is only profitable provided this increase in gross surplus exceeds the cost of adding a new contractual party, i.e. $V^M - V^N > c$. Section 8 will discuss conditions under which this condition is more likely to be met.

A critical question proposition 5.1 leaves unanswered is the timing of operator 2's involvement. Can the senior lender wait to discover whether a back-up operator will be needed after operator 1 fails, or is it essential that the second operator's capital contribution to the contract be made before that uncertainty is realized? In principle, the mezzanine investor could simply store their endowment at date zero and, when called upon at date 2 to take over operations, pledge the verifiable future value $\omega(1+r)$ of that storage investment to the contract. Our next result says that it is in fact essential that the mezzanine investor be part of the original capital structure.

Proposition 5.2. *If $\omega > 0$ then all contracts with a back-up operator involve $e_2 > 0$. Furthermore, if and only if*

$$V_o + \omega(1+r) < \eta$$

then a strictly positive fraction of the capital commitment e_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

$$2V_o + \omega(1+r) < V^N < 2\eta.$$

The first inequality is the participation constraint for operator 1 while the second is the condition under which back-up operators create value. That second condition must hold if adding the second operator creates enough value to offset cost c.

The first condition implies $V_o < \eta$. Should $\epsilon_2 = 0$ then operator 2's participation constraint has slack so that the contract can request a strictly positive commitment of capital from manager 2 at date 0 without changing any of the subsequent payoffs. If $V_o + \omega(1 + r) < \eta$, then, even if they commit their storage investment ω to the investment once uncertainty is resolved, the participation constraint still has slack. In that case, the senior lender is strictly better off requesting at least part of e_2 before uncertainty is resolved and exchanging those promises for a higher payoff if and only if operator 2 is called upon. Since this raises the senior lender's surplus, operator 1 can then propose a contract that lowers mortgage payments strictly. □

Proposition 5.2 establishes the indissociability of operator 2's human capital and financial capital. From the point of view of this argument there is a key distinction between the two elements of operator 2's outside option, V_o and $\omega(1 + r)$. Operator 1 would like operator 2 to commit both elements early to the contract so that payments can be optimally allocated to the node where the participation constraint has slack. But the first part is inalienable and cannot be transferred to the senior lender early on, whereas operator 2's endowment of capital can. The optimal contract takes full advantage of that second portion. The next section will illustrate these ideas in the context of a numerical example.

6 Implementation

The previous section established that adding a mezzanine investor to the project can increase total surplus. As usual, there are many ways to implement any given optimal contract. In this section, we describe one implementation that relies on arrangements that are common in commercial real estate. For concreteness, we do so in the context of a specific parametrization of our economy. In this example, both the the senior lender and the mezzanine investor receive fixed payment notes. In the event of failure in period 1, the mezzanine investor has the option to assume ownership and receive all residual cash-flows in period 2 after they make the payment due the senior lender. The parametrization we employ is simply meant to illustrate the model's key mechanism, not as a careful quantification of the importance of this mechanism.

Assume that both operators are endowed with $\omega = 0.1$ and are equally productive ($\theta = 1$). For simplicity we normalize the value of their outside opportunities to $V_o = 0$. Rents are $R = 0.65$ when the investment is successful while the probability of success in each period is $\pi = 94\%$. The opportunity cost of capital (the two period return on the lender's best alternative investment option) is $r = 8\%$ which, given $V_o = 0$ means that absent moral hazard frictions, making the investment would be profitable.

The private benefit associated with shirking is $\eta = 0.12$. This value implies that no two-party contract is profitable for the senior lender without termination. Indeed, if continuation occurs with full probability, the senior lender expects, at best, $\pi R - \eta \approx 0.49$ each period, while she needs to contribute at least $m = 1 - \omega = 0.9$ to the project. She cannot generate the 8% return she needs[13] since

$$2 \times 0.94 \times 0.49 < 0.90 \times 1.08.$$

With a mezzanine investor in place, however, the project becomes profitable for all investors. In fact, adding the mezzanine investor makes it possible to eliminate all moral hazard frictions in this case so that operator 1 gets maximal surplus

$$V^M = \pi R + \pi R - (1 + r) \approx 0.14.$$

To build a contract that delivers this surplus, first set $e_1 = e_2 = \omega$ as is always at least weekly optimal so that $m = 1 - 2\omega = 0.8$. Select $q > 0$ so that

$$\pi q + \pi^2 q + (1 - \pi)\pi q = m(1 + r)$$

which gives $q \approx 0.46$. By construction then, a fixed payment note that delivers payment q to

[13] Recall that the reinvestment rate between period one and period two is zero by assumption.

the senior lender when the property is successful exactly covers the lender's opportunity cost of capital.

The mezzanine investor (operator 2) also receives a fixed-payment note that pays amount κ as long as the property succeeds. In addition, if the property fails in period 1 they take over management and receive an additional payment of $R - q - \kappa$ if they generate positive rental income in period 2. For participation by operator 2 to just hold we need:

$$\pi\kappa + \pi^2\kappa + (1 - \pi)\pi(R - q) = \omega(1 + r).$$

Indeed, when he takes over, his total payoff is $\kappa + (R - q - \kappa) = R - q$. The unique solution to the break-even condition for operator 2 is $\kappa \approx 0.053$. He receives an equity payoff of

$$R - q - \kappa \approx 0.137$$

when he is in charge of the property at date 2 and the property succeeds. Because

$$\pi \times (0.137 + 0.053) > \eta,$$

the no-shirking condition holds for the mezzanine investor once he takes over.

In addition, we need the no-shirking condition to hold for operator 1 in period 1 which requires that

$$\pi(R - q - \kappa) + \pi^2(R - q - \kappa) > \eta.$$

In the second period, if operator 1 is still in charge, we need

$$\pi(R - q - \kappa) > \eta.$$

The second condition obviously implies the first and holds since

$$\pi(R - q - \kappa) \approx 0.13 > 0.12.$$

In summary, the proposed contract which features fixed payment notes at origination for both the senior lender and the mezzanine investor, an option to assume ownership following poor performance in period 1, and a standard equity contract for the original operator is incentive feasible and gives the original operator the most surplus they can possible earn from this investment.

The implementation above has the mezzanine lender invest his entire endowment in the property at date 0. While this is not strictly necessary for optimality, at least part of that investment must be made at date 0 in any implementation because

$$V_o + \omega(1 + r) = 0.108 < 0.12 = \eta.$$

As we explained in the previous section, given this parametric condition, the no-shirking constraint will bind for the mezzanine investor once he takes over operations unless he made an investment in the property prior to learning the rent realization at date 1.

While the contract we built above displays a lot of familiar features, it has the non-standard feature that mezzanine investors earn most of their payoffs via the payout they get once they take over the property. In this sense, they are better off when the property fails in period 1. This is driven entirely by the binary nature of the economy we have studied. Adding catastrophic states such that not only the property fails in period 1 but becomes a negative NPV investment going forward no matter who is a the helm would break the correlation between failure in period 1 and the size of the payoff mezzanine investors can expect. Likewise, we could add cash-flow states such that the senior lender is repaid but any subordinated position is wiped out, which would reflect the fact that the junior nature of mezzanine claims makes them riskier. Our goal in this paper is to establish the potential role of skilled junior investors in mitigating moral hazard frictions in the simplest possible environment. As we have shown, a binary model suffices to make this point.

This example also illustrates the complementarity between the role of mezzanine financing in mitigating moral hazard frictions and the more traditional view in which junior financing plugs a financing gap. In the example we have described the senior lender is unwilling to provide 90% of the financing but is willing to invest 80% alongside a skilled investor. In the parameterization above, this only works because the back-up investor is skilled. But it is easy to show that were ω sufficiently large, a sufficiently large equity investment by the first operator would fully solve the problem as well.

Finally, we emphasize that while in this example fixed-payment notes for both investors together with an acceleration clause can implement the optimal contract, there are parametric situations where variable-payment notes are necessary. As long as ω is high enough, it is possible to fully eliminate moral hazard friction for the mezzanine investors when they take over. But if ω is such that the incentive compatibility constraint continues to bind when mezzanine investors take over, then notes that feature lower real payments over time for the senior lender may be necessary for optimality.

7 Operator vs. lender control

We have assumed that operator 1 is in charge of designing the contract and gets to make a take-it-or-leave-it offer to the the senior lender and to operator 2. In many ways, this is without loss of generality. Operator 1 maximizes their surplus subject to participation constraints for the other two agents. Standard duality results imply that the contracts we describe would remain optimal if the senior lender selected a contract subject to the restriction that operator 1 must expect a payoff V^N in the two-party case and V^M in the tri-party contract.

Likewise, while the contract proposed by operator 1 specifies contingencies that involve actions by other agents (termination, in particular), this does not require that they have control over that decision once that contingency is reached. It is enough for the contract to stipulate an acceleration clause that gives the senior lender the right to foreclose in the event that no mortgage payment is received at date 1, as mortgage contracts do in practice. It is then optimal for lenders to commit to exercise this option even if it turns out to be ex-post inefficient. The key assumption – as in all models in the spirit of De Marzo and Fishman

(2007) – is that lenders have the ability to commit. In practice, Black et al. (2017) estimate that the frequency of CRE loans extension between 2012 and 2014 in the United States was under 2 percent for securitized loans and around one third for portfolio loans (loans issued and kept by banks.) Commercial mortgage lenders do invoke their foreclosure rights in the majority of default cases.

The fact that the operator initiates the contract offer rather than the senior lender does have one important implication, however. When the senior lender makes a take-it-or-leave it proposal to operator 1, hiring the services of a back-up operator may be beneficial even when the optimal two-party contract features no termination. Indeed, at the optimal two-party contract the termination option may be so costly to invoke that, instead of using that option, the senior lender may choose to propose a contract such that the participation constraint of operator 1 has slack. With a back-up operator in place, the senior lender may be able to reduce that slack. Mezzanine investors create value for senior lenders, therefore, even in cases where the original contact features zero risk of inefficient termination. The working paper version of this paper[14] provides a full treatment of the case where the senior lender initiates the contract offer. Formally, we show:

Proposition 7.1. *When senior lenders make take-it-or-leave it offers to the first operator, the optimal two-party contract features termination with positive probability if and only*

1. $2V_o + \omega R < 2\eta$, *and,*
2. $\pi - (1-\pi)\frac{\pi R - \eta - S}{\eta - V_o} > 0$.

Furthermore, the maximal payoff the senior lender can generate with a mezzanine investor in place exceeds all payoffs she can generate with two-party contracts if and only if:

1. $2V_o + \omega(1+r) < 2\eta$, *and*
2. θ *is sufficiently close to* 1.

[14]The paper is available for download at (blinded)

Parameters may be such that

$$2V_o + \omega(1+r) < \eta$$

but, at the same time, that

$$\pi - (1-\pi)\frac{\pi R - \eta - S}{\eta - V_o} < 0$$

say because S is low. In that case, the optimal two-party contract does not feature any chance of termination and yet, bringing in a back-up operator raises the lender's surplus because the threat of termination becomes cheaper to invoke. Therefore, mezzanine contracts may create value even when the two-party contract does not contain any chance of early termination.

8 Implications

Stylized though it is, our model has a number of broad implications for the type of projects for which mezzanine is more likely to play the role we have emphasized in this paper and, secondly, for the optimal size of the capital commitment which should be required from mezzanine investors. We emphasize yet again that our model focuses strictly on moral hazard frictions and abstracts from mezzanine's first role in most instances, which is to plug the gap left by other sources of finances. The predictions we highlight in this section are solely those that directly follow from mezzanine's potential role in mitigating moral hazard frictions.

Including operator 2 in the contract is optimal when $V^M - V^N > c$. Particularly interesting is the case where $V^M - c > 0 \geq V^N$ i.e. the case where owning the property only becomes a positive NPV investment once a back-up operator in place. To see that this can happen, simply assume that η is high enough (moral hazard is sufficiently severe) that

$$2(\pi R - \eta) < (1-\omega)(1+r).$$

In that case, meeting the senior lender's participation constraint is not possible without termination being a positive probability. With S sufficiently close to $\pi R - \eta$, the project may be viable as a two-party venture, but if S is sufficiently low (recall that we allow it to be negative) the project is not. As long as θ is sufficiently close to 1 but S is sufficiently low, the project is viable with and only with a back-up operator in place.

As long as the cost c of including a back-up operator in the capital structure is partially fixed, the property has to be sufficiently large (R must be sufficiently high) to justify bearing the fixed cost. All else equal therefore larger projects should be more likely to feature a financial structure that includes mezzanine lenders as we model them.

Second and quite intuitively, operators and investments subject to more moral hazard frictions (a higher η) benefit more from the presence of back-up operators. Indeed, V^N increases as η falls while the threshold 2η past which back-up operators do not create value declines. Similarly, the benefit of including operator 2 in the contract increases if his η is lower. Simply put, low reputation operators stand to benefit the most from the presence of mezzanine investors, especially when the reputation of those mezzanine investors is high. In addition, moral hazard issues broadly defined are more likely to be severe in complex transactions involving for instance retail properties or hotels than in the more standardized deals common in the office and multi-family segments.

The effect of π, the probability of success, on the value of mezzanine contracts is ambiguous. On the one hand, a higher π implies higher surplus so that it becomes more likely all else equal that the benefits of mezzanine contracts will offset the fixed part of their cost. This is a version of the size effect we discussed above. A higher π also makes it more likely that a termination clause will be part of the original contract, since it is cheaper to invoke. But, on the other hand, termination occurs less often so that the expected gain associated with including back-up operators is small.

The easiest way to see that the effect of π is ambiguous is to note that when $\pi = 0$, $V^N = V^M = 0$ since the property has no value, while when $\pi = 1$ failure never happens so that the senior lender's and operator 1's payoffs are independent of whether or not operator 2 is part of the contract. Mezzanine investors cannot create value when there is no uncertainty.

When the property is risky however ($\pi \in (0,1)$) termination can be part of optimal two-party contracts and mezzanine becomes potentially valuable.

As for the optimal size of the capital contribution by mezzanine investors, our model predicts that this contribution (e_2) should be raised until the mezzanine investor can be promised a payoff of at least η when they take over operations. The first consequence of this observation is that the minimal equity contribution required from the mezzanine investor increases with the severity of frictions.

A second, more subtle implication is that the minimal contribution increases with the likelihood of failure. Under the optimal contract, a commitment at date zero of a unit of equity by the mezzanine investor can be exchanged for a an actuarially fair promise of $\frac{R}{1-\pi}$ delivered to the investor when they take over. If failure is a remote possibility (if $1-\pi$ is low), each unit of equity invested at date 0 can be traded for a large promise contingent on the investor stepping in. Riskier properties, in other words, should feature higher mezzanine commitments.

9 Conclusion

The presence of mezzanine investors in the capital structure can transform negative-NPV projects into positive-NPV projects by making it cheaper for senior lenders to provide incentives to property owners. With approval from the senior lender, skilled mezzanine investors have the option to take over and operate properties without experiencing the steep costs associated with the mortgage foreclosure process.

Mezzanine investors, in our theory, optimally provide a blend of capital and back-up operating skills.The optimal arrangement calls for a contribution to the capital structure by mezzanine investors to make it easier to provide them with the necessary incentives if and when they take over.

In our model, mezzanine lenders receive their highest payoff when the property underperforms early but remains viable as an ongoing concern. Cases where backup managers serve the purpose described in this paper should be thought of as properties that disappoint early but remain profitable. When properties experience shocks so severe that continuation is no longer possible, all stake-holders – including mezzanine investors – experience low returns. As more data on mezzanine returns become available, it will become possible to test this and our theory's other predictions.

More generally a richer cash-flow distribution would produce more precise predictions for the optimal blend of mezzanine and senior finance than our stylized model can. It will also make it possible quantify the importance of the mechanism we have described in this paper. Our main goal has been to describe the potential role of skilled junior investors in mitigating moral hazard frictions in the simplest possible environment.

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