Moral Hazards: Special Purpose Vehicles, Bankruptcy Remoteness and Non-recourse Lending

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Abstract

This paper considers the implications of moral hazard issues which arise when making a sequence of levered investments. A prototypical example of the phenomenon being considered is an investor (e.g., REIT) making a sequence of real estate acquisitions. The moral hazard arises when creditors cannot fully specify and/or investors cannot fully commit to the risk of future investments. Here equity holders may be able to expropriate creditors by inducing them to lend at a rate of interest that is not commensurate with the true risk of the loan. That is, conditional on the risk of future investment decisions. In this paper we show that if lenders are aware of the moral hazard problem and act rationally to price it into their debt contracts, the pricing of this risk can bias investment decisions toward riskier investments. This occurs, not by constraining investment decisions, but by creating incentives to follow an anticipated and ex ante priced path. In this environment recourse (cross-guarantees) may result in higher rather than lower interest rates. We conclude that in the presence of this moral hazard, non-recourse lending or bankruptcy remote entities are the first best from the perspective of controlling moral hazard risk while giving investors the opportunity to invest in future opportunities.
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I. Introduction

The acquisition of commercial real estate is typically financed by non-recourse loans.\(^1\) Why? The thesis of this paper is that potential moral hazard issues associated with financing a sequence of investments, as is typically done when forming a portfolio of commercial real estate, can have important implications for the design of efficient loan contracts. Specifically, we show that when lenders are aware of the moral hazard problem and act rationally to price it into their debt contracts, the pricing of this risk can bias investments decisions toward riskier investments. This occurs, not by constraining investment decisions, but by creating incentives to follow an anticipated and ex-ante priced path. Here non-recourse loans or bankruptcy remote entities are the first best from the perspective of controlling moral hazard risk while not constraining future investment opportunities.\(^2\) Use of non-recourse mortgages to finance commercial real estate investments is a prototypical example, of the phenomenon we are considering. Here cash-flows are separable and the moral hazard risk of sequential financing of investments may be severe.

One approach to mitigating moral hazard risk is to attempt to contractually prevent equity holders from engaging in actions that would result in expropriation. Thus, bonds may include covenants that attempt to preclude risk-increasing corporate actions (e.g., mergers), or that ensure that the firm maintains certain financial ratios. The efficacy

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1. To the best of our knowledge data on the fraction of commercial mortgages that are non-recourse are not available. In a conversation Law Prof. Grant Nelson author of Real Estate Finance Law, 2007 he reports that this type of loan dominates commercial mortgages.

2. Separability of investment assets and cash-flows is a necessary condition for non-recourse lending or bankruptcy remoteness to eliminate the moral hazard we are considering.
of covenants in restraining managerial behavior depends on the ability to anticipate future
risk-increasing possibilities and to contractually enforce such restrictions. Both are
problematic in terms of acquisition of commercial real estate. It is practically impossible
to anticipate all the relevant future states of the world (e.g., future financial innovations
or development opportunities). Enforcement of covenants depends firstly on (costly and
imperfect) monitoring and secondly on the ability to enforce compliance when deviation
from the covenants is observed. Realistically, covenants cannot prevent actions ex-ante,
they can only impose ex-post sanctions. Usually, violations of covenants constitutes an
“event of default” and results in a potential acceleration of repayment. However, such
acceleration may result in costly foreclosure. An alternative to contractually Constraining
managerial risk taking is to design contracts to reduce the incentives of managers to take
un-priced risks. This is the approach that we investigate in this paper.

Debt Contract Structures

Corporate and bankruptcy law and market practice provide a number of different
frameworks in which debt contracting may take place. In the event of bankruptcy and
liquidation, the majority of creditors are “general creditors who share pari passu (on an
equal basis) in the recovery value of the assets of the bankruptcy estate. In this situation
both creditors’ claims and firm assets are pooled. However, several forms of contracting
or corporate structuring can change the effective priority of debt claims. Secured debt
results in liens that take a portion of assets out of the bankruptcy estate. Thus, a mortgage
results in a legal claim of the mortgage holder on the recovery value of a property up to
the value of the mortgage debt, with the general creditors having a claim only on the
residual (if any). Creditors may voluntarily accept contractually junior claims, creating
senior/junior debt structures. Second mortgages are an example. Finally, corporations can create legally separate entities that legally partitions assets and associated claims into “bankruptcy remote” subsidiaries.\(^3\) Alternatively, the loan contract can be non-recourse where the creditor can only recover with respect to a particular asset or assets. Mortgages loans used to finance the acquisition of commercial real estate are an example where an entity (e.g., a REIT or an insurance company) acquires a set of properties, not through bankruptcy remote entities, but with the use of non-recourse loans.\(^4\)

All of these debt structures are found in financial markets. Pooling is the de jure base case and is common where there are large numbers of financial market creditors and/or where cash flows are not separable. Examples include uninsured depositors at banks and large corporations that rely primarily on bonds and/or commercial paper, rather than bank lending, for debt financing. Secured lending is common in many industries such as airlines and real estate. Bankruptcy remote structures are common in the acquisition of commercial real estate, project finance, and securitization.

Literature

In order to understand how our paper fits into the literature and to understand our contribution, we begin with a brief review of the literature on the costs and benefits of debt and then discuss previous work on the structuring of multiple projects. On the one hand, debt enjoys tax advantages vis-à-vis equity and can reduce the agency costs of equity. Miller and Modigliani (1958 and 1963) show that with tax deductibility of interest

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\(^3\) Strictly speaking “bankruptcy remote” protects creditors from claims arising outside the business being funded and “non-recourse” prevents creditors from attaching assets outside the business being funded. Securitizations and separately incorporated subsidiaries of a holding company provide this bidirectional isolation of assets and related claims from assets and claims in affiliated businesses. For convenience we will refer to such bidirectional isolation of claims as simply “bankruptcy remote.”

\(^4\) In contrast short term construction loans used to finance real estate development are typically recourse loans.
and in the absence of bankruptcy costs the optimal level of debt is 100%. Debt also can mitigate the free cash flow/over-investment problem identified in Jensen and Meckling (1986). On the other hand, debt has two major disadvantages: bankruptcy costs and the fact that it gives rise to its own agency costs. The expected bankruptcy costs are straightforward and increasing in leverage. The agency costs relate to the underinvestment or debt overhang problem first identified in Myer (1977) and to the moral hazard, or equivalently the asset substitution problem, identified in Merton (1974) and in Jensen and Meckling (1977).5

Myer (1977) argued that the presence of debt can eliminate otherwise profitable investments. His argument is known as the debt overhang problem. This problem arises when a firm has an investment opportunity that would have a positive NPV in isolation, but the firm has existing debt that cannot be serviced by existing projects. Myers argues that the firm will not be able to finance the new positive NPV projects because at least a portion of the benefits from those projects would flow to the existing debt holders rather than to the new equity holders. This situation presumes an ex-post adverse realization of a prior debt-financed project. Absent an adverse ex-post realization of the earlier project, the new investment would be made.

The structure of debt contracts and the related issue of corporate structure when multiple projects are involved have been examined from a number of different perspectives in the past. Childs, Ott, and Riddiough (1996), and others, argue that non-recourse loans will have higher interest rates than recourse loans or loans to multiple

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5 In an unusual approach, Chemmanur and John (1996) consider the problem of jointly or separately incorporating multiple projects from the perspective of an entrepreneur who wishes to maximize the private benefits of control while needing external financing. Debt raises underinvestment problems, while external equity raises the possibility of loss of control through takeover.
projects with cross-guarantees (what we call pooling). These authors consider the set of loans as a portfolio where diversification lowers the loan risks. They do not consider the impact of future investments decisions on the risk of a current loan, and the corresponding market rate of interest. We will show that cross-guarantees (recourse) in the presence of the moral hazard can in fact result in higher, not lower, interest rates to finance an investment.

Flannery et al (1993) is closest to our paper in its objective, if not in its method. They seek to examine the effect of jointly and separately incorporated projects of the scale of investment in each of two projects, given tax preference of interest, depreciation, and exogenous volumes of bonds issued for each firm (separate or combined). Equity is costless and available as needed. Flannery et al assume that bond holders rationally anticipate the investor’s ex-post investment decision when pricing debt. Our contribution is to show that, in competitive debt markets, bond holders can force the investor’s ex-post investment decision through their pricing of debt.

Finally, Kahn and Winton (2004) examine when the separation of assets into “good bank/bad bank” may be efficient and incentive compatible, and therefore feasible, in the presence of information asymmetries. Their model assumes assets are perfectly positively correlated. In contrast, our model relies on neither information asymmetries nor correlated assets. Both of course are important considerations in reality, and they would change the details of the equilibrium in our model (i.e., at what levels of risk and project surplus one structure would be preferred to another), but not the basic qualitative results.

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6 Parenthetically, our analysis shows that different equilibrium interest rates generated by different debt structures do not necessarily correspond to different expected returns to creditors or investors.
The remainder of the paper is organized as follows: Section II will discuss the effects of debt contract structure on possible wealth transfers arising when investments are sequentially financed. In Section III we will use a game theoretic model to show how strategic players would react in the case of recourse debt and investments, a structure that we show gives rise to a moral hazard. Lastly, Section V will discuss our findings and conclude.

II. Contract Types and Investment Distortions

In this section we develop a model that abstracts from all other considerations to investigate the impact on investment decisions of sequential financing of overlapping investments. In the context of the model we demonstrate that such financing can set up a moral hazard problem (under a full recourse debt structure) and that the creditor’s response to the problem can bias investment decisions toward more risky investments and limit the number of otherwise desirable investments undertaken. As we will see, this stems from the inability of creditors to fully specify, and investors to fully commit, to the risk of future investments. This can be important in practice for commercial real estate, because investments frequently overlap, with the risk of loans that finance earlier investments potentially affecting the choice of future investment. We model investment and borrowing decisions as a two player sequential move game, the investor/lender game. While highly simplified, the model is sufficient to demonstrate our thesis. We now describe the model’s agents, investment opportunities, financing, and determine the equilibrium.

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7 For example, we ignore the tax impact of debt and bankruptcy costs and take the capital structure as given.
Agents

Both the investor and lenders are assumed to be risk-neutral. There is a competitive banking sector that makes loans whose expected rate of return equals the risk-free rate of interest. We consider a single investor who can make two sequential investments (e.g., acquisitions of two office complexes). The investor must finance each investment in-turn, they cannot be financed simultaneously.

Investment Opportunities

The investor can sequentially initiate two investments. Without loss of generality we will assume that the investor starts the game with equity of $2. The terminal value of an investment will be realized one period in the future. The investor must finance each project in-turn, they cannot be financed simultaneously. There are two types of investments: safe (S) and risky (R) each of which costs one dollar. A safe project may be risky, but is always less risky than a risky investments. The expected rates of return on the investments are \( E[ROA_S] = E[ROA_R] = r_f + s \). When, \( s > 0 \) the investments will be said to have an expected surplus. In our model we assume a common surplus to eliminate differences in the \( E[NPV] \) as a basis for investment choice. In isolation (e.g., non-recourse financing or with bankruptcy remote entities) both types of investments would be made.

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8 The key assumption is not the number of investments but is the ability to *choose* the risk of future acquisitions before the outcome of earlier investments are revealed.
9 Our results do not depend on limiting the number of projects to two, as we will discuss later.
10 The same qualitative conclusions would be obtained if the payoff were realized sequentially as long as the second investment was made before information about the outcome of the first investment was revealed.
11 Because of the assumption of risk neutrality, future payoffs are discounted at the risk free rate, \( R_f \). If \( s > 0 \), a project will have a positive expected net present value.
Each investment has at most two terminal values, a high value and a low value \((V^h_i, V^l_i, \ i = S \text{ or } R)\). Without loss of generality, the safe investment is assumed to be riskless (e.g., \(V^h_S = V^l_S = R_f + s\)). The investments’ state-contingent outcomes and their probabilities \((\pi^H_i \text{ and } \pi^L_i, \ i = S \text{ or } R)\) are common knowledge. The outcome of an investment is realized one period in the future. The financing decision for a second investment is made \textit{before} the outcome of the first investment is observed. Finally, the outcomes for multiple investment, including investments of the same type, are uncorrelated.\(^{12}\)

\textit{Financing}

Investments are financed by both debt and equity. The loan-to-value ratios \((k)\) for both investments types are exogenously determined and identical.\(^{13}\) Surplus funds are invested at the risk free rate. With recourse the debt contracts are structured so that both the creditors’ claims and firm assets (values) are pooled. To finance an acquisition the investors solicit a loan from a risk neutral bank that is part of a competitive banking industry. Competition assure that, conditional upon the information set available at loan origination, the loans will be priced so that the bank earns an expected rate of return equal to the risk free rate of interest \((r_f)\). In the case of the first investment, the bank’s information set includes the type of the first investment \((S_i \text{ or } R_i)\), the outcomes associated with both investment types and the corresponding probabilities. At the time the first loan is solicited the investor can make representations about the type of a second

\(^{12}\) For example, potential acquisitions have no market risk.

\(^{13}\) To ensure the combination of a safe project and a risky project, with recourse, would be risky we assume that \(V^l_i + (R_f + s) > R_f k\).
investment, but it is impossible to write a contract that will constrain the investor’s choice. If a second investment is to be undertaken, the second bank’s information set is augmented by knowledge of the type of the second investment and the interest rate charged on the loan that financed the first investment. In one period the asset values are realized and payoffs are made according to the loan contracts.\textsuperscript{14} The problem we consider is not one of “debt overhang.” Our set up contrasts with Myers (1977) where the decision to undertaking (finance) a second investment is made after information about the (undesirable) state of the world for the first investment is revealed.\textsuperscript{15}

Decisions

The investment and borrowing decisions that make up the sequential move game are:

1. The investor solicits a loan to finance the first investment where its type is given (known).
2. The bank quotes a rate of interest for a loan to finance the investment.
3. Conditional upon the quoted interest rate the investor decides if it is desirable to undertake the first investment.
4. The investor then decides if it is desirable to undertake a second investment and if it is what type should be undertaken.\textsuperscript{16}
5. If a second investment is to be undertaken a loan is solicited.
6. Given the quoted interest rate, the investor decides if in fact it is desirable to undertake the investment.
7. The outcomes of the investment or investments are revealed.
8. Payments are made to creditors and the investor

\textsuperscript{14} Without loss of generality and to simplify the derivation of the model the outcomes of the investments are observed at the same time, one period in the future.

\textsuperscript{15} We will conclude that both Myer’s debt overhang and our moral hazard issue can be resolved by non-recourse financing.

\textsuperscript{16} The key aspect of the game (i.e., source of the moral hazard) is the investor’s ability to chose the type of the second project. Our results would not change future projects arrived randomly and the choice was to wait (at a low cost) until a project of the desired type became available.
The game’s equilibrium will be determined by back-ward induction. We start by describing each of the agents’ strategies

First Lender’s Strategy

As we will see with recourse the type of the second investment can affect the expected payoff to the first loan. The first lender knows this. While the bank can price its loan along a continuum of interest rates, in a competitive market it will price the loan at an interest rate, $I^1$, such that the first loan earns an expected return (conditional upon the bank’s anticipation as to second investment type) equal to the risk free rate. Since there are 3 potential second types $P_2 \in \{\Phi, S_2, R_2\}$, the bank need to only choose between three loan rates. For each of the possible second investments, the bank determines the rate it would need to lend at, conditional on the known first investment type and hypothetical second investment type, i.e., $I^1_{P_1, \tilde{P}_2}$.\textsuperscript{17}

Investor’s Strategy

The investor is aware that the first lender will do the above analysis, and does the same analysis for each second investment type. The investor then chooses the sequence of investments (i.e., the type of the second investment) that maximizes, over the sequence of investments, his $E(\text{NPV})$.

Second Lender’s Strategy

With two investments, the second bank has full information and cannot be expropriated. Thus, the pricing of the second loan ($I^2$) is fully determined by the previous decisions.

\textsuperscript{17} The symbol $\tilde{\cdot}$ will be used to indicate a future choice.
Interest rate determination

Let, $I_i^1,(i=S\text{ or } R)$ denotes the interest rate charge on a loan to finance the first investment. For example, if the first investment is safe and the bank anticipates the investor undertaking a risky second investment, then the expected payment to the creditor on the first loan is: $E[D_1 | S_1 \cap \overline{R_2}] = \pi_h^b \text{Min}(kI_{S_1}^1, \frac{(R_f^f + s) + V_h^b}{2})$ + $\pi_h^l \text{Min}(kI_{S_1}^1, \frac{(R_f^f + s) + V_h^l}{2})$ (1)

Equation (1) illustrates how the sequential nature of investment decisions can influence lending rates and investment decisions. With recourse, the expected payoff on the safe loan is determined by the probabilities and outcomes of the second risky investment. With a favorable outcome on the second investment ($V_{R}$), the investor will be able to make the contracted interest payment, $kI_{S_1}^1$, on the first loan. With an unfavorable outcome the creditors will split the pooled payoff from the investments. With a competitive banking industry and risk neutrality, conditional upon a safe first investment and the anticipation of a risky second investment, a bank will charge a rate of interest, $R_f$, so that the expected return on the first loan will equal: $E[D_1 | S_1 \cap \overline{R_2}] = R_f$ (2)

From (2) we can solve for the interest rate $I_{S_1 \cap \overline{R_2}}$ that will be charged to finance the investment. Similar relationships can be derived for all combinations of first and second investment.

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18 All rates are expressed as one plus the rate of interest.
19 Here the expectation is after the decision about a second project is made but before the outcomes of either project is observed. In contrast, if the second project is anticipated to be $\overline{R_2}$, $E[D_1 | S_1 \cap \overline{R_2}] = kI_{S_1}^f$
20 For simplicity, given default, we assume that with recourse the payoffs are independent of the contracted interest rates.
investment, including no second investment. These interest rates are assumed to be common knowledge. In contrast, with non-recourse financing, market interest rates only depend upon the probability distribution of outcomes of the investment being financed.

We now illustrate the potential for moral hazard when an investor can not commit to their choice (risk) of a second investment. We will see, the moral hazards arises because the investor can freely, and strategically, choose the type of the second investment before the outcome of the first investment is known.

III. Moral Hazard and Investment Selection

A Safe First Investment

We first consider the case where an investor solicits financing on an investment (property acquisition) that is known to be safe. Here the payoff to the first investment is certain and equals \( R_f + s \). As was seen above, with recourse lending a bank needs to consider the implications of the risk of a subsequent investment on the interest rate charged on the loan. Three cases need to be considered: no second investment (\( \emptyset_2 \)), a safe second investment (\( S_2 \)), or a risky second investment (\( R_2 \)). When the bank anticipates that there will not be a second investment, or that it will be safe, the loan to finance the first investment would be anticipated to be risk free and a competitive bank would then charge the risk-free rate. If the second investment is in fact safe, the risk-free rate will be charged to finance both investments (i.e., \( I_{S_1 \cap S_2}^1 = I_{S_1 \cap S_2}^2 = R_f \)).

Alternatively, the investor can decide to undertake a risky second investment. From (1) and (2) we can solve for the interest rate that a competitive bank will charge on

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21 Taking the choice of the first project as given simplifies the analysis while maintaining the essence of the moral hazard problem. Our conclusions would not be changed if projects arrived randomly and the first project has arrived. The key is the investor’s ability to choose the type of later projects (e.g., by waiting for a project of the desired type to arrive).

22 Given the safe project is risk free, both \( I_{S_1 \cap \emptyset}^1 \) and \( I_{S_1 \cap S_2}^1 \) will equal \( R_f \).
a risk free investment, given the anticipation that the investor will undertake a risky second investment. This is:

\[
I^1_{S_1 \cap R_2} = \frac{1}{1 - \pi'_R} \left[ R_f - \pi'_R \frac{R_f + s + V'_R}{2k} \right] > R_f
\]

We see that with recourse, a risk-neutral institution will be forced to charge an interest rate in excess of the risk free rate to finance a risk-free investment. This contrasts with non-recourse lending where a competitive bank will always charge the risk-free rate to finance a risk-free investment. Two variables that determine the spread between \( I^1_{S_1 \cap R_2} \) and \( R_f \) are the magnitude of the surplus \( s \), and \( \pi'_R \). Increases in an investment’s surplus and decreases in \( \pi'_R \), will decrease the spread between the market and risk-free rates of interest.

At the time a second loan is solicited, both investment types as well as the interest rate charged on the first loan are common knowledge. The bank will then charge an interest rate so that the expected rate of return on the second loan (conditional upon the information set) equals the risk-free rate. When realizations are the same as anticipations, the bank will charge a rate on the second loan so that \( I^2_{S_1 \cap R_2} = I^1_{S_1 \cap R_2} \). The investor’s problem is to choose the second investment type so that the expected net present value of his equity will be a maximum. Because the interest rate charged on the first loan depends upon the creditor’s anticipation as to the second

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23 Given a competitive banking industry this is true even if both projects are to be financed by the same bank.

24 The interest rate, \( I^2 \), is uniquely determined by the project types and the interest rate charged on the first loan \( I^1 \), it follows that the investor will know \( I^2 \).
investment type, the expected net present value of the investor’s equity for a sequence of investments will also depend upon the first bank’s anticipations.

To derive the terminal values for the game, we start by considering cases where the loans are priced in accord with the investor’s actual choice. For example, consider the cases where the first investment is safe and the investor decides not to undertake a second investment ($\emptyset_2$) or undertakes a safe second investment ($S_2$). Remembering that for a safe investment $V^h_s = V^0_s = R_f + s$, we find that when no second investment is undertaken the expected net present value of the investor’s equity is $\frac{s}{R_f}$. Thus, when two safe investments are undertaken the expected payoffs become $\frac{2s}{R_f}$.

We now consider the case where a risky second investment is anticipated and is undertaken. Here the investor only receives a return on his investments when the payoff to the risky investment is $V^h_r$. Thus, the expected net present value of the investor’s equity for the sequence of investments $S_1 \cap R_2$ becomes:

$$E\left[ NPV_E | S_1 \cap R_2, I^1_{S_1 \cap R_2} \right] = \frac{R_f^h \left[ (V^h_r - k(I^2_{S_1 \cap R_2})) + (R_f + s) - k(I^1_{S_1 \cap R_2}) \right]}{R_f} - 2(1-k)$$

Thus, when the investor acts in accord with the banks’ anticipations, the banks will earn a normal rate of returns on their loans and the expected net present of the sequence of investments value is $\frac{2s}{R_f}$. 

16
To illustrate the moral hazard problem, consider the case where, based upon the investor’s representation, the loan for the first investment is priced as if both investments will be safe (i.e., $I^1_S = I_{S_1 \cap \bar{S}_2}^1 = R_f$). In absence of contracts that constrain the investor he can act strategically and decides to do $R_2$ rather than $S_2$. A competitive bank will then charge an interest rate of $I^2_{R_2} = I_{S_1 \cap R_2}^2$ to finance the second investment and the net present value of the investor’s investments becomes:

$$
E\left[ NPV_E \mid S_1 \cap R_2, I^1_{S_1 \cap \bar{S}_2} \right] = \frac{\pi^h_R \left( V^h_R - k I^2_{S_1 \cap R_2} \right) + (R_f + s) - k R_f}{R_f} - 2(1-k)
$$

$$
= \frac{2s}{R_f} + T_S^R,
$$

(5)

where $T_S^R > 0$.

Here the bank that financed the first investment did not price the loan at a rate high enough to compensate for the risk associated with the pooling of a risky and a safe investment. This miss-pricing results in a transfer of wealth ($T^R_S = \pi^h_R [I_{S_1 \cap R_2} - R_f]/R_f$) from the first bank to the investor. To compensate for the moral hazard risk, the first bank must charge an interest rate greater than the risk-free rate. At any interest rate less than $I^1_{S_1 \cap \bar{R}_2}$ the investor can transfer wealth from the first bank to himself by deciding to undertake a risky second investment.

Table 1 presents the strategic form of the sequential move investor/lender game when the investor has decided upon undertaking a safe first investment. The strategies for the first bank are noted long the left margin of the table and the investor’s strategies are indicated along the top margin. The table’s entries are the payoffs to the first bank and investor for the corresponding strategy combination. For example, the first cell reports that when the bank quotes an interest rate of $R_f$ and the investor decides not to undertake a second investment the expected net present value of the loan to the bank is 0 and the

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25 $T^\text{actual anticipated}_S$ denotes the wealth transfer to the investor when the interest rate on the first loan is based upon an anticipation of the second project type and with a known actual project type.

26 Remember the interest rate charge in the second loan $I^2$ is not a decision variable for the bank.
expected net present value of the investor’s equity investment is $\frac{s}{R_f}$. Note that because the second bank has full information, the expected net present value of its loan will always be zero. For clarity the strategies and payoffs for the second loan is not included in the table. From the strategic form of the game we can see that the Nash equilibrium (indicated by *** ) is for the first bank is to charge an interest rate of $I^c_{s_i \cap R_2}$ and for the investor to respond by undertaking a risky second investment. Here both the first and second banks earn normal rates of returns on their loans and the investor has a non-negative expected NPV of $\frac{2s}{R_f}$. The derivation of the Nash equilibrium by the consideration of off equilibrium strategies is described in the Table.

The rational response of the first lender to the investor’s incentives force them to price the first loan so that an investor will not undertake a safe second investment. Thus, the rational response of banks to the moral hazard problem effectively precludes the investor from undertaking a second safe investment even though in isolation it has a non-negative E[NPV]. This contrasts with non-recourse lending where the interest rates charged on the safe investment will be the risk-free rate and any non-negative NPV project will be undertaken. In terms of our model recourse lending would be expected to eliminate economically efficient investment opportunities.

A Risky First Investment

We next consider the investor/lender game when the investor has decided to undertake a risky first investment. Again three cases need to be considered: no second investment ( $\emptyset$ ), a safe second investment ( $S_2$ ), or a risky second investment ( $R_2$ ). To
derive the terminal values for the game, we start by considering cases where the loans are priced in accord with the investor’s actual choice.

Consider the case where the first investment is risky and the bank anticipates a second investment will not be undertaken (i.e., \( r_1 \cap \emptyset_2 \)). Let \( I_{r_1 \cap \emptyset_2} \) represent the interest rate quoted on the first loan. At this rate the expected payment to the creditor becomes:

\[
E[D_1 | R_1 \cap \emptyset_2^{-}] = \pi_R^h \text{Min} \left\{ k I_{r_1 \cap \emptyset_2}^c, V_R^h \right\} + \pi_R^f \text{Min} \left\{ k I_{r_1 \cap \emptyset_2}^c, V_R^l \right\}
\]

This implies that the bank will be willing to lend at an interest rate:

\[
I_{r_1 \cap \emptyset_2} = \frac{1}{\pi_R^h} \left[ R_f - \frac{\pi_R^f V_R^l}{k} \right].
\]

When the realizations are the same as anticipations the expected net present value of the investor’s investment is again \( \frac{2s}{R_f} \).

Following reasoning similar to that used to derive (3) we find that when the first bank anticipates the investor will undertake a safe second investment it will charge an interest rate of \( I_{r_1 \cap \emptyset_2} = I_{S_1 \cap \emptyset_2} \). \(^{27}\) If the bank’s anticipations are satisfied the expected net present value of the investor undertaking two investments will again be \( \frac{2s}{R_f} \).

Finally we consider the case where an investor chooses a risky first investment and the bank anticipates that they will chose a risky second investment. In this case the expected payment on the first loan is:

\(^{27}\) With full recourse the order of investment has no impact on market interest rates.
\[ E[D_1 | R_1 \cap \bar{R}_2] = \left( \pi^h_R \right)^2 \min \left\{ k I^1_{R_1 \cap \bar{R}_2}, \frac{V^h_R + V^h_k}{2} \right\} + 2 \pi^h_R \pi^l_R \min \left\{ k I^1_{R_1 \cap \bar{R}_2}, \frac{V^h_R + V^l_k}{2} \right\} + \left( \pi^l_R \right)^2 \min \left\{ k I^1_{R_1 \cap \bar{R}_2}, \frac{V^l_R + V^l_k}{2} \right\}. \] (8)

For simplicity, and without loss of generality, we will assume the undesirable outcome \((V^l_k)\) on a risky investment is sufficiently small to trigger default on both investments.\(^{28}\)

From this assumption and competitive banking we find that:

\[ E[D_1 | R_1 \cap \bar{R}_2] = \left( \pi^h_R \right)^2 k I^1_{R_1 \cap \bar{R}_2} + 2 \pi^h_R \pi^l_R \left( \frac{V^h_R + V^l_k}{2} \right) + \left( \pi^l_R \right)^2 V^l_k = k R_f. \] (9)

Which implies that:

\[ I^1_{R_1 \cap \bar{R}_2} = \frac{1}{\pi^h_R} \left[ \frac{R_f - \pi^l_R}{\pi^h_R - \pi^l_R} \left( \frac{V^h_R + V^l_k}{2} \right) \right]. \] (10)

It can be easily shown that diversification can lower the market interest rate (i.e., \(I^1_{R_1 \cap \bar{R}_2} < I^1_{R_1 \cap \bar{R}_2}\.\)\(^{29}\) When realizations are the same as expectations, the expected net present value of the investor’s investments is again \(\frac{2s}{R_f}\).

We have found, regardless of the type of the first investment, that when a bank’s anticipations are met the investor’s expected net present value for a single investment is always \(\frac{s}{R_f}\), but when two investments are undertaken it becomes \(\frac{2s}{R_f}\). These are efficient outcomes and are the same as would be obtained with contracts that constrain the investor’s future investment choice and/or non-recourse lending.

\(^{28}\) That is, \(V^h_R + V^l_k = k R_f\).

\(^{29}\) Implicitly this is the case considered in Childs, Ott, and Riddiough (1996).
As was previously the case, a moral hazard problem presents itself when it is in the investor’s interest to misrepresent the type investment that will be undertaken in the future. Here there are two situations that are subject to moral hazard, in the first the loan for the first investment is priced as if the second investment will be safe (i.e., $I_{R_1 \cap R_2}^1$). In absence of contracts that constrain the investor’s investment choice the investor can act strategically and decides to do $R_2$ rather than $S_2$. Now the expected net present value of the investor’s equity investment becomes:

$$E\left[ NPV_E \mid R_1 \cap R_2, I_{R_1 \cap \bar{R}_2}^1 \right] = \frac{\pi_R^h \left( V_R^h - k I_{R_1 \cap \bar{R}_2}^1 \right)}{R_f} - (1 - k) \frac{2s}{R_f} + T_S^R$$  \hspace{1cm} (11)

where $T_S^R = \pi_R^h k \left[ I_{R_1 \cap R_2} - I_{R_1 \cap \bar{R}_2} \right] / R_f > 0$.

Thus, by acting strategically the investor is able to transfer wealth of $T_S^R$ from the first bank to himself.

A second example of the moral hazard problem occurs when the bank believes the investor’s representation that he will undertake a risky second investment (i.e., $I_{R_1 \cap \bar{R}_2}^1$), but in fact the investor only undertakes a single risky investment. Now the expected net present value of the investor’s equity is:

$$E\left[ NPV_E \mid R_1 \cap \bar{R}_2, I_{R_1 \cap \bar{R}_2}^1 \right] = \frac{\pi_R^h \left( V_R^h - k I_{R_1 \cap \bar{R}_2}^1 \right)}{R_f} - (1 - k) \frac{s}{R_f} + T_R^\varnothing$$  \hspace{1cm} (12)

where $T_R^\varnothing = \pi_R^h k \left[ I_{R_1 \cap \bar{R}_2} - I_{R_1 \cap R_2} \right] / R_f > 0$

Here by acting strategically, the investor is able to transfer, $T_R^\varnothing$ wealth from the first bank to themselves. This occurs because the bank that financed the first investment did not price the loan at a rate that is high enough to compensate for the risk associated with financing a single risky investment.
When the bank charges $I_{R_1 \cap R_2}$ for the first loan, the investor’s decision as to the number of investment to undertake (i.e., considering wealth transfer) depends upon the relationship between surplus associated with an investment ($\frac{S}{R_f}$) and potential wealth transfer $T_R$ from the lender. When $T_R > \frac{S}{R_f}$, it will be optimal for the investor to only undertake one investment. This is clearly the case when the surplus is zero. The conditions under which the investor will choose to undertake only one investment are derived in Appendix A.\(^{30}\)

Table 2 presents the strategic form of the investor/lender game that represents the interactions between the investor and a bank or banks. The payoff associated with each of the strategy combinations are presented in the body of the table. Inspection of the Table reveals that the investor’s strategy $R_1 \cap S_2$ is a dominated strategy as is strategy of first bank of lending at interest rate $I_{R_1 \cap S_2}$. Thus we can conclude that a rational bank’s response to the moral hazard associate with sequential investing will preclude a investor from undertaking a subsequent safe investment. We have found this to be true regardless of the type of the investor’s initial investment.

In Table 2 we see that absent surplus (i.e., $s = 0$) that the game’s Nash Equilibrium (indicated by **) for the first lender is to charge the interest rate $I_{R_1 \cap S_2}$ and for the investor to undertake one risky investment. Here, as was previously the case, the response of lenders to the moral hazard biased the investor’s investment decision.

\(^{30}\)In the game both $T_R$ and $\frac{S}{R_f}$ are common knowledge and it is optimal for the investor to undertake only one project, rather than accepting a loss the first bank would require an interest rate of $I_{R_1 \cap S_2}$ for the first loan.
toward risky investments and eliminated otherwise desirable investment investments

We now consider the game with a surplus (i.e., $s > 0$). First, we contend that if for the strategy combination $I_1^1 R_1 \cap \emptyset, R_1 \cap R_2$, the wealth transfer from the investor to the lender ($T_1^\emptyset$) is less than the present value of the surplus (i.e., it is optimal for the investor to undertake two investments) competition will drive the interest rate that the bank will be willing to lend down to $I_1^1 R_1 \cap \emptyset$. In this circumstance the investor/lender game will have a Nash Equilibrium (indicated by ***) at the strategy combination $I_1^1 R_1 \cap \emptyset, R_1 \cap R_2$.

As was the case with a safe first investment, the rational response of the first lender to the investor’s incentives will force them to price the first loan so that an investor will not undertake a safe second investment. Thus, the rational response of banks to the moral hazard problem results in effectively precludes the investor from undertaking a second safe investment even though in isolation it has a non-negative $E[\text{NPV}]$.

**V. Conclusions**

We started by asking the questions, why is the acquisition of commercial real estate typically financed by non-recourse loans and/or through the use of bankruptcy remote entities? Our answer is that they are that these institutions are efficient responses to the moral hazard issues which arise when making a sequence of levered investments. The moral hazard arises when creditors cannot fully specify and/or investors cannot fully commit to the risk of future investments. Here equity holders may be able to expropriate creditors by inducing them to lend at a rate of interest that is not commensurate with the true risk of the loan. That is, conditional on the risk of future investment decisions. In this paper we show that, with recourse, if lenders are aware of the moral hazard problem
and act rationally to price it into their debt contracts, the pricing of this risk can bias investment decisions toward riskier investments. This occurs, not by constraining investment decisions, but by creating incentives to follow an anticipated and ex ante priced path. In this environment recourse (cross-guarantees) may result in higher rather than lower interest rates. We conclude that in the presence of this moral hazard, non-recourse lending or bankruptcy remote entities are the first best from the perspective of controlling moral hazard risk while giving investors the opportunity to invest in future opportunities. However, the bankruptcy remote structure requires strong conditions of asset separability, freedom from asset substitution, and legally enforceable separation of assets and creditors. We observe these conditions where we observe bankruptcy remote structures being used, for instance in securitizations or commercial real estate.
Bibliography


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Table 1: Moral Hazard in Borrowing Strategic Form: Safe First Investment

<table>
<thead>
<tr>
<th>$I_f$</th>
<th>$S_1 \cap \varnothing_2$ (loan one NPV, NPV investor)</th>
<th>$S_1 \cap S_2$ (loan one NPV, NPV investor)</th>
<th>$S_1 \cap R_2$ (loan one NPV, NPV investor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_f$</td>
<td>$0, \frac{s}{R_f}$</td>
<td>$0, \frac{2s}{R_f}$</td>
<td>$-T_s^g, \frac{2s}{R_f} + T_s^g$</td>
</tr>
<tr>
<td>$I_{S_i \cap \bar{R}_2}^1$</td>
<td>$-T_r^g, \frac{s}{R_f} + T_r^g$</td>
<td>$-T_r^g, \frac{2s}{R_f} + T_r^g$</td>
<td>$0, \frac{2s}{R_f}$</td>
</tr>
</tbody>
</table>

Legend: $T_{act}^{ant}$ denotes the wealth transfer to the investor when the interest rate on the first loan is based upon an anticipation that the second project type will be $ant$ while the investor actually project type is $act$.

**Wealth Transfers**

\[ T_s^g = \pi_s^g[k[I_{S_i \cap \bar{R}_2} - R_f]/R_f > 0 \]

\[ T_r^g = T_r^S = k[R_f - I_{S_i \cap \bar{R}_2}]/R_f < 0 \]

**Derivation of Unique Nash Equilibrium**

Why this is the unique Nash Equilibrium is apparent when we consider off equilibrium strategies. For example, if first bank decides to charge the rate $R_f$, the investor would not change his decision to undertake a risky second investment. But the change in bank’s strategy (interest rate) would result in a transfer of wealth from the bank to the investor of \[-T_s^g = -\pi_s^g[k[I_{S_i \cap \bar{R}_2} - R_f]]. \] Thus, the first bank would not desire to change their choice of interest rate. Alternatively, consider the investor’s situation if they changed their strategy choice to $S_1 \cap S_2$. Now the expected net present value of the investor’s equity is $\frac{2s}{R_f} + T_r$ where $T_r = k[R_f - I_{S_i \cap \bar{R}_2}] < 0$ and changing their strategy has made the investor worse off because he over paid for the loan. Thus the strategic combination $I_{S_i \cap \bar{R}_2}^1$ and $S_1 \cap R_2$ is a Nash Equilibrium for investor/creditor game.
Table 2: Moral Hazard in Borrowing Strategic Form: Risky First Investment with Surplus

<table>
<thead>
<tr>
<th></th>
<th>$I_1$</th>
<th>$R_1 \cap \emptyset$</th>
<th>$R_1 \cap S_2$</th>
<th>$R_1 \cap R_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(loan one NPV, NPV investor)</td>
<td>(loan one NPV, NPV investor)</td>
<td>(loan one NPV, NPV investor)</td>
<td>(loan one NPV, NPV investor)</td>
</tr>
<tr>
<td>$I_{1}^{1}$</td>
<td>$R_{1} \cap \emptyset$</td>
<td>$0, \frac{S}{R_f}$</td>
<td>$-T^{S}<em>\emptyset + \frac{2s}{R_f} + T^{S}</em>\emptyset$</td>
<td>$-T^{S}<em>\emptyset + \frac{2s}{R_f} + T^{S}</em>\emptyset$</td>
</tr>
<tr>
<td></td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{1}^{1}$</td>
<td>$R_{1} \cap S_2$</td>
<td>$-T^{\emptyset}_S + \frac{S}{R_f} + T^{\emptyset}_S$</td>
<td>$0, \frac{2s}{R_f}$</td>
<td>$T^{r}_S, \frac{2s}{R_f} + T^{r}_S$</td>
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</tr>
<tr>
<td>$I_{1}^{1}$</td>
<td>$R_{1} \cap \bar{S_2}$</td>
<td>$-T^{\emptyset}_R + \frac{S}{R_f} + T^{\emptyset}_R$</td>
<td>$-T^{S}_R + \frac{2s}{R_f} + T^{S}_R$</td>
<td>$0, \frac{2s}{R_f}$</td>
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</table>

Wealth Transfers

When $I_{1}^{1}$:

$T^{\emptyset}_S = \pi^B_R [I_{R_1 \cap \emptyset} - I_{R_1 \cap S_2}] / R_f < 0$, $T^{\emptyset}_R = \pi^B_R [I_{R_1 \cap \bar{S_2}} - I_{R_1 \cap \emptyset}] / R_f < 0$, and $T^{S}_\emptyset > |T^{S}_\emptyset|$.

As long as $T^{\emptyset}_S < \frac{S}{R_f}$ chose $R_1 \cap R_2$.

When $I_{1}^{1}$:

$T^{\emptyset}_S = \pi^B_R [I_{R_1 \cap \emptyset} - I_{R_1 \cap S_2}] / R_f > 0$, $T^{\emptyset}_R = \pi^B_R [I_{R_1 \cap \bar{S_2}} - I_{R_1 \cap \emptyset}] / R_f > 0$, and $T^{\emptyset}_S > T^{S}_R$.

As long as $(T^{\emptyset}_S - T^{\emptyset}_R) < \frac{S}{R_f}$ chose $R_1 \cap R_2$.

When $I_{1}^{1}$:

$T^{\emptyset}_R = \pi^B_R [I_{R_1 \cap \emptyset} - I_{R_1 \cap \bar{S_2}}] / R_f > 0$, $T^{\emptyset}_S = \pi^B_R [I_{R_1 \cap S_2} - I_{R_1 \cap \emptyset}] / R_f < 0$

As long as $T^{\emptyset}_R < \frac{S}{R_f}$ chose $R_1 \cap R_2$. 

29
Appendix 1

For our analysis we need to find when the \( E[NPV] \) of single risky project, at the two risky project rate \((I^1_{R \cap R_i})\), is smaller than two risky projects at the two project rate. That is:

\[
E[NPV \mid R_1 \cap \emptyset, I^1_{R \cap R_i}] < E[NPV \mid R_1 \cap R_2, I^1_{R \cap R_i}] = \frac{2s}{R_f}
\]

Substituting from (11) into the first portion of the above expression we obtain

\[
\frac{s - T_R^i}{R_f} = \frac{s}{R_f} + \frac{1}{R_f} \left[ \pi^h_R V^h_R - k \pi^l_R \left( \frac{1}{\pi^h_R} \left[ R_f - \frac{\pi^l_R V^l_R}{k} \right] \right) \right] < \frac{2s}{R_f}
\]

Simplifying we obtain:

\[
\frac{1}{R_f} \left[ \pi^l_R V^h_R - k \pi^l_R \left( \frac{1}{\pi^h_R} \left[ R_f - \frac{\pi^l_R V^l_R}{k} \right] \right) \right] < \frac{s}{R_f}
\]

(13)

Using the assumption that \( \pi^l_R V^h_R + \pi^h_R V^l_R = R_f + s \) we find that the \( E[NPV] \) of two projects at the two project rate are greater than a single project at the two project rate if:

\[
\pi^l_R (V^h_R + \frac{\pi^l_R}{\pi^h_R} V^l_R) (1 - k) < s \left( 1 - \frac{\pi^l_R k}{\pi^h_R} \right)
\]

(14)

We know the left-hand side of (14) is positive, so that a necessary condition for two \( R \) projects to result in a higher \( E[NPV] \) is that \( 1 - \frac{\pi^l_R k}{\pi^h_R} > 0 \), substituting \( 1 - \pi^l_R \) for \( \pi^h_R \), and simplifying we find that the necessary becomes \( \frac{1}{1+k} > \pi^l_R \). Thus, there is a critical value below which an investor will only do one project even though a project has a positive net present value. We would expect the financial institution that provides the first loan to know what the investor’s optimal response to the interest rate charged on its loan is.