THREE ESSAYS ON LEVERAGE AND DEBT CONTRACTS

By

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My studies considered three things: (1) the choice between non-recourse secured debt and recourse debt (unsecured debt or secured debt with recourse) by firms that are sequentially acquiring assets and then making investment choices once those assets have been acquired, (2) how secured debt financing impacts both the asset substitution and underinvestment problems, and (3) the frequency with which credit rating changes result from changes in the firm's operating environment versus changes in capital structure controlled by management.

First, non-recourse secured debt is shown to be optimal for firms engaged in the acquisition of assets which have little need for non-contractible ongoing investment. Unsecured debt provides superior post-acquisition incentives for owners of assets that require ongoing investment or that can be easily modified. Empirical tests using Real Estate Investment Trusts provide evidence supporting the model and consistent with previous work.

Second, the underinvestment problem does not depend on the proportion of the original debt that is secured and the asset substitution problem decreases in the proportion of the original debt that is secured. Debt capacity increases with the proportion of debt that is secured as the asset substitution problem is lower for a given level of debt. An analysis of a large sample of firms with COMPUSTAT data supports the model predictions.

Third, I found that management action plays a significant role in credit rating changes. Twenty-four percent of downgrades and 41% of upgrades have a substantial management influence. The frequency of management impact on credit ratings shows the limitations of credit risk modeling using structural models that assume constant capital structure.

CHAPTER 1
INTRODUCTION

This analysis of leverage and debt contracts comprises the following three studies: (1) Investment Incentives and the Recourse Structure of Debt: Theory and Evidence, (2) Secured Debt Financing and Leverage: Theory and Evidence and (3) Anatomy of a Ratings Change.

Investment Incentives and the Recourse Structure of Debt: Theory and Evidence provides a model of the choice between non-recourse secured debt and recourse debt (unsecured debt or secured debt with recourse) by firms that are sequentially acquiring assets and then making investment choices once those assets have been acquired. Non-recourse secured debt is shown to be optimal for firms engaged in the acquisition of assets which have little need for non-contractible ongoing investment. Unsecured debt provides superior post-acquisition incentives for owners of assets that require ongoing investment or that can be easily modified. The recourse structure, mix of recourse and non-recourse debt, of Real Estate Investment Trusts, publicly traded entities that use significant amounts of non-recourse debt, are shown to be consistent with this model and with predictions of the Stulz and Johnson (1985) model.

Secured Debt Financing and Leverage: Theory and Evidence models how secured debt financing impacts both the asset substitution and underinvestment problems and documents empirical evidence in support of the model. The model considers a firm with a mix of secured and unsecured risky debt claims against an asset in place and the opportunity to acquire another asset. I show that (1) the underinvestment problem does not depend on the proportion of the original debt that is secured and (2) the asset substitution problem decreases in the proportion of the original debt that is secured. Debt capacity increases with the proportion of debt that is secured as the asset substitution problem is lower for a given level of debt. An analysis of a large sample of firms with COMPUSTAT data supports the model predictions. First, leverage is positively and significantly related to the fraction of the debt that is secured, controlling for other variables known to affect leverage. Second, attaching collateral to the debt, unlike shortening maturity (Johnson (2003)) or including protective covenants (Billett, King and Mauer (2007)), does not increase debt capacity by mitigating the underinvestment problem.

Anatomy of a Ratings Change documents the frequency with which credit rating changes result from changes in the firm's operating environment versus changes in capital structure controlled by management. The analysis uses a sample of 604 credit rating changes about which sufficient information is available to attribute the cause of the rating change to management, operational or economic causes.

I find that management action plays a significant role in credit rating changes. Twenty-four percent of downgrades and 41% of upgrades have a substantial management influence. The frequency of management impact on credit ratings shows the limitations of credit risk modeling using structural models that assume constant capital structure.

CHAPTER 2

INVESTMENT INCENTIVES AND THE RECOURSE STRUCTURE OF DEBT: THEORY AND EVIDENCE

Introduction

This analysis models a firm's choice of the recourse structure of its debt: the mix of recourse and non-recourse debt. The firm in this model has investment opportunities that arrive sequentially. The firm chooses which assets to acquire and whether to finance the acquisition with non-recourse secured debt (project finance) or debt that has recourse to the other projects: unsecured debt or secured debt with recourse. The firm then chooses how to deploy the acquired assets. The firm makes a non-contractible choice of how much to invest in the asset that determines the expected net present value of the project, and a non-contractible choice of technology that determines the volatility of the project returns.

The recourse structure of debt impacts the payoffs to the firm (1) when assets are acquired (*acquisition incentives*) and (2) from investments that change the expected net present value and volatility of the acquired project (*investment incentives*). The optimal recourse structure minimizes the risky debt related distortions to the acquisition and investment incentives. Some firms use all recourse debt, others only non-recourse debt and some a mix of recourse and non-recourse debt.

The model's predictions about the recourse structure of debt financing are supported by an analysis of the recourse structures of Real Estate Investment Trusts (REITs) debt. While non-recourse, project financing, is common for private firms, its use by public firms is limited, see Esty and Sesia (2005).[1] The empirical analysis focuses on REITs as (1) there are a large number of publicly traded REITs with considerable variation across firms in the mix of non-recourse and

[1]Some publicly traded firms have subsidiary debt that is not guaranteed by the parent which is effectively project financing. See Kolasinski (2006).

recourse debt with nearly all firms using some non-recourse debt and (2) the popularity of non-recourse debt among REITs is consistent with the model. Recourse debt financing distorts acquisition incentives. If an asset purchase is financed with recourse debt, the value of the debt is influenced by subsequent asset purchases and how they are financed. There are wealth transfers to or from the original lender. However, there are no wealth transfers when the first asset purchase is financed with non-recourse secured debt: the value of the non-recourse debt claim depends only on the project financed. Non-recourse secured debt financing eliminates the debt overhang problem of Myers (1977).

Potentially offsetting the distortions to acquisition incentives, the debt-related distortions to investment incentives are smaller when the firm's assets are bundled as collateral for recourse debt. A capital structure with recourse debt provides better incentives to maintain and manage the acquired assets than a capital structure where the projects are financed with non-recourse debt and thus non-recourse debt is not a dominant contract. Since the benefits of bundling collateral vary with both the nature of the assets and the size of the firm, some borrowers choose non-recourse debt while others use debt with recourse or a mix of non-recourse and recourse debt.

The first improvement in investment incentives when a project is financed with recourse debt is that incentives to increase project return variability are smaller. The wealth transfer from the lender(s) to the firm from increased project variability is greater with non-recourse debt than with recourse debt where the collateral is bundled. When the collateral is bundled with other non-perfectly correlated projects, an increase in project specific volatility is at least partially diversified away by the returns on other assets. Thus, when the collateral is bundled, spending resources on negative NPV modifications to the asset that increase return volatility is less attractive as it results in a smaller wealth transfer away from the lender. Consistent with the model prediction that firms have stronger incentives to modify assets financed with non-recourse debt, I provide industry commentary indicating that non-recourse REIT debt covenant protection constrains modifications to the asset much more than REIT unsecured debt contracts and that the resulting limited operating flexibility is a drawback to non-recourse financing.[2]

The second advantage of recourse debt financing is that it mitigates the incentives to under-invest in the assets in place. This occurs because bundling two less than perfectly correlated assets lowers the promised yield on the debt per dollar borrowed relative to when the projects are financed on a standalone basis with non-recourse debt. This idea is similar to Lewellen (1971) where the diversification effect of conglomerate mergers lowers the probability of default for a given level of debt and increases debt capacity. In this model, the diversification effect occurs when recourse debt is used.

REIT industry commentary is also consistent with idea in this model that recourse financing improves investment incentives. Specifically, industry commentary states that higher quality assets are financed with non-recourse debt while lower quality assets are more likely to collectively provide the collateral for recourse debt. Lower quality assets are more likely to require non-contractible investments in the future to reposition the asset. The incentive to under-invest in repositioning is greater with non-recourse debt financing. The returns to lower quality assets depend on idiosyncratic factors and thus benefit from the diversification effects of bundling the collateral.

[2]Along the same lines, John and John (1993) point out that project financing contracts pre-commit the cash flows to customers, suppliers and creditors and curtail managerial discretion.

The intuition of the model equilibrium starts out with the case where the firm sequentially purchases two assets with either non-recourse or recourse debt financing.[3] Recourse debt financing provides better incentives to manage the asset and thus the combined value of the assets is greater with recourse debt. The extent of the gain from recourse financing depends on the nature of the asset and is referred to as the asset's *investment sensitivity.* If the assets are sufficiently investment sensitive, then the expected gain from bundling the assets as collateral for recourse debt exceeds the expected losses associated with positive NPV acquisitions that are not taken because of the debt overhang problem. In this case, recourse debt financing is optimal. When the assets are not sufficiently investment sensitive the optimal strategy is non-recourse debt financing. Extending past the two asset case, the firm that starts with non-recourse debt may convert some of its non-recourse debt to recourse debt (pledging the most investment sensitive assets as collateral for the recourse debt) after acquiring a large number of assets because the gains from recourse financing are increasing in the number assets bundled as collateral for recourse debt. Finally, if the transactions costs of repurchasing the non-recourse debt are high, the firm only uses recourse debt when it purchases a large number of assets at the same time.

Theoretical works related to this model include Kahn and Winton (2004) and Flannery et. al. (1993) who model the trade-offs between a separately capitalized subsidiary structure (non-recourse debt) and joint incorporation (recourse debt). In Flannery et. al. (1993) and Kahn and Winton (2004) the borrower transfers wealth from the recourse lender by changing the mix of assets. Separately financed subsidiaries (effectively non-recourse financing) reduce the ability to

[3]It is easy to show that the firm does not finance one asset with non-recourse debt and the other recourse debt.

shift assets.[4] In our model, non-recourse debt creates a greater asset substitution problem with regard to changing the volatility of the assets in place. I provide evidence that suggests the recourse structure of REIT debt and REIT debt contract design are influenced by this problem. The idea in this model that combining assets as collateral for recourse debt lowers the nominal cost of debt and hence improves investment incentives is also present in Flannery et. al. (1993).

In John and John (1991) non-recourse project finance creates the flexibility to optimally assign different debt levels to two separate projects so as to minimize agency costs and taxes.[5] Finally, in this model and Berkovitch and Kim (1990) non-recourse debt eliminates the debt overhang problem with regard to purchasing additional assets. In Berkovitch and Kim (1990) non-recourse debt is not a dominant contract when asymmetric information is introduced. In this model, non-recourse debt is not a dominant contract with symmetric information because non-recourse debt creates greater distortions to the incentives to manage the assets.

Our analysis of the recourse structure of REITs uses a sample of 1,277 firm years of data from 1990-2003 and provides empirical support for a number of the model predictions and complements the anecdotal evidence in support of the model. There is considerable variation in the mix of non-recourse and recourse debt financing by REITs, however, nearly all REITs use some non-recourse debt.

The analysis shows that REITs typically start out with all of their debt as non-recourse secured debt. Consistent with the model, the firms that experience large enough growth to capture the diversification benefit of bundling collateral eventually use some recourse debt

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[4]In Triantis (1992) securing debt mitigates the asset substitution problem as the borrower cannot sell assets and reinvest the proceeds in more risky ventures without paying off the debt secured by the asset that is sold.

[5]Corporate level taxes also influence the mode of incorporation in Flannery et al. (1993).

(typically unsecured debt). When firms with all non-recourse debt access unsecured debt capital, they are left with significant amounts of unsecured debt which is consistent with a larger number of projects being bundled.

The estimates of a probit model indicate that the probability that a firm transitions from all non-recourse debt to some recourse debt financing is increasing in the size of the firm, increasing in the growth during the year and decreasing in leverage. The significantly positive relation between firm size and the probability the firm transitions to unsecured debt is consistent with the idea that firms must reach a sufficient size in order to realize the diversification benefits of bundling several projects as collateral for unsecured debt. The finding that firms are more likely to transition to unsecured debt financing in a year where they grow a lot suggests that they tend not to buy back secured debt. In fact, in the year the firm transitions to unsecured debt the average firm grows by nearly seventy percent and nearly all of the growth is financed with unsecured debt.

In some cases, firms that have transitioned to unsecured debt financing, use non-recourse secured debt to finance subsequent acquisitions. Estimates of a probit model show that firms with unsecured debt are more likely to finance future acquisitions with non-recourse secured debt if they are highly leveraged. This evidence is consistent with the predictions of the Stulz and Johnson (1985) model where firms finance additional investments with secured debt in order to mitigate the wealth transfer to existing lenders as the potential wealth transfers are larger when the firm is highly leveraged.

In summary, the model derives two central predictions about how the recourse structure of debt chosen by a firm varies with agency costs of debt inherent in the assets held by the firm and the number of assets. These predictions are supported by the analysis of REITs. The first prediction is that firms use non-recourse debt financing when debt related distortions to the incentives to invest in assets in place are small. While the potential debt related distortions to investment incentives are difficult to measure directly, industry commentary that (1) lower quality assets are bundled to support recourse debt and (2) non-recourse debt contracts provide tighter protective covenants support this prediction. The second prediction is that for assets like commercial real estate where non-recourse debt financing is attractive, recourse debt financing may be used by firms that have acquired a large number of assets. I document patterns in the mix of recourse and non-recourse debt by REITs that are consistent with this prediction.

I also show that REITs have nearly twice the financial leverage of industrial firms. This is somewhat surprising given (1) REITs do not pay corporate taxes on earnings distributed to shareholders (dividends) and hence debt financing does not have the tax advantage it does for industrial firms (see Howe and Shilling (1988)) and (2) REITs grew a great deal by acquiring assets during the sample period and the presence of growth options should mitigate the use of leverage. Our model provides an explanation for this finding. Specifically, our model suggests that REITs rely heavily on non-recourse debt because it eliminates the underinvestment problem with regard to asset purchases and REIT assets are not investment intensive. It follows that if non-recourse debt financing mitigates the major agency cost of debt, then firms that in equilibrium borrow on a non-recourse basis, REITs, should be more leveraged.

Debt Recourse and Investment Incentives

This section models the relationship between the recourse structure of debt (i.e., the mix of recourse and non-recourse debt outstanding) and the incentives to (1) acquire assets and (2) invest in the assets that have been acquired. After describing the set up of the model, the optimal debt recourse structure is shown in three different cases: (1) when the firm is acquiring assets that do not require investment to maintain the assets, (2) when the assets have been acquired and the borrower decides the level of investment to improve and/or maintain the assets, and (3) when the assets have been acquired and the borrower decides whether to change project risk. These results lead to a characterization of equilibrium outcomes where the nature of the firm's assets, growth options and the number of assets that have been acquired determine the optimal recourse structure.

Model Set-Up

Consider a firm with a fixed amount of equity capital and access to debt markets to finance the purchase of projects. The amount of equity is fixed in order to focus on the recourse structure of the debt. Incorporating taxes or asymmetric information to obtain an equilibrium amount of outside equity would needlessly complicate the model. The project opportunities arrive sequentially and have random payoffs that are uniformly distributed between V-B and V+B. There are no synergies between the assets: liquidating one asset does not impact the value of the other asset and thus the recourse structure of the debt does not impact the liquidation decision.[6] The expected payoff of the project is V, and B determines the volatility of the project payoff. The variance of the project payoff is $B^2/3$.

The debt financing can be either non-recourse secured debt or debt with recourse to the other assets. The results of this model are largely the same if the recourse debt is unsecured or secured (i.e., has a first lien on an asset). Thus for simplicity I assume that the recourse debt is unsecured and it has a *pari passu* claim on all unencumbered assets proportional to the face amount of the debt.

[6]Specifically, if there were synergies associated with the two projects, the firm would consider these synergies when deciding whether to liquidate the assets. At another level, if there are synergies between the assets, the notion that they are separate assets is reduced.

The sequence of events and information structure are as follows. At t=0, the first of two projects arrives. Each project is described by values for V and B. At t=1, the second investment opportunity (project) arrives. At t=2, the firm makes non-contractible investment choices on all acquired assets are made. The project outcomes are realized and the cash flows distributed to the lender(s) and the firm at t=3. All debt contracts mature at t=3 and do not make coupon payments. All agents are risk neutral and the risk free rate of interest is zero.

The firm makes two investment choices. First, it can expend resources to increase the net present value of the project. Specifically, it can increase the project V. Second, the firm can expend resources to alter the volatility of the project returns: change B. Since we are interested in how the recourse structure of the firm's borrowings impacts investment incentives (i.e., the returns to equity as V and B change) I do not needlessly complicate the model by specifying a cost function for changing V or B. A recourse strategy that results in a higher return to increasing V or lower return to increasing B provides better investment incentives than an alternative recourse structure where the returns to increasing V are lower or the returns to increasing B are higher.

Solving the three pieces of the model demonstrates the relative advantages of non-recourse and recourse debt. The first problem, the *acquisition strategy problem,* assumes that the V and B are fixed. Projects arrive at t=0 and t=1 drawn from a distribution of V and B. This allows us to isolate the impact of the recourse structure of debt on acquisition incentives.

The second part of the analysis, the *investment incentives problems,* derives the returns to the investment choices at t=2. First, the marginal return to the firm from increasing V with recourse debt and non-recourse debt are derived. Second, the firm's incentives to engage in asset substitution, the marginal value to the firm from increasing B, with recourse debt and non-recourse debt are derived.

Debt Recourse and Acquisition Incentives

Using non-recourse debt eliminates wealth transfers across lenders as assets are acquired. The value of the non-recourse debt depends only on the amount borrowed and the collateral. Subsequent acquisitions and how they are financed have no impact on the value of non-recourse debt outstanding. The agency costs of debt resulting from these wealth transfers are well known. An important issue for the equilibrium in this model is the extent to which the firm passes up positive NPV acquisitions with recourse debt.

I start with the following simple example where the firm invests $3 in equity and borrows $12 to finance a zero-NPV acquisition: a project that has an expected total payoff, or V, of $15. With B=10, a non-recourse lender would require a face amount of approximately $14.05 to have an expected return of zero. If a second project with the same parameter values arrives the next period, the firm could raise $3 in fairly priced outside equity and borrow $12 in fairly priced non-recourse debt purchase the project.

Alternatively, the firm could attempt to finance the first project purchase with recourse debt financing. With a correlation between the project payoffs of zero and assuming the lender knows the second project will be taken and financed with unsecured debt, the fair face value of recourse debt for the first project would be $12.54. When the second project arrives, the second lender would similarly provide $12 worth of recourse debt with a face amount of $12.54. Both lenders would have an expected return of zero and the firm would also have an expected return of zero given the project parameters. The next section shows that lower face value of the recourse debt ($12.54 versus $14.05 with non-recourse debt) induces better incentives to invest in the acquired assets.

However, it is not rational for the firm to invest in the second project. Passing up the zero-NPV second project results in a wealth transfer away from the original lender. Knowing the second project will not be taken, the fair face value of the original recourse loan is $14.05, the non-recourse face amount.

Extending the example above, assume the first project is financed with recourse debt and a non-negative NPV second project will arrive with certainty. However, the NPV of the project is uncertain: the second project V will be drawn from a uniform distribution between 15 and 20. All of this information is known to the first lender. Lending is perfectly competitive and the second lender will price the loan to have an expected NPV of zero considering the original loan and project. The firm only takes the second project if it increases the value of the equity stake. The equilibrium outcome is that the firm rejects all second period projects with V less than V* and V* equals $15.81. Although all projects with V>$15 are positive NPV on a standalone basis, the projects with values of V between $15 and $15.81 reduce the value of the equity stake: the wealth transfers to the original lender exceed the project NPV.

In this example, the firm knows the distribution of the second project's V and all projects have the same B. If the projects arrive with different mean returns (V) and return volatilities (B), then the moral hazard problem associated with recourse debt financing is considerably larger. The firm also has an incentive to pass up high V projects in order take lower V projects with high levels of B.[7]

[7]Chapter 3 shows that the priority of the first loan influences the moral hazard problem. Specifically, the extent of the underinvestment problem (passing up positive NPV) projects is identical if the original debt is secured or unsecured. However, the asset substitution problem (picking lower NPV projects that have large values of B) is mitigated, but not eliminated if the original debt is secured without recourse.

Considering only the acquisition incentives, non-recourse debt is the dominant contract. The case for recourse debt financing is shown in the next section when the investment decisions are endogenous. With recourse debt, firms chose levels of V that are closer to first best and have weaker incentives to spend resources to increase B.

Debt Recourse and Investment Incentives

The impact of the recourse structure of the firm's debt on investment incentives is shown by deriving the relation between the marginal return to the firm from investments that change the project's payoff distribution and the recourse structure of debt. The investment is made after two projects have been acquired. The recourse structure of the firm's debt liabilities only has an impact on investment decisions if the firm has more than one project. For simplicity, the two projects are assumed to be identical. The case where each project is financed by non-recourse secured debt is compared to the case where each project is financed by unsecured debt: the two assets serve as collateral for the unsecured debt.

Specifically, I compare the returns to the firm associated with an increase in V (the expected value of the project) and B (the volatility of the project returns) for two firms that both have acquired two projects. Rather than rationally price the debt, I assume each firm has the same face value of debt outstanding. This allows us focus on how the recourse structure of the debt influences investment incentives holding leverage constant.

From the setup described above, if each project is financed by non-recourse secured debt with a face value of F, the probability of solvency for each project is

$$1-\frac{F-(V-B)}{2B} \tag{1-1}$$

The lender receives F when the project is solvent and, on average, receives the midpoint of [V-B, F] when the project is insolvent. Therefore, the expected payment to the lender is

$$F\left[1-\frac{F-(V-B)}{2B}\right]+\left[\frac{F-(V-B)}{2B}\right]\left[\frac{F+(V-B)}{2}\right] \tag{1-2}$$

The firm receives V less the expected payment to the lender.

$$V-F\left[1-\frac{F-(V-B)}{2B}\right]-\left[\frac{F-(V-B)}{2B}\right]\left[\frac{F+(V-B)}{2}\right] \tag{1-3}$$

In the case where two projects are collateral for unsecured debt, I assume the project payoffs are uncorrelated assets for tractability. However, the qualitative results hold for any correlation less than one. If the two projects are perfectly correlated, there is no distinction between non-recourse debt and bundling the collateral (i.e., using unsecured debt). The total payoffs to the first and second projects are drawn from uniform distributions between V_1-B_1 and V_1+B_1 and between V_2-B_2 and V_2+B_2. Together, the two projects have a total payoff drawn from a symmetric triangular distribution with a minimum at V_1-B_1+V_2-B_2 and a maximum at V_1+B_1+V_2+B_2. For simplicity, I assume that each project is expected to be solvent: $F<V$ for each project. The probability of solvency for a firm with unsecured debt against both projects is

$$1-\frac{[(F_1+F_2)-(V_1+V_2)+(B_1+B_2)]^2}{2(B_1+B_2)^2} \tag{1-4}$$

Conditional on solvency, the lenders receive a total of F_1+F_2. Thus, the probability of solvency times the payoff when solvent is

$$(F_1+F_2)\left[1-\frac{[(F_1+F_2)-(V_1+V_2)+(B_1+B_2)]^2}{2(B_1+B_2)^2}\right] \tag{1-5}$$

Likewise, the probability of insolvency times the expected payoff conditional on insolvency is

$$\frac{2(F_1+F_2)^3-3(F_1+F_2)^2(V_1+V_2-B_1-B_2)+(V_1+V_2-B_1-B_2)^3}{6(B_1+B_2)^2} \tag{1-6}$$

The total payoff to the lenders is

$$(F_1+F_2)\left[1-\frac{[(F_1+F_2)-(V_1+V_2)+(B_1+B_2)]^2}{2(B_1+B_2)^2}\right]+\frac{2(F_1+F_2)^3-3(F_1+F_2)^2(V_1+V_2-B_1-B_2)+(V_1+V_2-B_1-B_2)^3}{6(B_1+B_2)^2} \tag{1-7}$$

The manager receives the total expected payoff less the expected payoff to the lender from 1-7 above.

$$(V_1+V_2)-(F_1+F_2)\left[1-\frac{[(F_1+F_2)-(V_1+V_2)+(B_1+B_2)]^2}{2(B_1+B_2)^2}\right]-\frac{2(F_1+F_2)^3-3(F_1+F_2)^2(V_1+V_2-B_1-B_2)+(V_1+V_2-B_1-B_2)^3}{6(B_1+B_2)^2} \tag{1-8}$$

Differentiating 1-3 with respect to V yields the marginal value to the firm of increasing the project's expected payoff with non-recourse secured debt financing.

$$\frac{B-F+V}{2B} \tag{1-9}$$

With unsecured debt, differentiating (8) with respect to V_1 gives:

$$1-\frac{(F_1+F_2)(F_1+F_2-V_1-V_2+B_1+B_2)}{(B_1+B_2)^2}+\frac{3(F_1+F_2)^2-3(V_1+V_2-B_1-B_2)^2}{6(B_1+B_2)^2} \tag{1-10}$$

The partial derivatives of the payoff to the firm from increasing the mean project payoff of one project are larger in the recourse (unsecured) case than in the non-recourse secured case for all plausible parameter values. It follows that unsecured debt financing (bundling the collateral) improves the firm's incentives to invest in its assets in place.

The intuition behind why investment incentives are better when the collateral is bundled is straightforward. When two less than perfectly correlated projects are bundled, the probability of default on the unsecured debt is lower than the probability of default with two separate non-recourse debt financed projects holding the total face value of debt constant. Thus, the returns to the firm of increasing the expected return to the project are greater as the wealth transfer to the lender is smaller. Further, the improved investment incentives with recourse debt grow with the number of uncorrelated assets the firm owns.

The idea that combining two less than perfectly correlated assets lowers the probability of default for a given amount of debt dates back to Lewellen (1971) who argues that conglomerate mergers could generate value by increasing debt capacity. The point that debt capacity is enhanced because investment distortions are lower for a given level of debt when two assets are combined is also made by Flannery et. al. (1993) in a model where a firm decides whether to jointly or separately incorporate two assets. The point here is that these potential improvements in investment incentives are lost when the firm uses non-recourse debt to finance its assets.

Debt Recourse and Technology Choice Incentives

Risky debt creates the potential for the asset substitution problem because the firm has an incentive to increase the risk of the asset returns in order to transfer wealth from existing lenders. Changing B changes the variance of the payoff without changing the expected payoff. Differentiating 1-3, the expected payoff to the firm with non-recourse secured debt financing, with respect to B yields

$$\frac{(B-F+V)(F-V+B)}{4B^2} \tag{1-11}$$

Differentiating 1-8, the payoff to the firm with recourse (unsecured) debt financing, with respect to B_1 gives:

$$\frac{(2F_1+2F_2-2V_1-2V_2-B_1-B_2)(F_1+F_2-V_1-V_2+B_1+B_2)^2}{-6(B_1+B_2)^3} \tag{1-12}$$

The partial derivative of the payoff to the firm from increasing the variability of the project payoff of one project is smaller in the unsecured case than in the secured case for all plausible parameter values. It follows that using unsecured debt reduces the firm's incentive to pursue activities that increase the variance of the project payoff.

The intuition behind why recourse debt financing (bundling the two projects) lowers the incentive to increase asset volatility is more subtle. When two less than perfectly correlated assets are bundled, the expected wealth transfer away from bondholders associated with an increase in the volatility of returns to either asset is smaller. The borrower walks away from the poorly performing asset when it is financed by non-recourse debt. When the asset performs poorly and is bundled with another asset, in many states of the world the other asset performs sufficiently well that the borrower has no incentive to default. Two related implications of this analysis are (1) assets that can be transformed relatively easily are not good collateral for non-recourse (project) debt financing and (2) debt covenants limiting what can be done with the collateral will be much more restrictive with non-recourse project financing.

Equilibrium Recourse Strategies

The analysis shows that non-recourse debt financing provides better acquisition incentives than recourse debt financing. However, recourse debt financing provides (1) better incentives to invest in the assets in place and (2) limits incentives to engage in negative NPV increases in the volatility of the project returns. Using non-recourse debt versus recourse debt trades better acquisition incentives off against the better ongoing investment incentives of using recourse debt.

The intuition behind the equilibrium outcomes in this model are easily returning to the numerical example in the *Debt Recourse and Acquisition Incentives* section. Assume that when the first asset purchase is financed with either recourse debt or non-recourse debt the second asset is financed with same type of debt. Later I show that if the first asset is financed with recourse debt then there is no gain from financing the second asset with non-recourse debt and if the first asset is financed with non-recourse debt then there is no gain from financing the second asset with recourse debt. In the numerical example, all positive NPV projects (V> \$15) are taken with non-recourse debt and only projects with V > \$15.81 are taken with recourse debt.

Focusing only on the level of V (ignoring B for simplicity), suppose that the levels of V in this example reflect the level of investment made with non-recourse debt. The value of both assets is higher if they are both financed by recourse debt and the gain in value from using recourse debt is larger when the assets are *investment sensitive.* Now suppose when *both assets* are financed with recourse debt, the value each project is \$0.41 higher than with non-recourse debt. In this case, all projects that are taken with non-recourse debt (V > $15) are taken with recourse debt financing as well. With recourse debt financing the project with V = $15 is also undertaken by the recourse lender because the marginal value of the second project is worth $15.82 to the recourse debt borrower (the V of the second project is effectively $15.82) and the recourse debt borrower takes all projects with V > $15.81.

When it is rational to purchase all positive NPV second assets, there is no cost to using recourse debt as (1) both projects are undertaken, (2) the debt is priced assuming both projects are undertaken and (3) the firm captures the better investment incentives associated with recourse financing. In fact, it is the better investment incentives that make the second asset purchase rational.

If recourse debt financing increases each project value by at least $0.41, then recourse debt obviously dominates non-recourse debt. Likewise, if recourse debt has a small impact on project values, the expected losses from passing up positive NPV projects exceeds the expected enhancement to project values. Thus, recourse debt financing occurs when the assets are sufficiently investment sensitive.

Since non-recourse debt is only used to finance assets with low investment sensitivity, one would expect firms that use non-recourse debt financing to be highly leveraged. Non-recourse debt financing is used by firms that have small investment sensitivity so the agency costs of debt financing with regard to investments in the asset are small. Non-recourse debt financing eliminates the agency costs of debt with regard to acquisition incentives. Thus, the agency costs of debt are lower for all levels of debt for firms that in equilibrium choose non-recourse debt and leverage should also be higher for firms that choose non-recourse debt.

If the first asset is purchased with non-recourse debt financing, in this two asset example, the second asset is de facto non-recourse debt financing because there is only one asset available to pledge as collateral. More importantly, in this equilibrium, if the firm financed the purchase of the first asset with recourse debt, it would not purchase the second asset with non-recourse debt because then there would be no improvement in investment incentives associated with bundling the collateral. However, if over time, perhaps as the result of poor operating performance, the firm's leverage became higher than expected at the time the initial debt financing was arranged, the firm might use non-recourse debt financing to limit the wealth transfer to the original lender. This point is made by Stulz and Johnson (1985).

The firm that finances its asset purchases with non-recourse debt might convert its non-recourse debt to recourse debt as the probability the firm expects to purchase more assets in the future falls since the role of non-recourse debt is to provide better incentives. Likewise, as the firm acquires assets using non-recourse debt financing, it may find it optimal to bundle some of the assets as collateral (particularly investment sensitive assets). Since the improved incentives to invest in the asset and limited incentives to increase asset volatility associated with recourse debt occur because of the diversification effect of bundling uncorrelated assets, these benefits are increasing in the number of assets the firm owns.

The optimal recourse structure of the debt would be a mix of recourse and non-recourse debt. As the firm uses recourse debt to buy back non-recourse debt, it enjoys benefits from improving the investment incentives on the assets pledged as collateral for the recourse debt but increases the underinvestment problem. Provided that the firm expects to continue purchasing assets, an internal optimal mix of recourse and non-recourse debt will exist for firms that initially start out with non-recourse debt. Obviously, the firm will pledge the most investment sensitive assets as collateral for the recourse debt.

It is important to note that the optimal recourse structure for firms that start out with non-recourse financing is either (1) all non-recourse debt or (2) a mix of non-recourse debt and a sufficiently large amount of recourse debt (assets pledged as collateral for recourse debt) to realize significant benefits of bundling the collateral. Put another way, as the firm uses more recourse debt to buy back more non-recourse debt, the benefits of bundling the initially grow at an increasing rate with the number of assets pledged as collateral for recourse debt. This is an important testable prediction of the model. I would expect that firms in an industry that uses non-recourse debt will either have (1) all non-recourse debt or (2) a mix of recourse and non-recourse debt with a significant proportion of the debt non-recourse. Further, small firms with few projects will be more likely to have all non-recourse debt and firms with several projects will be more likely to have a mix of recourse and non-recourse debt.

The size of the transaction costs associated with buying back secured debt play an important role in how the firm that starts with all non-recourse debt "transitions" to using recourse debt. If the costs of buying back the debt (including the lenders ability to extract rents by holding out) are large, the firm is less likely to transition to recourse debt by buying back the debt. However, if the firm purchases several assets in one period, the firm can effectively use recourse debt without buying back non-recourse debt. The transactions costs associated with repurchasing the debt are likely to be increasing in the risk of the debt because the bargaining space is limited by the firm's ability to buy the bonds at par. The non-recourse lender is able to extract some rents from the borrower when the debt is repurchased. Thus, the potential amount the non-recourse lender can extract increases with the risk of the debt. Thus, I would expect (1) highly leveraged firms to be less likely to transition to recourse debt financing because of the potential wealth transfers, and (2) firms that grow a lot in particular period to be more likely to transition to recourse debt financing.

Recourse Strategies: Evidence from Real Estate Investment Trusts

This section provides an empirical examination of the recourse structure of REIT debt. I focus on Real Estate Investment Trusts because it is an industry with a large number of publicly traded firms and an industry that relies significantly but not exclusively on non-recourse debt financing. Specifically, while REITs may have both secured and unsecured debt, virtually all of the secured debt is mortgages (non-recourse secured debt) against specific income earning properties (see Moody's Investor Services (2002)). While the recourse of the debt is not explicitly stated in SEC filings, our spot check of REIT 10-K filings reveals that most of the secured debt is listed as either mortgage debt or trust deed debt – both of forms of non-recourse debt. Less commonly, the filings explicitly indicate that the secured lender does not have recourse to other assets of the firm. Project financing is mostly a source of debt capital for private firms (see Esty and Sesia (2005)). REITs are the only public firms, and hence have systematic data available on the recourse structure of the entity's debt, that I am aware of that borrow extensively on a non-recourse basis.

Real Estate Investment Trusts and Their Debt Contracts

Since they were initially created under the tax code, REITs allow broad ownership of real estate with deferred corporate taxes if the majority of income is paid as dividends to shareholders. REITs engage in two broad lines of business: owning equity interests in real estate and owning mortgages and mortgage-backed securities. Our analysis eliminates REITs that hold exclusively mortgages in their asset portfolio: mortgage REITs. Instead I focus on REITs that own income producing commercial real estate: equity REITs.[8] The Tax Reform Act of 1986 made key changes in REIT legislation, facilitating a fundamental shift in the business activities of REITs. Before 1986, REITs were essentially passive holding vehicles for real estate and real estate mortgages. After the tax law change, REITs were allowed to actively manage and operate the real estate they owned. By the early 1990s, nearly all REITs actively managed their real estate holdings and hence our analysis focuses on this time period.

The nature of the business of REITs and the assets they hold fit the model conditions for firms that would borrow on a non-recourse basis. First, REITs have grown rapidly through the acquisition of real estate assets held by private investors (see Riddiough and Wu (2006)). With REITs natural advantage of raising capital in liquid public markets, such growth was not surprising and was probably anticipated by managers. Thus, REIT borrowers would naturally value the improved acquisition incentives associated with non-recourse debt financing. Second, the REIT assets are distinct projects with very little synergies across the assets. Thus, the REIT has limited concerns about any lost synergies that might occur when a secured lender forces the liquidation of an asset.

Third, commercial real estate is not an investment intensive asset in the context of this model and thus the diminished incentives to maximize the value of the asset through investments to maintain the asset are less problematic in commercial real estate. Commercial real estate requires significant investment to maintain the asset. However, such investment is easily contractible. For example, Ling and Archer (2005) report that non-recourse lenders require borrowers to set aside funds each year (typically $250 per year for apartment units and $0.15 per

[8]Health-care and lodging REITs are excluded, as is common, because these tend to operate in fundamentally different ways than REITs owning all other types of property.

square foot of industrial, office or retail space) in a reserve account. The accumulated balances in these reserve accounts are used to fund non-recurring capital costs like replacements of (1) carpets, (2) roofs and (3) air conditioning. Further, the models of Brown, Ciochetti and Riddiough (2006) and Williams (2001) explain the stylized fact that REITs are more likely to own assets that are not investment sensitive while private owner-managers own the investment intensive assets.

An important aspect of our model is the predicted relation between the recourse structure of debt and the borrower's incentives to modify the technology. Modifying the technology in the context of commercial real estate is referred to as "repositioning" the asset. The limitations on reconfiguring commercial real estate assets observed in debt contracts are consistent with the model. Specifically, there are much stronger restrictions on reconfiguring assets in non-recourse debt financing and this is an important drawback to non-recourse debt financing. A discussion of the merits of secured (non-recourse) versus unsecured debt financing by Moody's Investors Service (2002) specifically mentions (1) the prevalence of restrictive covenants in secured debt contracts and (2) the lost flexibility associated with these restrictions:

> mortgage agreements typically inhibit or restrict the ability of an owner to reposition properties, if it results in cash flow disruption. In addition, secured lenders may balk at an owner reformatting a property, such as reconfiguring and expanding space, even if it desperately needs it, if doing so entails ejecting key tenants. These factors can make the mortgaged asset less attractive to a buyer, thus impairing asset liquidity and constraining a firm's ability to strategically reposition or even manage its portfolio. REITs that fund with unsecured debt do not face these challenges. REITs consistently tell us that this strategic flexibility issue is one of the biggest drawbacks of mortgage debt.

These points are consistent with our model's prediction that the incentives to modify assets in a manner that transfers wealth away from lenders are greater with non-recourse debt financing. Thus, it follows that we would expect, as observed, tighter covenant restrictions on asset repositioning in non-recourse debt contracts.

The same report goes on to state that the nature of the assets influences whether they are financed with non-recourse or recourse debt:

> The best assets tend to get mortgaged, with the weaker ones left unencumbered to support the unsecured bonds. This happens because it is more efficient to pledge high quality assets.

Asset quality refers to the cash flows generated from the asset and the likelihood that these cash flows will be maintained (see Ling and Archer (2005)). High quality assets are located in strong markets and have long term leases with tenants that are unlikely to default on the lease. Further, the age of the building is important. High quality assets are new buildings with modern designs that are unlikely to require a reconfiguration to attract tenants in the future. Further, Avalon Bay's 10-K filing for 2002 reports "We expect to continue to fund development costs…from retained operating cash and borrowings under the unsecured credit facility (p.48)." Avalon Bay uses unsecured (recourse debt) to fund investment in real estate assets that are being developed (investment intensive assets) and funds stabilized assets with non-recourse mortgage debt.

The observed relationship between asset quality and debt recourse is consistent with the model in two regards. First, the model suggests that it is inefficient to use non-recourse financing when non-contractible investments are likely to be required. Thus, the model suggests it is inefficient to fund lower quality assets with non-recourse debt as they are likely to require investments to reconfigure the asset in the future and it is difficult to write a debt contract ex-ante that specifies that the borrower will engage in the optimal reconfiguring of the asset. Second, the returns to low quality assets are more variable and idiosyncratic as the asset cash flows depend on local market dynamics. Thus, the diversification benefit of bundling the collateral (using these assets to support unsecured, non-recourse, debt) is higher for low quality assets.[9]

Sample Description and Summary Statistics

This section describes the sample of REITs that are used in the analysis of the recourse structure of REIT debt. This section also compares the usage of secured debt and leverage of REITs to industrial firms. The mix of secured and unsecured borrowing by firms is initially examined using annual COMPUSTAT data from 1990 through 2003. I compare equity REITs, excluding healthcare and lodging REITs, to industrial firms: SIC codes from 2000 through 5999. Data are available from COMPUSTAT to calculate leverage ratios for industrials for 63,662 firm-years and for REITs for 1,277 firm-years. Calculating secured debt to total debt ratios reduced the available firm-years to 55,493 for industrials and 1,202 for REITs because the secured debt ratio is undefined for firms with no debt. Those observations, which have a leverage ratio of zero, are included in the data for calculating descriptive statistics about leverage ratios, but not in the data for calculating descriptive statistics about secured debt ratios.

Book leverage is defined as the sum of Total Long-Term Debt (Item 9) and Debt in Current Liabilities (Item 34) divided by Total Assets (Item 6). The numerator is adjusted by Debt Due in One Year (Item 44) when a footnote flag indicates that Item 44 is included in Item 9. Because Item 44 is a part of Item 34, failing to make this adjustment double counts debt due in one year. The secured debt ratio is defined as Secured Debt and Mortgages (Item 241) divided by total debt. Total debt is the numerator from the debt ratio calculation.

Before presenting the comparison of REITs and industrial firms it is important to note that our subsequent analysis of REIT debt seniority strategies incorporates data available from the

[9] I thank David Ling for raising this point.

SNL DataSource to calculate the secured debt ratio and to add some firms that do not have COMPUSTAT data. The initial comparison of REITs and industrials relies on COMPUSTAT data for comparison. Later, I combine the SNL DataSource and COMPUSTAT because the COMPUSTAT data tends to understate the ratio of secured debt to total debt.[10] However, this bias is relatively small and does not qualitatively impact the summary statistics presented in Table 2-1.

As shown in Table 2-1, the mean (median) leverage of 47.4% (48.4%) of REITs is much greater than the mean (median) leverage of 27.5% (22.4%) for industrial firms. The usage of secured debt shows a dramatic difference in the recourse structure of debt: REITs have median secured debt to total debt ratio of 78.1% versus 16.3% for industrial firms and REIT secured debt is generally non-recourse while the secured debt of industrial firms has recourse to other assets. Information about whether secured debt has recourse to the other assets of the firm is not indicated by COMPUSTAT. However, as mentioned above it is widely known that the secured

[10] Both SNL DataSource and COMPUSTAT report total debt and secured debt but the definitions are not identical. The SNL DataSource definition does not include mandatorily redeemable preferred stock in its debt measures while COMPUSTAT does. For most firm-years, the debt ratios calculated using SNL DataSource and COMPUSTAT are the same within one-tenth of one percent. Spot checking 10-K filings for firm-years where there were larger disagreements traced differences to (1) treatment of mandatorily redeemable preferred stock, (2) issues with short-term debt or (3) very rarely, legitimate ambiguity of classification in the original filing. SNL DataSource defines secured debt as being debt backed by real property while COMPUSTAT includes debt backed by letters of credit and similar instruments. The SNL DataSource data includes all secured debt backed by real property, regardless of maturity, while COMPUSTAT only includes long-term secured debt. There is no direct measure of short-term secured debt in COMPUSTAT. Comparing secured debt ratios across SNL DataSource and COMPUSTAT resulted in more frequent disagreements of material magnitude. The differences overwhelmingly came from the values for secured debt. The most common difference is that SNL DataSource would reflect a firm-year having a secured debt ratio of 100% and COMPUSTAT would reflect a lower number. Commonly, this difference would be would be exactly explained if COMPUSTAT’s Debt in Current Liabilities was added to COMPUSTAT’s Secured Debt and Mortgages. Spot-checking 10-K filings overwhelming verified this explanation.

debt of REITs generally does not have recourse to other assets. Non-recourse secured debt financing by industrial firms is very rare (see Esty and Sesia (2005)).

The fact that REITs are more leveraged than industrial firms is not consistent with traditional models of leverage: (1) REIT debt financing does not have the tax advantage it does for industrial firms because REITs do not pay corporate taxes on earnings distributed to shareholders as dividends and, and (2) REITs grew a great deal by acquiring assets during the sample period and the presence of growth options has been shown to reduce leverage in numerous studies. Our model suggests that REITs rely heavily on non-recourse debt because (1) it virtually eliminates the underinvestment problem associated with acquisitions and (2) REIT assets are not investment intensive. It follows that if non-recourse debt financing mitigates the major agency cost of debt, then firms that in equilibrium borrow on a non-recourse basis, REITs, should be more leveraged.

Evolution of the Recourse Structure of REIT Debt

This analysis examines the model predictions regarding how the recourse structure of REIT debt evolves over time. In this analysis, I rely exclusively on data from the SNL DataSource because the treatment of secured debt is more accurate than COMPUSTAT. Using the SNL DataSource, the sample grows to 1,440 firm years of data from 146 different firms. The model predicts that firms that have assets that are likely to be funded with non-recourse debt, will start out using non-recourse debt financing and may use some unsecured debt when they have a sufficiently large number of assets to realize the diversification benefits of bundling unencumbered collateral to support non-recourse debt.

Our analysis uses the IPO year as the year the firm starts out. Our sample of REITs includes some firms that accumulated assets in the 1960s and 1970s and that have been publicly traded for decades although most of the sample REITs went public in the 1990s. As noted in the discussion of REITs, the industry took its present shape in the early 1990s both through new REIT offerings and through the transition of REITs from older-style passive holding vehicles to the present form of owners and managers of real assets. Firms with IPO dates before 1990 are treated as having conducted their IPOs in 1990.

Table 2-2 shows the recourse structure of REIT debt for a sample of 146 REITs by year relative to the IPO. Consistent with the model of firms acquiring assets with secured debt and transitioning to unsecured debt to improve investment incentives, REITs often start out with only secured debt. Among firms with a defined secured debt ratio reported in the year prior to the IPO, 35 (75%) are entirely secured or have *de minimis* unsecured debt while only 12 have more than 5% of their debt unsecured. At the end of the IPO year, 62% of the firms with debt are entirely secured.

Two patterns emerge. First, the fraction of firms with all of their debt secured shrinks steadily in the years immediately following the IPO. Second, beginning in the year of the IPO, the mean size of the firms using unsecured debt is much larger than that of firms using only secured debt. Consistent with the model's prediction that firms will transition to recourse debt when they become sufficiently large, only 34% of firms are using only secured debt four years after the IPO. In that year, the mean size of secured firms is $594 million while the mean size of firms using unsecured debt is $1,833 million.

The firms that do not rely exclusively on non-recourse debt have considerable amounts of unsecured debt outstanding. The mean percentage of total debt that is secured, conditional on not relying entirely on secured debt, is around 50%. Consistent with model, firms either rely exclusively on secured debt financing or have a sizeable amount of unsecured debt outstanding. The advantage of using unsecured debt in this model comes from the having a diversified set of projects serving as collateral for the unsecured debt. This advantage is only realized when a large number of projects serve as collateral for the unsecured debt. Thus, our model predicts that firms will use large amounts of unsecured debt when they deviate from using all secured debt.

Analysis of Recourse Structure Transitions

The data presented in Table 2-2 indicate that REITs typically initially borrow on a non-recourse basis. At some point, some these firms borrow on an unsecured basis. The following analysis looks more closely at these recourse structure transitions. Specifically, the firm-year observations are coded according to whether the firm's debt was (a) entirely secured or (b) had some unsecured debt.[11] The 1165 firm-years with necessary data are broken down into four categories:

- **all non-recourse secured** observations: firm-years where the firm's debt was entirely secured (391 firm years),
- **event year** observations: 92 firm-years where the firm has some recourse debt in it's capital structure and had all non-recourse debt the prior year (i.e., the firm transitioned into borrowing on an unsecured basis),
- **post-event** observations: 655 firm-years following an *event year* where the firm continued to use at least some unsecured debt,
- **second event** observations: 27 firm-years where a firm transitioned back to borrowing exclusively on a non-recourse basis after having used at least some unsecured debt.

Table 2-3 presents mean and medians for each of the four categories for leverage (total debt to total assets), secured debt ratio (secured debt to total debt), the percent change in the total dollar amount of secured debt outstanding from the year prior and the percent change in total

[11] A firm with a nominally unsecured line that was small relative to either the size of the firm or the value of a single asset is characterized as having all of its debt secured.

assets from the year prior. By construction, the percentage of the debt that is secured is 100% for the *all non-recourse* and *second event*, observations and less than 100% in the other categories.

Consistent with the model prediction that the advantages of unsecured debt result from the diversification effect of bundling assets, the transition to unsecured debt financing leaves firms with a significant amount of unsecured debt. The mean proportion of the debt that is unsecured is 31.3% at the end of the year of the transition to unsecured debt financing. By definition 100% these firms' debt was secured at the prior year end. The nature of the transition to using unsecured debt suggests that the transactions costs associated with retiring secured debt are high. During the year in which firms' transition to using unsecured debt, the median change in the value of secured debt is 1.7%. Most firms do not buy back any non-recourse secured debt. However the median change in total assets is 44.4%. Thus, the typical firm transitions to recourse debt financing by financing the purchase of a large number assets with unsecured debt.

The results of a systematic analysis of the factors that influence the probability that a firm transitions to using unsecured debt are reported in Table 2-4. Specifically I estimate a probit model that includes all the observations (483 firm-years) where the firm started the year with all non-recourse secured debt. These firms are assigned the value of one if they transition to unsecured debt during the year and zero if their debt remains entirely non-recourse secured. If firms transition to unsecured debt to take advantage of the diversification effect of unsecured debt then we should expect the likelihood of a transition to using unsecured debt to be positively related to the firm size as firm size is a proxy for the number of projects. Recognizing that some firms may find it costly to retire their secured debt we would expect that the likelihood of a transition to using unsecured debt to be positively related to growth during the year (the percent change in firm size) and leverage. If the firm is more leveraged, the secured debt is riskier and the cost of buying back the debt should be higher. The probit model includes year and property-type dummy variables as control variables.

The results of the probit analysis reported in Table 2-4 are consistent with the predictions of the model. The coefficients on the firm size and change in firm size variables are positive and statistically significant at the 1% and 5% levels respectively. The coefficient on the leverage variable is negative and significant at the 1% level.

Secured Debt Financing and the Underinvestment Problem

The final analysis uses this data to test the implications of the Stulz and Johnson (1985) model. Stulz and Johnson (1985) show that financing an investment with secured debt when the firm has unsecured debt outstanding mitigates the underinvestment problem by avoiding wealth transfers to existing unsecured lenders. It follows that firms with more financial leverage have a greater debt overhang problem and thus a greater incentive to finance acquisitions with secured debt.

I test this conjecture by estimating a probit model on the sample of all firms that start a particular year with at least some unsecured debt. The sample includes the 646 firm-years where the firm started the year with some unsecured debt. These firms are assigned the value of one if they increase the fraction of their debt that is secured debt and zero if they reduce the fraction of their debt that is secured. The explanatory variables include the firm's financial leverage and the fraction of the firm's debt that is secured and year and property type dummy variables.

The results reported in Table 2-5 support the predictions of the Stulz and Johnson (1985) model. The probability that a firm increases its reliance on secured debt financing is an increasing function of its leverage at the start of the year. The leverage variable is positive and statistically significant at the 1% level. Firms with large amounts of leverage face a greater debt overhang problem and they mitigate this problem by financing additional investments with secured debt.

Conclusion

I provide a model of the choice between non-recourse secured debt and recourse debt (unsecured debt or secured debt with recourse) by firms that are sequentially acquiring assets and then making investment choices once those assets have been acquired. Non-recourse secured debt financing eliminates the underinvestment problem. However, unsecured debt provides superior post-acquisition incentives for owners of assets that might require non-contractible ongoing investment or that can be easily modified. Specifically, with unsecured debt the individual projects are bundled as collateral. Bundling the collateral lowers the face value of the debt and improves incentives to invest in the assets in place. When the collateral is bundled the incentives to modify the assets in place (asset substitution) are reduced.

The relative merits of recourse and non-recourse debt lead to the prediction that non-recourse debt is optimal for firms engaged in the acquisition of assets which have little need for non-contractible ongoing investment. Consistent with this prediction REITs use significant amounts of non-recourse secured debt. Since the advantages of using unsecured debt increase with the number of projects that are bundled as collateral, the model predicts that firms which find non-recourse secured debt financing optimal will transition to unsecured debt when they acquire a sufficient number of assets.

The recourse structure, mix of recourse and non-recourse debt, of Real Estate Investment Trusts, publicly traded entities that use significant amounts of non-recourse debt, are shown to be consistent with this model along several dimensions. Consistent with the borrower’s stronger incentive to modify the asset, industry commentary indicates that covenant protection is considerably tighter in commercial real mortgage contracts (non-recourse secured financing) relative to REIT unsecured debt contracts and that the resulting limited operating flexibility is a drawback to non-recourse financing. Further industry commentary indicates that higher quality assets are financed with secured debt while lower quality assets provide the collateral for unsecured debt. Lower quality assets (1) are much more likely to require non-contractible investment to reposition the asset (the model shows that investment incentives for these kinds of investments are distorted with non-recourse debt financing) and (2) have returns driven by idiosyncratic factors and thus benefit from the diversification effects of bundling the collateral.

The formal statistical analysis provides additional evidence consistent with the model. First, most REITs go public with all non-recourse secured debt. Second, when firms transition to unsecured debt they end up with a large amount of unsecured debt so as to capture the diversification benefits of bundling the collateral. Third, the probability that a firm transitions to unsecured debt financing is increasing in the size of the firm, the growth during the year and decreasing in leverage. The fact that firms are more likely to transition to unsecured debt financing in year were they grow a lot and when they are not highly leveraged is consistent with the notion that it is expensive to buy back secured debt when the firm is highly leveraged.

Finally, I show that firms with unsecured debt outstanding are more likely to borrow in the future using secured debt if they are highly leveraged. This evidence is consistent with the predictions of the Stulz and Johnson (1985) model. Firms finance additional investments with secured debt in order to mitigate the wealth transfer to existing lenders and the wealth transfer is larger when the firm is highly leveraged.

Table 2-1. Summary leverage and secured debt to total debt statistics for REITs and industrial firms.

	N	Mean	Std. dev.	Percent at min.	25^{th} pctile.	Median	75^{th} pctile.	Percent at max.
Industrials total debt to total assets	63,662	27.5%	26.2%	12.9%	4.6%	22.4%	40.9%	3.7%
REITS total debt to total assets	1,277	47.4%	23.1%	5.9%	36.1%	48.4%	61.9%	2.4%
Industrials secured debt to total debt	55,493	33.0%	36.2%	28.0%	0.0%	16.3%	65.0%	3.6%
REITS secured debt to total debt	1,202	66.8%	32.5%	4.9%	40.6%	78.1%	96.5%	8.1%

Data is for the 1990 to 2003 timeframe and is drawn from COMPUSTAT. Firms with no total debt have undefined secured debt to total debt ratios. The industrial firms are all firms with a current SIC code (DNUM) between 2000 and 5999 with data available to calculate the ratios. There are 63,662 firm-year observations for which leverage ratios can be computed and 55,493 firm-year observations for which secured debt to total debt ratios can be computed for industrials. For REITs, there are 1,277 firm-observations for leverage ratios and 1,202 observations for secured debt to total debt ratios. Ratios greater than 100% are set equal to 100%.

Table 2-2. Evolution of the recourse structure of REIT debt.

	Leverage (TD/TA)			Secured debt ratio (SD/TD) conditional on SD/TD>=95%				Secured debt ratio (SD/TD) conditional on SD/TD<95%				
	N	Mean leverage	Median leverage	N	Mean secured debt ratio	Median secured debt ratio	Mean total assets ($mm)	N	Mean secured debt ratio	Median secured debt ratio	Mean total assets ($mm)	Percent of firms all secured
Pre-IPO	49	69.0%	58.9%	35	99.5%	100.0%	933.7	12	63.8%	87.0%	464.5	74.5%
IPO	146	40.5%	40.8%	84	99.9%	100.0%	409.9	51	56.9%	62.2%	748.2	62.2%
IPO+1	145	45.1%	46.4%	82	99.7%	100.0%	433.5	59	55.9%	58.7%	1,077.0	58.2%
IPO+2	141	46.0%	46.2%	68	99.5%	100.0%	452.6	67	56.2%	58.8%	1,127.7	50.4%
IPO+3	129	45.2%	47.6%	53	99.6%	100.0%	597.0	72	47.8%	51.9%	1,383.4	42.4%
IPO+4	127	46.5%	47.5%	41	99.7%	100.0%	594.0	80	47.0%	46.8%	1,833.0	33.9%
IPO+5	124	46.9%	47.0%	41	99.5%	100.0%	472.0	77	47.7%	45.8%	2,298.8	34.7%
IPO+6	118	49.7%	48.8%	42	99.7%	100.0%	559.4	71	45.1%	40.7%	2,585.8	37.2%
IPO+7	105	49.5%	49.2%	36	99.4%	100.0%	800.6	65	44.2%	39.0%	2,146.0	35.6%
IPO+8	89	52.3%	51.7%	28	99.4%	100.0%	789.6	59	41.1%	33.8%	2,535.0	32.2%
IPO+9	87	51.5%	52.5%	26	99.4%	100.0%	863.0	59	43.4%	38.2%	2,739.6	30.6%
IPO+10	61	52.0%	53.5%	18	99.7%	100.0%	796.0	41	45.0%	37.1%	2,718.4	30.5%
IPO+11	42	48.3%	51.4%	19	99.8%	100.0%	990.9	22	43.6%	35.9%	2,248.3	46.3%
IPO+12	40	49.7%	53.6%	14	99.7%	100.0%	662.7	25	50.3%	50.4%	2,589.0	35.9%
IPO+13	37	48.6%	52.0%	16	99.5%	100.0%	679.7	19	46.4%	47.7%	3,170.7	45.7%
All Firm-Years	1,440	47.9%	48.7%	603	99.6%	100.0%	595.3	779	48.3%	47.0%	1,959.2	43.6%

Descriptive statistics for leverage ratios and secured debt to total debt ratios are drawn from SNL DataSource for equity REITs excluding healthcare and lodging. Statistics are reported relative to the IPO year, which is set to 1990 for firms that went public prior to 1990. Leverage ratios are reported for all the firms in the sample. Secured debt ratios are only reported for firms with positive leverage. The percentage of the debt that is secured (secured debt ratio) is reported for the full sample and for the sub-sample of firms that do not rely exclusively on secured debt.

Table 2-3. Recourse structure transitions.

		Leverage (TD/TA)		Secured debt ratio (SD/TD)		Change in secured debt		Change in total assets	
	N	Mean	Median	Mean	Median	Mean	Median	Mean	Median
All secured	391	52.5%	52.4%	99.3%	100.0%	12.3%	5.7%	24.9%	9.8%
Event year	92	46.5%	44.7%	68.7%	75.1%	9.0%	1.7%	69.1%	44.4%
Post-event	655	49.6%	48.6%	46.3%	42.9%	5.0%	1.3%	21.8%	11.0%
Second event year	27	53.0%	54.8%	96.7%	100.0%	20.5%	12.9%	25.0%	12.8%

Data is 1,165 firm-years from SNL DataSource. Firm-years are categorized by whether their liability structure includes unsecured debt. Observations are eliminated when (1) there is insufficient data to calculate changes in secured debt and total assets or (2) the firm's total assets are less than $50 million. Observations are classified as all secured if 100% of their debt is secured. Event year observations represent the year during which firms began using some unsecured debt. Post-event firms are those that have continuously maintained some unsecured debt in their capital structures after starting to use unsecured debt. Second event year observations are the firm-years where the REIT reverted to an entirely secured liability structure after having had some unsecured debt. Change in secured debt and change in total assets are the changes in the book value of those categories relative to the previous year.

Table 2-4. Probit model of the factors influencing the transition to unsecured debt financing.

Variable	Coefficient	
Intercept	-8.89	**
	(-5.63)	
Size	0.70	**
	(6.04)	
Growth	0.31	*
	(2.48)	
Leverage	-1.02	*
	(-2.07)	
Pseudo R^2	0.235	

The sample includes 483 observations where the firm started the year with all secured debt. These firms are assigned the value of one if they transition to unsecured debt during the year and zero if their debt remains entirely secured. The explanatory variables are size (log of total assets in thousands of dollars at the beginning of the year), growth (percent change in total assets during the year), and leverage (total debt to total assets at the start of the year). The model includes unreported year and property-type dummy variables. Z statistics are reported in parentheses. Coefficients that are different from zero at the 5% level are denoted with * and coefficients that are different from zero at the 1% level are denoted with **.

Table 2-5. Probit model of increases in secured debt financing.

Variable	Coefficient
Intercept	-0.44
	(-0.83)
TD_{-1}/TA_{-1}	0.81*
	(2.18)
SD_{-1}/TD_{-1}	-0.08
	(-0.39)
Pseudo R^2	0.035

This probit model predicts whether a firm increases its use of secured debt. The sample includes the 646 firm-years where the firm started the year with unsecured debt: observations are all firm-years with a lagged secured debt to total debt ratio of less than 90% and a lagged total asset value of more than $50 million. These firms are assigned the value of one if they increase the fraction of their debt that is secured debt and zero if they reduce the fraction of their debt that is secured. The explanatory variables are leverage and fraction of the debt that is secured at the start of the year. Firm year and property type dummies are included but not reported. Z statistics are reported in parentheses and * denotes coefficients that are different from zero at the 5% level.

CHAPTER 3
SECURED DEBT FINANCING AND LEVERAGE: THEORY AND EVIDENCE

Introduction

This analysis models how the priority structure of a firm's debt (the mix of secured and unsecured debt) impacts both the asset substitution and underinvestment problems and empirical evidence in support of the model. The model considers a firm that has secured and unsecured risky debt claims (original debt) against an asset in place. The firm has the opportunity to acquire other assets in the future. Risky debt outstanding creates an incentive to over-invest in negative NPV high-risk projects, the asset substitution problem, because of the wealth transfers away from existing lenders. Wealth transfers to the original lender lead the firm to under-invest, that is, pass up some low-risk positive NPV projects. The model shows how the extent of the underinvestment and asset substitution problems depend on the proportion of the original debt that is secured.

If the original debt is secured by the asset in place and does not have recourse to other assets of the firm, the debt claim is essentially project financing, and the value of the original debt is independent of the nature of any assets acquired in the future and how they are financed. There are no wealth transfers and thus risky debt does not distort the acquisition decision as in the analysis in Berkovitch and Kim (1990) and Chapter 2 of this study. Chapter 2 shows that non-recourse secured debt financing limits acquisition incentive distortions but creates poor incentives to maintain existing assets. Consistent with their model, the use of non-recourse secured debt by publicly traded firms is limited to select industries such as real estate investment trusts (see Esty and Sesia (2005) and Kolasinski (2006)).

Secured debt with recourse to the other assets of the firm is the more common form of secured debt financing for industrial firms and is the focus of the model and empirical analysis.

When the original debt is secured with recourse, it has a first lien on the asset in place and a claim on the unencumbered portion of any new asset acquired along with the new lenders that finance the new asset purchase. Underinvestment occurs because of the wealth transfer to the original lender in states of nature where the value of the original asset is insufficient to make the original debt payment and hence the return on the acquired asset serves as collateral (i.e., the new asset co-insurers the original debt). The magnitude of this wealth transfer does not depend on the priority structure of the debt. Secured debt financing with recourse does not mitigate the underinvestment problem: investments in low risk and positive NPV projects co-insure the original debt to the same extent whether the original debt is unsecured or secured with recourse.

In contrast, the acquisition of a high risk project is likely to result in states of nature where the acquired asset return is insufficient to pay the new lenders. In this case, the new lenders have a claim on the original asset when the original debt is unsecured and a wealth transfer from the original lender occurs: there is an asset substitution problem. However, if the original debt is secured by the assets in place, there is no wealth transfer. Thus, borrowing on a secured basis mitigates the asset substitution problem. In summary, secured debt with recourse financing does not mitigate the underinvestment problem but does mitigate the asset substitution problem.

The analysis extends this insight into a model of the relation between the proportion of the debt that is secured and debt capacity. Specifically, I show that the borrower can increase leverage without increasing the incentive to invest in high risk assets by increasing the proportion of the original debt that is secured. That is, if a firm converts some of its unsecured debt into secured debt, increasing the proportion of its debt that is secured, financial leverage can be increased without increasing the wealth transfer away from the original lender associated with the purchase of risky asset (i.e., the asset substitution problem). The borrower's debt capacity is positively related to the proportion of the debt that is secured as the agency costs of debt are lower for any given level of leverage when a greater proportion of the debt is secured.

The model in this paper is related to other models where secured debt reduces debt related investment distortions. The models of Berkovitch and Kim (1990) and Chapter 2 focus on non-recourse debt. In the model closest to this one, Stulz and Johnson (1985), financing investments with secured debt mitigates the underinvestment problem when a firm has unsecured debt in place. Their model does not obviously offer a competing explanation for one of the central predictions of this model: the proportion of debt that is secured should be positively related to leverage. More importantly, in Stulz and Johnson (1985) follow-on secured debt financing mitigates the underinvestment problem. An important testable implication of our model is that secured debt is not used to mitigate the underinvestment problem.

In Triantis (1992), secured debt mitigates an asset substitution problem because with secured debt the borrower cannot sell an asset and buy another without repaying the debt. Our model does not consider this possibility. In Triantis (1992), the fact that the asset is pledged as collateral eliminates the borrower's ability to asset substitute. It would follow that the extent that the asset substitution problem is eliminated, and hence debt capacity increased, depends on the proportion of assets that are encumbered. In this model, the asset substitution problem mitigation depends on the proportion of the debt that is secured.[12]

The model's two predictions about the relationship between the priority structure of the borrower's debt and leverage are supported by an analysis of firms with data available on COMPUSTAT between 1985 and 2004. First, I find that the fraction of the firm's debt that is secured is positively related to financial leverage controlling for the variables found to be

[12]Other models provide a role of secured debt in a framework where the borrower has private information: Besanko and Thakor (1987a), Besanko and Thakor (1987b) and Bester (1985).

significantly related to leverage in previous work. The positive relation between the fraction of the debt that is secured and leverage adds to the literature that documents a relationship between the nature of a firm's debt and its financial leverage. Faulkender and Petersen (2006) find that firms that have access to public bond markets have higher financial leverage. Johnson (2003) finds that the negative impact of growth options on leverage is attenuated by shortening the maturity of the debt. Billet, King and Mauer (2007) find evidence consistent with tighter debt covenants mitigating the impact of growth options on leverage.

The second prediction of the model is that, in contrast with the documented impact of debt maturity and covenant protection on leverage, securing debt *does not* increase debt capacity by mitigating the impact of growth options on leverage. This prediction is also supported by the data. Specifically, the model of firm leverage is estimated for sub-samples of the data sorted by market-to-book ratio. The coefficient on the fraction of debt that is secured is lower for the higher market-to-book ratio sub-samples and statistically insignificant for the highest market-to-book sub-sample.

Our analysis also sheds light on the relationship between tangible assets and leverage documented in the literature originally by Titman and Wessels (1988). Titman and Wessels (1988) point out that the fixed nature of tangible assets makes them better collateral to loan against. Tangible assets may also increase debt capacity because they can be redeployed by the lender (Williamson 1988 and Pulvino (1998)). Since it is easier to perfect liens against tangible assets one would expect, and I find that, the proportion of debt that is secured is related to the amount of the borrower's fixed assets. This calls into question whether the relationship between secured debt and leverage is an artifact of the impact of fixed assets on debt capacity or vice versa.

Our analysis suggests that the relationship between the fraction of the debt that is secured and leverage is not an artifact of the impact of fixed assets on debt capacity. Specifically, I find that (1) fixed assets increase leverage when they are not secured and (2) actually securing fixed assets further increases leverage. The proportion of a firm's assets that are fixed and the proportion of the debt that is secured are both positively related to leverage in models that include both variables. It is possible that some assets labeled as fixed on accounting statements are more tangible and easily redeployed than others and these assets are more often used as collateral for secured debt. To address this I decompose the fraction of debt that is secured into an annual industry mean component and a firm specific deviation from that mean. Both components are positively related to leverage. To the extent that the nature of the assets within an industry are similar, the firm year deviation from the industry mean, which is positively related to leverage, is less likely to be driven by the nature of the assets and more likely to be the result of the firm's desire to minimize the agency costs of debt associated with higher leverage.

Finally, I run separate regressions of secured debt to total assets and unsecured debt to total assets: the components of leverage. The point estimates on the market-to-book ratio and tax variables are very similar in the two models. The fixed asset ratio variable is significantly positive in both the secured debt to total assets and unsecured debt to total assets model. Firms borrow more against hard assets even when they are not pledged as collateral. The point estimate on the fixed asset ratio is approximately twice as large in the secured debt model. When the amount of secured as a fraction of total assets is added to the unsecured debt model, the coefficient is significantly negative but greater than negative one: as the model predicts, secured debt crowds out unsecured debt but not one for one.

Estimating separate models of secured debt to total assets and unsecured debt to total assets provides insights into the relationship between profitability and leverage. The coefficient on profitability is negative and significant, the relationship found in other work analyzing leverage, in the model of unsecured debt to total assets. However, profitability is positive and significant, the more theoretically plausible relationship, in the secured debt to total assets model.

Our results shed some light on the findings of Faulkender and Petersen (2006) that firms with access to public debt markets are more levered. Specifically, I estimate the leverage model on the sub-sample of firms that have public debt and the sub-sample that do not. The point estimate on the fraction of debt secured variable is almost three times as large for the sub-sample of firms with access to public debt markets. Further, the public debt dummy is positive and significant in the model of unsecured debt to total assets and negative and significant in the model of secured debt to total assets. Firms with public debt access rely less on secured debt financing but secured debt financing has a greater impact on leverage for the firms with access to public debt markets. Secured debt does not crowd out unsecured debt financing as much for firms with public debt access. This suggests public lenders may be more willing than private unsecured lenders to provide debt capital on subordinated basis.

The final analysis reports the results of an instrumental variables regression to control for the potential endogeneity of the fraction of the debt secured. In our model the costs of perfecting the collateral impact the amount of secured debt financing. Thus, I use the components of property, plant and equipment as instruments for the fraction of debt that is secured given the costs of perfecting different components of tangible assets should vary. These data are only available for the early part of the sample period. For the sub-sample where data are available, the estimates of the instrumental variables regression confirm the findings of the OLS results.

Secured Debt and Debt Capacity

This section models the relationship between the proportion of a firm's debt that is secured and the extent of risky debt investment distortions. The firm has an asset in place with a risky payoff. The purchase of the original asset is financed with some combination of recourse secured debt and/or unsecured debt. Subsequently, the firm has an opportunity to acquire a second asset with a stochastic payoff. I then derive the relationship between the proportion of the firm's debt that is secured debt and the extent of the asset substitution problems and underinvestment problems.

Model Set Up.

At t=0 the firm purchases an asset with some combination of secured debt, unsecured debt and equity. The secured debt has recourse to other assets subsequently purchased. New investments do lead to wealth transfers when non-recourse debt financing, project financing, is used. This analysis focuses on secured debt with recourse as non-recourse debt financing is not a common source of funding for public firms (see Esty and Sesia (2005)). The model from Chapter 2 motivates why non-recourse debt financing is limited.

The outstanding debt matures at t=2 and no coupon payments are required prior to maturity. The face value of the original secured debt is denoted D_S and the face value of the original unsecured debt is denoted D_U. The face value of the firm's total debt at t=0, denoted D_0, equals $D_{0S} + D_{0U.}$ At t=1, the firm has the opportunity to purchase a second asset. The original debt contracts do not contain contractual provisions constraining the nature of the second asset. Further, once the first asset is acquired it cannot be sold and replaced with another asset. All debt contracts mature at t=2 so there is risky debt outstanding when the firm purchases the second asset. The risk free rate of interest is zero and all agents are risk neutral.

For simplicity of exposition, the debt contracts are not priced. We are concerned with the relation between the agency costs of risky debt and the proportion of the debt that is secured versus unsecured. In particular, I examine how wealth transfers to or away from the original lenders associated with new investment depend on the seniority structure of the debt and leverage. The wealth transfers depend on the face value of debt: the values of D_{0U} and D_{0S}. Solving for D_{0S} and D_U as functions of the amount initially borrowed, the distribution of payoffs to the original asset, and the distribution of projects available to the firm would needlessly complicate the analysis.

The value of the asset purchased at t=0, the original asset, is denoted A_0. I assume that the original asset is a tangible asset and the entire value of the asset can be pledged as collateral. The value of the original asset at t=2 is either $A_0 + X$ or $A_0 – X$. The firm's original debt is risky: $A_0 + X > D_0 > A_0 – X$.

The value of the second asset, which can be purchased at t=1, is denoted A_1. The value of the second asset at t=2 is either $A_1 + Z$ or $A_1 – Z$. Let D_1 represent the face value of the debt used to finance the purchase of the second asset. The borrowing at t=1 can be further decomposed into $D_{1U} + D_{1S} = D_1$. Assume that $D_1 > A_1 – Z$, that is, the new debt would be risky if the second asset were a standalone project.

Underinvestment

The original debt has a claim against the second asset when the first asset turns out to be worth $A_0 – X$. This claim creates the underinvestment problem. Specifically, the original lenders have a claim of $D_{0U} + D_{0S} – (A_0 – X)$ on the second asset. The wealth transfer associated with an investment in the second asset depends on the size of the claim on the second asset and how the second asset is financed. The size of the claim depends on the amount borrowed, $D_{0U} + D_{0S}$, but not on the proportion of the debt that is secured or unsecured. The proportion of the original debt that is secured does not impact the wealth transfer to the original lender. Thus, the extent of the underinvestment problem depends on the amount borrowed against the original asset and not the proportion of the debt that is secured.

If the second project is equity financed, the original lender's claim is a first lien on the second asset. If the second asset is financed with equal priority debt, the original lender's claim is pari passu with subsequent bond holders and the wealth transfer to the original lenders is smaller. If the new debt is secured by the second asset, then the original bondholders have a subordinated claim against the second asset. In this case, as shown by Stulz and Johnson (1985), the underinvestment problem is mitigated by secured debt financing of new investments when the existing debt has recourse to subsequently acquired assets.

Asset Substitution Problem

The asset substitution problem comes about because the lenders that fund the second assets share a claim with the original unsecured lenders against the first asset in the good state that is valuable when the second asset performs poorly. This claim can result in a wealth transfer away from the original unsecured lender. The extent of the wealth transfer is limited by the amount of secured debt used to finance the first asset. Specifically, note that before the acquisition of an additional project, the original unsecured lender would be paid in full in when the first asset performs well.

If the second asset is acquired and performs poorly, then the second lender has a claim of $D_{1U} – (A_1 – Z)$ against the first asset to the extent that it is not encumbered by secured debt. The first unsecured lender and the second unsecured lender will share the total payoff not encumbered by secured debt claims, $A_0 + X + A_1 – Z – D_{0S} – D_{1S}$, in proportions $D_{0U} / (D_{0U} + D_{1U})$ and $D_{1U} / (D_{0U} + D_{1U})$. If the second asset is acquired, the value of the first unsecured lender's claim becomes:

$$\left(\frac{D_{0U}}{D_{0U}+D_{1U}}\right)\left(A_0+X+A_1-Z-D_{0S}-D_{1S}\right) \tag{3-1}$$

Equation 3-1 states that the total payoff to the two projects less any secured debt claims is allocated pro rata to the unsecured claimants in proportion to the face amounts of their unsecured claims. If the first asset performs well, without a pari passu claim by the second lender, the first unsecured lender is paid in full. Secured debt against the first asset naturally would have been paid in full. With the second project in place, the original unsecured lender has a proportional claim on the "unencumbered" assets (i.e., the total payoff of all the projects net of secured claims).[13]

The wealth transfer, the source of the asset substitution problem, is the difference between (1) the original lender's claim when the first asset performs well and there is no second asset purchase, D_{0U}, and (2) the value of the original unsecured lender's claim when the original asset performs well and a second asset is acquired and performs poorly. The wealth transfer, W_{XFER}, is:

$$W_{XFER}=D_{0U}-\left(\frac{D_{0U}}{D_{0U}+D_{1U}}\right)\left(A_0+X+A_1-Z-D_{0S}-D_{1S}\right) \tag{3-2}$$

[13] For simplicity of exposition, equation 3-1 assumes that the secured claims on each project's payoff are less than each project's payoff. Violating this assumption would not qualitatively impact the results, but would have the unpaid portion of the secured debt be treated as additional unsecured debt. Because we are interested in cases in which the first project performs well, we know the secured portion of the original debt must be less than the good payoff to the first project. Further, assuming all the debt funding the second project is unsecured is more conservative with respect to wealth transfers from the first lender. The use of secured debt to fund the second asset would allocate a higher proportion of the total payoff of the two projects to the second lender(s) before proportionally allocating the remainder to the unsecured lenders.

The wealth transfer is limited by the initial amount of secured debt, D_{0S}. The ability to extract wealth from the original lenders by investing in a high risk asset is limited by the amount of secured debt in the initial capital structure. Thus, the asset substitution problem is limited by the amount of secured debt outstanding.

The following shows that increasing the amount of secured debt in the initial capital structure increases debt capacity in the sense that by increasing the fraction of the debt that is secured, the firm can increase total debt without increasing the asset substitution problem. Setting the total differential of the wealth transfer equal to zero results in the amount, R, by which unsecured debt must be reduced when a dollar of secured debt is added to keep the wealth transfer constant:

$$R = \frac{1}{1 + W_{XFER}\left(\frac{D_{1U}}{D_{0U}^{2}}\right)} \tag{3-3}$$

R is less than one for all plausible values of the parameters. Therefore, the wealth transfer can be held constant with a reduction in the face value of unsecured debt of less than one dollar when the face value of secured debt against the first project is increased by one dollar. Replacing unsecured debt with secured debt will always allow more debt for a given level of wealth transfer.

Model Discussion and the Equilibrium Leverage and Level of Secured Debt

The two key results of the model are that increasing the proportion of secured debt in a firm’s liability structure (1) mitigates the asset substitution problem but (2) does not mitigate the underinvestment problem. Thus *debt capacity* increases with the proportion of debt that is secured. That is, with greater reliance on secured debt financing the firm can increase leverage without increasing the asset substitution problem. Thus, the model suggests that if a firm’s leverage decision trades off benefits of leverage (tax deductibility of interest payments, avoidance of issuing undervalued equity or elimination of free cash flow) against risky debt related investment distortions, then firms with greater reliance on secured debt should have greater financial leverage as the risky debt related investment distortions are lower.

The model provides a clear benefit of secured debt financing. However, there is no cost of secured debt that would motivate the use of unsecured debt. The most obvious limitation of the amount of secured debt is a lack of assets that can be pledged as collateral. Further, there are other costs of secured debt contracting that are generally not present with unsecured debt discussed in detail in Stulz and Johnson (1985) and Triantis (1992). For example, there are expenses associated with the attachment and perfection of the security interest. There is a loss of flexibility with secured debt financing as debt contracts must be renegotiated before a secured asset is sold. Finally, secured lenders have an incentive to move for liquidation of critical assets, perhaps at fire sale prices, in financial distress (for example see Brown, James and Mooradian (1994)).

Comparison to Other Models

Other theoretical models consider the role of secured debt. Our model is closest to Stulz and Johnson (1985) in that it considers how the seniority of debt impacts wealth transfers associated with new investment. Stulz and Johnson (1985) show that the underinvestment problem is limited when the second asset is financed by debt that is secured by the second asset or debt that is senior to the original debt. In this model, the extent that the *existing debt* is secured impacts the wealth transfers associated with new investment.

In Triantis (1992) security protects the borrower from asset substitution with regard to assets in place as the borrower cannot sell an asset and buy a higher risk asset without first paying off the secured debt. In Triantis (1992) the extent of the asset substitution problem with regard to assets in place depends on the proportion of assets that are encumbered by secured debt. In our model, the asset substitution problem depends on the proportion of the original debt that is secured.

Other models, Bester (1985), Besanko and Thakor (1987a), Besanko and Thakor (1987b) and Chan and Thakor (1987), allow for private information about the borrower's prospects. In these models, pledging collateral signals favorable private information about the borrower's prospects. These models do not yield competing explanations for the predictions of this model.

Data and Preliminary Analysis

This study uses COMPUSTAT data for the years 1985 through 2004. The sample excludes observations for regulated firms (historical SIC codes between 4900 and 4939) and for financial firms (historical SIC codes between 6000 and 6999).[14] Leverage is defined as total debt divided by book debt plus the market value of equity. The sum of book debt and market equity, firm value, is obtained from total assets (data6) minus common equity (data60) plus the product of fiscal year closing price (data199) and shares outstanding (data25). Total debt is the sum of long-term debt (data9) and debt in current liabilities (data34). Because debt in current liabilities includes debt due in one year (data44), total debt is adjusted downward by the value of debt due in one year to avoid double counting if a footnote flag indicates that debt due in one year is included in the long-term debt value.

The fraction of the firm's debt that is secured (Fraction Secured) equals secured debt and mortgages (data241) divided by total debt. The Fraction Secured variable is decomposed into industry and firm-specific components. Industry Fraction Secured is the annual mean of fraction secured for each industry, where industry is defined based on historical SIC code. Residual

[14] Although there appear to be a few exceptions using the simple SIC code screen, COMPUSTAT indicates it does not collect secured debt information for regulated firms.

Fraction Secured is the firm-year deviation from the corresponding industry-year mean. Unsecured Debt is the total debt minus secured debt and mortgages.

The estimated models of leverage include the variable of interest in this study, Fraction Secured, and the following variables used in previous studies. The Market-to-book ratio (firm value divided by total assets) is the standard proxy for growth options. Fixed Assets is the ratio of net property, plant and equipment (data8) to total assets. Log Sales, defined as the log of net sales (data12), measures firm size. Profitability is EBITDA (data172+data14+data15+data16) divided by total assets. Volatility is the standard deviation of the three most recent annual first differences of EBITDA that do not require the current year's data to calculate divided by the mean total assets over the four yearends used to calculate the first differences in EBITDA[15].

Following Faulkender and Petersen (2006) I use a dummy variable for the presence of a rating to proxy for capital market access. The variable is set to one if the firm has an S&P long-term issuer credit rating (data280). Dummy variables for net operating loss carry forwards and investment tax credits are set to one if the corresponding data items (data52 and data51) have a nonzero value[16].

After eliminating observations with missing values, the final sample includes 64,791 firm years of data. There are 12,930 observations where leverage is zero. The fraction of the firm's debt that is secured is undefined in this case. Thus, much of the analysis focuses on the sample of 51,861 firm-year observations where firms have positive leverage. Table 3-1 presents summary statistics for the variables discussed above.

[15]These variables are among those found to be significant and widely used in recent capital structure papers. For example, see Hovakimian, Opler and Titman (2001), Johnson (2003), Billett, King and Mauer (2006) and Faulkender and Petersen (2006).

[16]Missing values are set to zero.

Mean leverage ratios for sub-samples of the data sorted by (1) fraction secured and market-to-book ratio and (2) fraction secured and fixed asset ratio are reported in Tables 3-2 and 3-3. Table 3-2 shows mean leverage for firms two-way sorted by fraction of debt secured and market-to-book ratio. As shown in previous work, higher market-to-book ratios are largely associated with lower leverage. However, sorting the data by market-to-book ratios reveals some interesting non-linear relationships not reported in other work. The maximum mean leverage (34.1%) occurs for the firms with market-to-book ratios between 80% and 110%. Firms with low market-to-book ratios (less then 80%) have less leverage than firms with market-to-book ratios between 80% and 110%. This provides some evidence consistent with the idea that the market-to-book ratio captures growth options. Firms in the market-to-book ratio range between 80% and 110% have no or minimal growth options according to this measure. Leverage should not increase as the market-to-book ratio falls further. In addition, it is interesting to note that as market-to-book ratios increase beyond 200%, the declines in financial leverage are very modest.

This provides preliminary evidence that the fraction of the debt that is secured is positively related to debt capacity. The mean leverage ratio largely increases with fraction secured within market-to-book subsamples (Table 3-2) and within fixed assets subsamples (Table 3-3). The data sorted in this fashion, as predicted by the model, do not suggest that securing debt is a mechanism for mitigating the under investment problem. The positive relation between leverage and the fraction of the debt that is secured is most pronounced for the less than 80%, 80% to 110%, and 110% to 150% market-to-book cohorts and minimal for the higher market-to-book cohorts. This is in sharp contrast to the findings of Billet, King and Mauer (2007) and Johnson (2003). Billet, King and Mauer (2007) provide a two-way sort of leverage by market-to-book and debt covenants and find that stronger covenant protection has larger positive impact on leverage for high market-to-book firms. Johnson (2003) interacts the market-to-book ratio with the maturity of the debt in a regression analysis and finds that shortening the maturity of the debt has a greater positive impact on leverage for higher market-to-book ratio firms.

Table 3-3 shows mean leverage for firms two-way sorted by fraction of debt secured and the ratio of net fixed assets to total assets. As shown in other work, most notably Titman and Wessels (1988), leverage increases with the extent that the firm's assets are tangible. More importantly for this analysis, leverage ratios increase with the Fraction Secured holding Fixed Assets constant (i.e., moving down the Fixed Assets columns). The relationships in Table 3-3 suggest that firms borrow more (1) against hard assets, perhaps because they can be redeployed by the lender and (2) when these hard, collateralizeble assets, are actually pledged as collateral.

Regression Analysis

The empirical analysis begins with regression models that attempt to explain leverage with variables that have been used in other studies and the fraction of the firm's debt that is secured. This analysis finds a positive and significant relation between leverage and the fraction of the debt that is secured. Next I examine how the impact of the fraction of the debt that is secured on leverage varies across different market-to-book sub-samples in order to determine whether securing debt increases debt capacity by mitigating the underinvestment problem. The remainder of the empirical analysis (1) addresses the seniority structure of the debt and (2) provides an instrumental variable estimation of the leverage model to control for potential endogeneity in the original leverage model.

Analysis of Leverage and the Fraction of the Debt That is Secured

Table 3-4 reports results of a regression of leverage on the fraction of debt secured and other traditional explanatory variables. The standard errors are robust to clustering by firm. Model (1) uses Fraction Secured as an explanatory variable. The coefficient on the Fraction

Secured is positive and significant at the 1%. The results of model (1) imply that a one standard deviation change in the Fraction Secured will change Leverage by 2.75% (the sample standard deviation of leverage is about 19%). The significantly positive relation between Fraction Secured and Leverage is consistent with the model prediction that securing debt increases debt capacity controlling for other variables that effect leverage including the fixed assets ratio.

Model (2) splits the Fraction Secured into the industry-year mean and the firm-year deviation from the corresponding mean. Both components are strongly economically and statistically significant. Model (2) implies that one standard deviation changes in industry-year mean fraction secured and firm-year deviations will change leverage by 1.91% and 2.20%. The finding that the firm-year deviation from the industry mean fraction secured is positively related to leverage is important because one might argue that the choice to secure debt is driven by the nature of the firm's assets and that the positive relation between the fraction of the debt that is secured and leverage is driven by the nature of the assets rather than that the assets are secured per se. To the extent that the nature of the assets within an industry are similar, the firm-year deviation from the industry mean, which is positively related to leverage, is less likely to be driven by the nature of the assets and more likely to be the result of the firm's desire to minimize the agency cost of debt associated with the chosen higher leverage.

Next the relation between fraction secured and leverage is estimated on firms with rated debt and firms without rated debt subsamples. Results of estimated models for the two subsamples are reported in Table 3-5. There is a stronger relation between fraction secured and leverage for firms with public debt market access. The point estimates on the fraction secured variable, and the industry-mean and firm-specific components of the fraction secured, are approximately three times larger for the rated sample.

Having established that leverage increases with the fraction of the debt that is secured, the first prediction of the model, we turn to the model's second prediction: secured debt does not increase debt capacity by mitigating the underinvestment problem. The results presented in Table 3-2 suggest that this is not the case. Leverage does not increase more dramatically with the fraction of debt that is secured for firms with high market-to-book ratios. The results presented in Table 3-2 are confirmed by the cluster-robust regression analysis for groups of firms in different market-to-book regions results presented in Table 3-6.

The coefficients on firm-specific component of the faction secured variable are almost identical for the market-to-book less than 0.8, market-to-book between 0.8 and 1.1 sub-samples and then decline monotonically as the sample market-to-book ratio increases. The coefficient on the industry-mean fraction secured is positive and relatively large for the low and intermediate market-to-book ratio sub-samples (the coefficients are .109, .130 and .135 for the market-to-book less than 0.8, market-to-book between 0.8 and 1.1 and market-to-book between 1.1 and 1.5 sub-samples respectively). Moving to higher market-to-book ratio sub-samples the point estimate for the industry mean-fraction secured variable falls. For market-to-book between 2.0 and 2.5 and market-to-book between 2.5 and 3.0 sub-samples, the coefficient on the industry-mean fraction secured variable is insignificant. Finally, the industry-mean fraction secured variable is negative and significant for the highest market-to-book firms.

Analysis of the Seniority Structure of Debt

This section provides estimates of separate models that explain the two components of the firm's leverage: the ratio of secured debt to market value of assets and the ratio of unsecured debt to market value of assets. The same explanatory variables, other than fraction of the debt that is secured, are used to explain both components. Table 3-7 presents the estimated model of secured debt and Table 3-8 presents the estimated models of unsecured debt as proportions of firm value. The estimated coefficients on nearly all of the variables are of the same sign in both models. The coefficients are often very similar. For example, the coefficient on the dummy variable for net operating loss carry-forwards is 0.011 in the model of unsecured debt to total assets and 0.013 in the model of secured debt to total assets. The most interesting exception is that the profitability variable is positively related to unsecured debt to total assets (the result for total leverage found in this and other papers) and negatively related to secured debt to total assets (a finding more consistent with proposed theories).

The most important result for this analysis is that the ratio of fixed assets to total assets variable is positive and significant at the 1% in both the unsecured debt to total assets and secured debt to total assets models. The finding that the ratio of unsecured debt to total assets increases with the proportion of hard assets indicates that firms borrow more against hard assets even when they are not pledged as collateral.

A second model of unsecured debt to total assets adds the proportion of secured debt to total assets (the proportion of assets that are encumbered) as an explanatory variable. The coefficient on secured debt to total assets variable, is negative and significant: secured borrowing crowds out unsecured borrowing. The coefficient on the secured debt to total assets variable is far greater than -1 (-.08), which is predicted by the model and thus leverage increases with the proportion of the debt that is secured. More importantly, the ratio of unsecured debt to total assets remains significantly positively related to the ratio of fixed assets controlling for the proportion of fixed assets that are encumbered by secured debt.

The finding that the public debt dummy is positive and significant in the model of unsecured debt to total assets and negative and significant in the model of secured debt to total assets coupled with the earlier finding that the point estimate on the fraction of debt secured variable is almost three times as large for the sub-sample of firms with access to public debt markets shed some light on the findings of Faulkender and Petersen (2006) that firms with access to public debt markets are more levered. These results imply that firms with public debt access rely less on secured debt financing but secured debt financing has a greater impact on leverage. Secured debt does not crowd out unsecured debt financing as much for firms with public debt access. This suggests public lenders are either more willing than private lenders to provide debt capital on subordinated basis or public lenders rely on more on the presence of secured debt to protect them against the asset substitution problem.

Instrumental Variables Analysis

The relationship between a firm's leverage and the fraction of that firm's debt that is secured could be jointly determined by an unobserved factor. The most obvious candidate for such a relationship is the nature of the firm's assets. That is there are unmeasured characteristics of assets that make good collateral for secured lending also increase debt capacity. This concern motivates the analysis where the fraction secured is decomposed into an industry average and deviation from the industry average (firm specific) component. The idea discussed above is that the nature of the assets is relatively constant across firms in an industry. The positive relation between leverage and industry average secured debt could very well be related to the nature of the assets rather than the fact that the assets are secured. However, the industry specific component, which is positively related to leverage, seems much less likely to be driven by within industry differences in the nature of the hard assets.

I further address this issue by performing a two-stage instrumental variables regression. The model gives us some guidance as the cost of perfecting the collateral influence the attractiveness of secured debt financing. Thus I use components of property, plant and equipment (PP&E) as instruments for the fraction of debt secured. The PP&E components are only available from COMPUSTAT for select years ending around 1997. In the (unreported) first stage, both instruments are strongly statistically significant.

The model explains leverage using the explanatory variables used in the earlier analysis, including the fraction of debt that is secured. If the fraction of debt secured is jointly determined with a firm's leverage level, the measured effects of changing the use of secured debt may include or be biased by firm characteristics which simultaneously influence both the dependent variable, leverage, and one of the explanatory variables, fraction secured. Using two-stage least squares estimation, predicted levels of fraction secured are generated using all the exogenous explanatory variables and two instruments: the fraction of assets represented by the depreciated value of buildings and the fraction of assets represented by the depreciated value of capitalized leases and leasehold improvements. The results shown in Table 3-10 show that (1) the coefficient on the instrument for secured debt financing is positive and significant and (2) the coefficients on the control variables are qualitatively the same as in the OLS regressions reported earlier.

Conclusion

This paper provides a model of the seniority structure of debt where the asset substitution problem decreases with the proportion of a firm's debt that is secured. Specifically, the firm is less likely to purchase a high risk asset in order expropriate wealth from lenders when the debt structure has considerable secured debt. This idea is extended to show that debt capacity is increasing in the fraction of the debt that is secured. However, in contrast to shortening the maturity of the debt, increasing the fraction of the debt that is secured does not mitigate the underinvestment problem.

An empirical analysis of COMPUSTAT firms supports the two predictions of the model. First, I find a positive and significant relation between leverage and the fraction of the firm's debt that is secured. Second, the relation between leverage and the fraction of the firm's debt that is secured is not related to the borrower's market to book ratio. Thus, as predicted by the model, secured debt does not mitigate the underinvestment problem. Secured debt is unlike protective covenants (Billett, Mauer and King (2007)) and debt maturity (Johnson (2003)) which appear to enhance debt capacity by mitigating the underinvestment problem.

Table 3-1. Summary statistics.

Sample of firms	Variable	Obs	Mean	Std.	Min	Max
Positive leverage	Leverage	51,861	0.226	0.187	0.000	0.740
Positive leverage	Fraction secured	51,861	0.331	0.367	0.000	1.000
Positive leverage	Industry fraction	51,861	0.331	0.150	0.000	1.000
Positive leverage	Residual fraction	51,861	0.000	0.335	-0.805	0.913
Positive leverage	Market-to-book	51,861	2.086	2.989	0.528	34.231
Positive leverage	Fixed assets	51,861	0.324	0.236	0.000	0.925
Positive leverage	Log sales	51,861	4.862	2.486	-6.908	12.564
Positive leverage	Profitability	51,861	0.004	0.494	-4.932	0.581
Positive leverage	Volatility	51,861	0.163	0.273	0.004	2.297
All firms	Leverage	64,791	0.205	0.190	0.000	0.740
All firms	Market-to-book	64,791	2.152	3.052	0.528	34.231
All firms	Fixed assets	64,791	0.313	0.236	0.000	0.925
All firms	Log sales	64,791	4.798	2.556	-6.908	12.564
All firms	Profitability	64,791	0.006	0.484	-4.932	0.581
All firms	Volatility	64,791	0.163	0.271	0.004	2.297

Sample is all firms with data available from COMPUSTAT between 1985 and 2004 excluding regulated firms (SIC codes between 4900 and 4939) and financial firms (SIC codes between 6000 and 6999). Leverage is the ratio of book debt to book debt plus the market value of equity. The fraction secured is secured debt divided by total debt. The fraction secured variable is decomposed into industry fraction secured, the annual mean fraction secured for all firms in the industry, and residual fraction secured, the difference between the firm's fraction secured and industry fraction secured. The control variables in the analysis of leverage include market-to-book, the ratio of firm market value to firm book value, fixed assets is the ratio of net property, plant and equipment to total book assets, log sales is the log of firm sales, profitability is EBITDA divided by total assets, and volatility is the standard deviation of the three most recent first differences in EBITDA. Variables using total debt in the denominator are undefined for firms with no debt.

Table 3-2. Mean leverage and number of firm-year observations conditional on fraction secured and market-to-book.

Fraction secured	Market-to-Book < 0.8	0.8 – 1.1	1.1 – 1.5	1.5 – 2.0	2.0 – 2.5	2.5 – 3.0	> 3.0	All firms
Exactly 0	0.224	0.256	0.204	0.147	0.114	0.093	0.086	0.160
	1,366	3,569	5,246	3,967	2,174	1,402	5,542	23,266
< 0.1	0.327	0.351	0.264	0.190	0.147	0.117	0.102	0.234
	632	3,064	4,528	2,650	1,301	664	1,872	14,711
0.1 – 0.2	0.284	0.344	0.261	0.179	0.121	0.103	0.071	0.223
	307	1,308	1,666	1,016	442	300	743	5,782
0.2 – 0.3	0.289	0.361	0.275	0.193	0.124	0.106	0.067	0.235
	259	1,151	1,332	747	391	215	658	4,753
0.3 – 0.4	0.313	0.355	0.271	0.184	0.123	0.106	0.064	0.233
	245	1,047	1,137	691	341	185	558	4,204
0.4 – 0.5	0.279	0.358	0.275	0.181	0.123	0.099	0.046	0.221
	246	912	1,042	662	321	190	641	4,014
0.5 – 0.6	0.284	0.358	0.286	0.186	0.120	0.087	0.046	0.222
	240	965	1,064	655	328	228	703	4,183
0.6 – 0.7	0.281	0.356	0.276	0.181	0.129	0.096	0.044	0.218
	244	949	1,092	647	357	247	712	4,248
0.7 – 0.8	0.296	0.345	0.266	0.176	0.126	0.094	0.046	0.218
	311	985	1,020	636	366	208	657	4,183
0.8 – 0.9	0.306	0.365	0.283	0.179	0.122	0.090	0.064	0.243
	363	1,231	1,186	700	376	233	525	4,614
> 0.9	0.347	0.368	0.285	0.189	0.143	0.121	0.080	0.257
	656	2,112	2,173	1,182	651	366	868	8,008
Exactly 1.0	0.282	0.310	0.232	0.149	0.101	0.086	0.058	0.201
	296	805	762	547	268	155	426	3,259
All firms	0.285	0.335	0.255	0.173	0.126	0.100	0.075	
	5,165	18,098	22,248	14,100	7,316	4,393	13,905	

Table 3-3. Mean leverage and number of firm-year observations conditional on fraction secured and fixed assets ratio.

	Fixed assets ratio										
Fraction secured	< 0.1	0.1 – 0.2	0.2 – 0.3	0.3 – 0.4	0.4 – 0.5	0.5 – 0.6	0.6 – 0.7	0.7 – 0.8	0.8 – 0.9	> 0.9	All firms
Exactly 0	0.146	0.140	0.154	0.161	0.170	0.188	0.200	0.228	0.222	0.214	0.160
	6,949	4,650	3,388	2,460	1,507	1,155	918	806	835	598	23,266
< 0.1	0.212	0.230	0.226	0.235	0.240	0.248	0.269	0.272	0.303	0.308	0.234
	2,942	3,334	2,731	1,875	1,204	859	736	581	345	104	14,711
0.1 – 0.2	0.159	0.207	0.219	0.246	0.253	0.239	0.259	0.299	0.304	0.241	0.223
	900	1,305	1,118	761	529	391	317	253	173	35	5,782
0.2 – 0.3	0.167	0.194	0.230	0.254	0.273	0.281	0.305	0.316	0.315	0.264	0.235
	742	964	899	683	457	365	264	193	142	44	4,753
0.3 – 0.4	0.147	0.193	0.226	0.254	0.271	0.294	0.317	0.339	0.338	0.327	0.233
	668	942	728	600	409	256	218	181	152	50	4,204
0.4 – 0.5	0.143	0.169	0.208	0.260	0.264	0.304	0.308	0.328	0.323	0.332	0.221
	724	861	698	553	378	257	208	157	140	38	4,014
0.5 – 0.6	0.135	0.162	0.209	0.251	0.281	0.323	0.323	0.318	0.359	0.316	0.222
	796	871	678	563	386	296	233	192	123	45	4,183
0.6 – 0.7	0.136	0.155	0.197	0.227	0.284	0.291	0.341	0.325	0.337	0.299	0.218
	720	892	710	564	375	313	233	211	173	57	4,248
0.7 – 0.8	0.148	0.151	0.181	0.211	0.264	0.276	0.309	0.350	0.325	0.348	0.218
	631	834	616	549	414	382	256	252	187	62	4,183
0.8 – 0.9	0.203	0.175	0.188	0.223	0.252	0.284	0.330	0.371	0.347	0.392	0.243
	610	784	744	600	445	402	396	298	248	87	4,614
> 0.9	0.227	0.194	0.201	0.227	0.256	0.284	0.355	0.381	0.374	0.364	0.257
	1,023	1,394	1,285	1,098	753	623	597	594	476	165	8,008
Exactly 1.0	0.146	0.132	0.152	0.190	0.227	0.269	0.275	0.289	0.330	0.319	0.201
	500	626	513	363	271	210	215	185	247	129	3,259
All firms	0.165	0.177	0.196	0.218	0.239	0.257	0.286	0.307	0.306	0.281	
	17,205	17,457	14,108	10,669	7,128	5,509	4,591	3,903	3,241	1,414	

Table 3-4. Determinants of market leverage using cluster-robust OLS regressions.

	Leverage (1)	Leverage (2)
Fraction secured	0.0749***	
	(17.1)	
Market-to-book	-0.00228***	-0.00215***
	(-8.45)	(-7.91)
Fixed assets	0.102***	0.0968***
	(16.1)	(15.3)
Log sales	0.00227***	0.00263***
	(4.90)	(5.68)
Profitability	-0.00704**	-0.00831***
	(-2.57)	(-3.02)
Loss carry forwards	0.0211***	0.0219***
	(6.59)	(6.79)
Investment tax credits	-0.0623***	-0.0630***
	(-13.2)	(-13.4)
Rated debt	0.0712***	0.0714***
	(16.4)	(16.4)
Volatility	-0.0267***	-0.0297***
	(-5.06)	(-5.45)
Industry fraction secured		0.128***
		(12.2)
Residual fraction secured		0.0652***
		(14.4)
Constant	0.147***	0.130***
	(37.2)	(25.4)
Observations	43,259	42,735
R-squared	0.08	0.08

Fraction Secured is secured debt divided by total debt. Market-to-book is the ratio of the firm value to the firm book value. Fixed assets is the ratio of fixed assets to total assets. Log sales is the natural log of net sales. Profitability is EBITDA divided by sales. Dummy variables are used for contemporaneous net operating loss carry forwards, investment tax credits and having a long-term issuer credit rating. Volatility is the volatility of earnings, defined as the standard deviation of changes in EBITDA over the four-year period preceding estimation divided by firm-mean total assets over that period. Industry fraction secured and residual fraction secured represent the decomposition of fraction secured into industry-year means and firm-year deviations from those means. Robust t-statistics are provided in parentheses with *** indicating significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level.

Table 3-5. Determinants of leverage by market access subsamples using cluster-robust OLS regressions.

	(1)	(2)	(3)	(4)
	Unrated Firms		Rated Firms	
	Leverage	Leverage	Leverage	Leverage
Fraction Secured	0.0568***		0.183***	
	(12.4)		(15.1)	
Market-to-book	-0.00210***	-0.00201***	-0.00261***	-0.00245***
	(-7.12)	(-6.71)	(-4.18)	(-3.94)
Fixed Assets	0.108***	0.105***	0.0822***	0.0753***
	(15.0)	(14.5)	(7.14)	(6.56)
Log Sales	0.00379***	0.00398***	-0.00245***	-0.00169*
	(7.37)	(7.66)	(-2.70)	(-1.86)
Profitability	-0.00243	-0.00285	-0.242***	-0.242***
	(-0.88)	(-1.04)	(-8.32)	(-8.31)
Loss Carry Forwards	0.0217***	0.0228***	0.0114*	0.0114*
	(6.15)	(6.40)	(1.75)	(1.74)
Investment Tax Credits	-0.0643***	-0.0648***	-0.0527***	-0.0541***
	(-12.1)	(-12.2)	(-5.83)	(-5.94)
Volatility	-0.0265***	-0.0294***	-0.0182	-0.0207
	(-4.91)	(-5.26)	(-0.64)	(-0.73)
Industry Fraction Secured		0.0987***		0.237***
		(8.48)		(11.1)
Residual Fraction Secured		0.0493***		0.171***
		(10.3)		(13.6)
	0.145***	0.131***	0.262***	0.243***
	(34.0)	(23.6)	(28.3)	(22.4)
Observations	33,324	32,819	9,935	9,916
R-squared	0.06	0.06	0.14	0.15

Fraction Secured is secured debt divided by total debt. Market-to-book is the ratio of the firm value to the firm book value. Fixed assets is the ratio of fixed assets to total assets. Log Sales is the natural log of net sales. Profitability is EBITDA divided by sales. Dummy variables are used for contemporaneous net operating loss carry forwards, investment tax credits and having a long-term issuer credit rating. Volatility is the volatility of earnings, defined as the standard deviation of changes in EBITDA over the four-year period preceding estimation divided by firm-mean total assets over that period. Industry fraction secured and residual fraction secured represent the decomposition of Fraction secured into industry-year means and firm-year deviations from those means. Models (1) and (2) use the sample of firms without public debt ratings. Models (3) and (4) use the sample of firms with public debt ratings. Robust t-statistics are provided in parentheses with *** indicating significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level.

Table 3-6. Determinants of leverage by market-to-book ratio subsamples using cluster-robust OLS regressions.

	Market-to-book ratio						
	< 0.8	0.8 – 1.1	1.1 – 1.5	1.5 – 2.0	2.0 – 2.5	2.5 – 3.0	> 3.0
Industry fraction secured	0.109***	0.130***	0.135***	0.0893***	0.0222	0.0346	-0.0341*
	(3.22)	(7.06)	(9.97)	(5.68)	(1.11)	(1.53)	(-1.93)
Residual fraction secured	0.0639***	0.0640***	0.0494***	0.0365***	0.0146*	0.0224*	-0.0140*
	(4.91)	(8.01)	(7.69)	(5.12)	(1.77)	(1.94)	(-1.80)
Market-to-book	0.000207	-0.00183***	-0.000823	-0.000479	-0.00129**	0.0000225	-0.000543
	(0.19)	(-2.88)	(-1.62)	(-0.91)	(-2.02)	(0.029)	(-1.39)
Fixed assets	0.0547***	0.0870***	0.0763***	0.0604***	0.0485***	0.0427***	0.0418***
	(2.81)	(7.57)	(9.15)	(6.52)	(4.07)	(2.84)	(3.43)
Log sales	0.00449***	0.000944	-0.000115	0.000426	-0.00115	-0.000477	0.00296***
	(2.67)	(1.01)	(-0.17)	(0.58)	(-1.28)	(-0.41)	(3.22)
Profitability	0.00903	-0.00767	-0.0512***	-0.0391***	-0.0430***	-0.0263***	-0.0135***
	(0.67)	(-0.70)	(-4.89)	(-4.32)	(-4.35)	(-2.63)	(-4.44)
Loss carry forwards	0.00572	0.0205***	0.0231***	0.0230***	0.0195***	0.0263***	0.00994*
	(0.59)	(3.58)	(4.98)	(4.49)	(3.40)	(3.34)	(1.82)
Investment tax credits	-0.0754***	-0.0547***	-0.0503***	-0.0385***	-0.0402***	-0.0412***	-0.0384***
	(-3.34)	(-5.37)	(-8.28)	(-6.54)	(-7.25)	(-5.23)	(-8.40)
Rated debt	0.174***	0.107***	0.0724***	0.0700***	0.0561***	0.0478***	0.0277***
	(9.42)	(15.4)	(14.1)	(11.1)	(7.95)	(5.19)	(3.93)
Volatility	-0.0491*	-0.0710***	-0.00519	0.0526***	0.0523***	0.0516***	0.0421***
	(-1.70)	(-4.31)	(-0.44)	(4.01)	(4.15)	(2.75)	(6.54)
Constant	0.208***	0.243***	0.164***	0.0973***	0.0906***	0.0595***	0.0504***
	(12.0)	(24.2)	(22.6)	(12.2)	(8.89)	(6.06)	(6.62)
Observations	2,876	9,965	11,783	7,216	3,542	1,980	5,373
R-squared	0.08	0.10	0.08	0.09	0.08	0.07	0.08

Industry fraction secured and residual fraction secured represent the decomposition of fraction secured into industry-year means and firm-year deviations from those means. Market-to-book is the ratio of the firm value to the firm book value. Fixed assets is the ratio of fixed assets to total assets. Log sales is the natural log of net sales. Profitability is EBITDA divided by sales. Dummy variables are used for contemporaneous net operating loss carry forwards, investment tax credits and having a long-term issuer credit rating. Volatility is the volatility of earnings, defined as the standard deviation of changes in EBITDA over the four-year period preceding estimation divided by firm-mean total assets over that period. Robust t-statistics are provided in parentheses with *** indicating significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level.

Table 3-7. Cluster-robust OLS model explaining the fraction of debt secured.

	Fraction Secured
Leverage	0.286***
	(17.7)
Fixed assets	0.0973***
	(8.08)
Log sales	-0.00289***
	(-3.48)
Profitability	0.0608***
	(16.4)
Rated debt	-0.234***
	(-35.4)
Constant	0.300***
	(45.3)
Observations	43,259
R-squared	0.09

Leverage is firm leverage, measured as total debt divided by firm (market) value. Fixed assets is the ratio of fixed assets to total assets. Log sales is the natural log of net sales. Profitability is EBITDA divided by sales. A dummy variable is used for the presence of a long-term issuer credit rating. Robust t-statistics are provided in parentheses with *** indicating significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level.

Table 3-8. Model of unsecured debt to firm value using cluster-robust OLS regressions.

	Unsecured-to-firm-value	Unsecured-to-firm-value
Fixed assets	0.0349***	0.0411***
	(7.91)	(9.22)
Market-to-book	-0.00128***	-0.00136***
	(-7.05)	(-7.46)
Log sales	0.00221***	0.00227***
	(6.71)	(6.86)
Profitability	-0.0113***	-0.0104***
	(-5.52)	(-5.07)
Loss carry forwards	0.0110***	0.0122***
	(4.83)	(5.29)
Investment tax credits	-0.0342***	-0.0364***
	(-10.4)	(-11.0)
Rated debt	0.104***	0.102***
	(31.0)	(30.2)
Volatility	-0.0148***	-0.0163***
	(-4.10)	(-4.48)
Secured to firm value		-0.0838***
		(-11.8)
Constant	0.0867***	0.0911***
	(32.8)	(33.3)
Observations	49,313	49,313
R-squared	0.10	0.11

Fixed assets is the ratio of fixed assets to total assets. Market-to-book is the ratio of the firm value to the firm book value. Log sales is the natural log of net sales. Profitability is EBITDA divided by sales. Dummy variables are used for contemporaneous net operating loss carry forwards, investment tax credits and having a long-term issuer credit rating. Volatility is the volatility of earnings, defined as the standard deviation of changes in EBITDA over the four-year period preceding estimation divided by firm-mean total assets over that period. Secured-to-firm-value is the ratio of secured debt to book debt plus the market value of equity. Unsecured-to-firm-value is the ratio of unsecured debt to book debt plus the market value of equity. Robust t-statistics are provided in parentheses with *** indicating significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level.

Table 3-9. Model of secured debt to firm value using cluster-robust OLS regressions.

	Secured-to-firm-value
Market-to-book	-0.00103***
	(-6.74)
Fixed assets	0.0727***
	(15.5)
Log sales	0.000640**
	(2.12)
Profitability	0.0110***
	(9.06)
Loss carry forwards	0.0133***
	(6.58)
Investment tax credits	-0.0262***
	(-8.96)
Rated debt	-0.0209***
	(-7.86)
Volatility	-0.0174***
	(-5.98)
Constant	0.0539***
	(23.2)
Observations	49,679
R-squared	0.03

Fixed assets is the ratio of fixed assets to total assets. Market-to-book is the ratio of the firm value to the firm book value. Log sales is the natural log of net sales. Profitability is EBITDA divided by sales. Dummy variables are used for contemporaneous net operating loss carry forwards, investment tax credits and having a long-term issuer credit rating. Volatility is the volatility of earnings, defined as the standard deviation of changes in EBITDA over the four-year period preceding estimation divided by firm-mean total assets over that period. Secured-to-firm-value is the ratio of secured debt to book debt plus the market value of equity. Robust t-statistics are provided in parentheses with *** indicating significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level.

Table 3-10. Two-stage least squares model of leverage using net components of property, plant and equipment as instruments for fraction secured.

	Leverage
Fraction secured	0.458***
	(4.74)
Market-to-book	-0.00257
	(-1.00)
Fixed assets	0.0897***
	(3.51)
Log sales	0.000926
	(0.41)
Loss carry forwards	0.0441***
	(3.51)
Investment tax credits	-0.0568***
	(-2.61)
Rated debt	0.147***
	(5.20)
Volatility	-0.0390
	(-1.45)
Constant	0.00301
	(0.076)
Observations	2,745
R-squared	.

Standard errors are robust to clustering by firm. The components of property, plant and equipment used are buildings (data155) and leases (data159). Fixed assets is the ratio of fixed assets to total assets. Market-to-book is the ratio of the firm value to the firm book value. Log sales is the natural log of net sales. Profitability is EBITDA divided by sales. Dummy variables are used for contemporaneous net operating loss carry forwards, investment tax credits and having a long-term issuer credit rating. Volatility is the volatility of earnings, defined as the standard deviation of changes in EBITDA over the four-year period preceding estimation divided by firm-mean total assets over that period. Robust t-statistics are provided in parentheses with *** indicating significance at the 1% level, ** significance at the 5% level, and * significance at the 10% level.

CHAPTER 4
ANATOMY OF A RATINGS CHANGE

Introduction

The financial press is reporting widespread concern by fixed income investors that shareholder-friendly activities will hurt credit quality and bondholders. Bloomberg and Moody's Investors Service calculated that the bond market has lost nearly $5 billion in the first eight months of 2006 to share repurchases, special dividends and cash financed acquisitions (Salas 2006).

Numerous structural models of credit risk beginning with Black-Scholes (1973) and Merton (1974) apply option pricing models to value risky debt[17]. This application assumes that management does not modify the capital structure and thus only changes in the operating environment change credit risk[18]. There is evidence that governance and ownership structures that can affect management incentives, impact bond yield spreads. Klock et al. (2004) find better corporate governance has an economically and statistically significant favorable effect on yield spreads. Particularly, their measure of governance improves with increased takeover defenses. Yield spreads appear to reflect protection from the potential wealth effects of acquisitions. Bhojraj and Sengupta (2003) find that, after controlling for other factors, (1) greater aggregate institutional ownership and more outside directors are associated with higher ratings and lower yields for new issues and (2) greater concentration of institutional holdings adversely impacts ratings and yields. With more concentrated shareholdings, owners may be more likely to take actions which expropriate bondholder wealth.

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[17]Acharya and Carpenter (2002) provides an extensive review of the models in this tradition.
[18]Collin-Dufresne and Goldstein (2001, p. 1930) note that the Merton model does not allow the firm to issue additional debt and "demonstrate that precluding this option generates a downward-sloping term structure of credit spreads for speculative-grade debt, in conflict with the empirical findings of Helwege and Turner (1999)."

This study provides direct evidence on the extent that the assumptions of the Merton model do not hold. The analysis examines 418 downgrades and 186 upgrades of industrial firms listed in COMPUSTAT that occurred between 1987 and 2004. Most of the rating changes were collected from the period 2002 through 2004. Among downgrades, 18% (75 observations) were primarily driven by management choices and actions. Management was a significant contributor for another 6% (27 observations). Among upgrades, 25% (47 observations) were primarily driven by management choices and actions. Management was a significant contributor for another 16% (30 observations).

Data and Methodology

For each rating change, we would like to know the extent to which it was caused by management choices rather than by economic or operating factors. Management choices are high-level financial decisions such as acquisitions, repurchases and tender offers. Economic factors include competition, demand and sovereign risks. Operating factors include general operating difficulties as well as restructuring costs and risks.

Rating change observations were collected from COMPUSTAT. The rating changed if the Standard and Poor’s long-term issuer credit rating at the end of the year was different than the rating at the end of the previous year. From a total of 808 year-over-year rating changes, the cause of the change could be determined for 75%, or 604 changes. Table 4-1 shows the yearly and directional distribution of all 808 year-over-year rating changes and of the 604 changes to which cause could be assigned.

I searched Factiva for relevant stories on each rating change from the sample described above. The ultimate search goal was to find one or more news stories that explained why the firm had been upgraded or downgraded. Because the initial database of rating changes was compiled from COMPUSTAT which uses Standard and Poor’s credit ratings, the ideal article specifically explained, often quoting S&P analysts, why Standard and Poor's had changed the credit rating.

When the date of the S&P rating change could be identified but there was no explicit attribution from S&P, there were three alternative sources of attribution. If there was information about the rating having been put on "watch" by S&P and the resolution of the watch was a change in the rating, any direct explanation of the cause for the watch was presumed to be the cause of the change. Whenever possible, this was verified using the additional sources discussed below.

If a firm's Moody's credit rating changed in the same direction and at approximately the same time as the S&P rating and it was generally reasonable to expect that the causes of the ratings changes were the same, the attribution for the Moody's rating change was used when it was not possible to draw inferences directly from S&P information.

Absent direct information from S&P and Moody's, the final sources of information were other stories about the company and transcripts of earnings conference calls. These last sources of information were only used if, based on dates and other cues, there was a clear basis for presuming the cause of the rating change could be correctly inferred from the additional sources.

The search for articles was adaptive to minimize the probability of missing relevant articles without having to read through hundreds of articles for each rating change. The initial search expression included all or part of the company name plus restrictions to only return articles mentioning Standard and Poor's or Moody's and ratings.[19]

Using information from the COMPUSTAT quarterly database, the window of time for each rating change was narrowed to three months. The publication date window for the search

[19]Specifically, the general form of the initial search expression was "CompanyName and ((Standard and Poor's) or S&P or Moody's) and (rating or ratings or rtgs or rtg)."

started the 15th of the month before the fiscal quarter and ended the 15th of the month after the fiscal quarter. In most cases, it was also possible to further pinpoint the date of the rating change by searching for articles of less than 20 words that contained the company name or a fragment of the company name. These extremely short articles are essentially headlines without any additional text. Almost every rating change in the initial dataset of 808 has one or more headlines for ratings and watch changes.

When the search failed to produce any results, the requirement that the articles contain references to ratings was dropped. If the search continued to fail, it was rerun with only the company name. Finally, a special effort was made to address concerns that the CONAME (company name) field in COMPUSTAT is currently different than the name that would have appeared in the press at the time of the rating change. This concern applies in two directions: (1) the failure to find any articles about a company could reflect a difference between the current company name (CONAME) and the company name at the time of the news event and (2) the search could have found information about the wrong company in cases such as now-merged companies. Reviewing company websites and also searching for articles using a wider date window and only the company name was used when necessary to address the first concern. The second concern was addressed by comparing details such as the starting and ending credit ratings.

Of the 808 changes, sufficient information was available to identify the causes for 604. Most of the 204 changes with unidentified causes are not missing completely from the article database. Rather, the available articles do not contain sufficient detail to confidently identify the cause of the change. Typical of the 204 is a case where the only direct reference to a credit rating change is in one of the extremely short headline stories discussed above as a means to precisely identify the date of the change.

The goal of this analysis is to document and understand why firms' credit ratings change. The ultimate question is whether management caused the change through a deliberate high-level financial decision or whether the change came from economic or operating factors. The simplest examples of deliberate high-level financial decisions that can drive credit rating changes are direct capital structure changing transactions. If management uses cash on hand or issues debt to repurchase common stock, the firm's credit quality will fall as its leverage increases. Conversely, management could issue common stock to redeem debt. It follows that the firm's credit quality will improve. While these two examples are among the most direct and strongest ways in which management can alter the firm's credit risk, there are numerous management actions which can directly change the firm's credit quality holding the economy and the underlying business operations constant.

At the opposite end of the spectrum from management-induced credit rating changes are credit rating changes which are caused by outside economic factors. Changes in industry fundamentals, either positive or negative, change the credit quality of the firm in fairly obvious ways. For a company with international operations, changes in sovereign risk levels directly change the riskiness of the firm's debt. Internationally or domestically, a firm operating in a regulated market might see an exogenous shock to firm value and credit risk with a changing regulatory climate.

Operating performance and risks are grouped with economic factors. Examples of operating factors are earnings or losses, as well as the predictability of those results. While some operating factors such as costs or risks associated with the restructuring of operations could be viewed as management choices, the focus of this analysis is to treat operations as exogenous to credit ratings. Drawing the line between management choices and other causes in this way gives conservative estimates of when firms deviate from the assumptions of structural credit risk models. Table 4-2 details potential causes of ratings changes and their assignments to management, economic or operating factors.

Using these causes as a guide, an overall score of 1 through 5 was given to each year-over-year rating change. Changes attributable entirely to management are scored 1 while changes attributable entirely to economics and operations are scored 5. Table 4-3 summarizes the scoring system. The assignment of the score generally reflects an aggregation of the factors from Table 4-2. However, it is sometimes possible to assign a score even though there is not underlying detail such as that described in Table 4-2. For example, if a firm is downgraded because of a series of shareholder friendly activities in the absence of any underlying business changes, it would be possible to assign a score of 1 even if there is no further detail about those shareholder-friendly activities.

Finally, note that because the basis of the analysis is year-over-year rating changes, when there were two or more rating changes in a fiscal year, the overall score was based on all the changes.

Results

Management actions frequently drive credit rating changes, both up and down. Table 4-4 shows the causes of downgrades by the quality of the debt. Downgrades resulting primarily from management actions are less common for firms that have a speculative grade rating before or after the downgrade. However, even for firms losing investment grade ratings, management choices play a role. Fifty-nine firms in the sample were downgraded from investment grade to speculative grade. Ten of those downgrades were entirely the result of management actions and four more of those downgrades were primarily the result of management action.

Management-induced downgrades from investment grade to speculative grade are particularly significant. First, as stated at the outset of the paper, deliberate credit quality changes by management are not contemplated in current credit risk models. Second, moving across the divide between investment grade and speculative grade brings (1) a well recognized change in demand as certain clienteles would be forced to sell the newly speculative-grade bonds and (2) an increase in required yield that is much greater than that which would be required for a comparable change within the investment grade ranks.

Two examples illustrate the most extreme cases where management actions are the sole driver of a firm moving from investment grade to speculative grade. Referencing an analyst at Standard and Poor's, Reuters News (2004a) reported on July 21, 2004 that the rating on Citizens Communications had been lowered to BB+ from BBB because of "concern that Citizens [had] shifted toward a more shareholder-friendly financial policy that [would] limit further de-leveraging and financial flexibility." Specifically, the firm planned to pay dividends which would lead to "a smaller financial cushion (Reuters News (2004)." Zale Corporation announced a large stock buyback on July 1, 2003. The BBB- credit, which was placed on watch for a possible downgrade by S&P following the announcement, was downgraded to BB+ before the end of the month (Reuters News Service (2003) and Dow Jones Capital Markets Report (2003)).

Table 4-5 shows the causes of credit rating upgrades by firm credit quality. An interesting contrast can be drawn between downgrades to speculative grade debt and upgrades to investment grade debt. From Table 4-4, we know that 41 out of 59 downgrades to speculative grade were entirely caused by economics and operations. Table 4-5 shows that only 7 out of 24 upgrades to investment grade were entirely caused by economics and operations. Management matters everywhere and sometimes, as illustrated by the cases of Citizens and Zale above, pro-shareholder actions are taken even when the impact on bondholders is significant (i.e. the debt falls to speculative grade). But, management matters even more in the opposite direction: a firm's chance of being upgraded from speculative to investment grade relies substantially on management choices.

Table 4-6 recasts the information detailed in Tables 4-4 and 4-5 to show the frequency with which management matters as a percentage of all upgrades or downgrades by credit quality. Management matters most for upgrades to investment grade. Thirty-eight percent of firms upgraded to investment grade were driven primarily by management. Another 21% had a significant management influence. As suggested earlier, the yield and demand differences between the highest speculative grade and the lowest investment grade are far greater than the differences between other one notch changes in credit quality. One group of ratings changes stands out as being dominated by economic and operating factors: downgrades within speculative grade. For 85% of downgrades within the speculative ranks, economic or operating factors were the primary cause of the downgrade. This should be expected because speculative grade bonds typically have covenants precluding the types of management actions that lead to downgrades.

Whenever possible, detailed data in the categories outlined in Table 4-2 was collected along with the assignment of each rating change to management versus economic or operating causes. Table 4-7 summarizes the incidence of selected actions and events as being one of the specific proximate causes of the rating change. Downgrades are dominated by a few particular causes. Among economic and operating causes, industry fundamentals were responsible for a total of 112 downgrades. Among management causes, acquisitions led to 67 downgrades, common stock repurchases led to 26 downgrades and financial policies led to 19 downgrades. This last category captures both explicit policy changes, typically articulated as a pro-shareholder shift, and policy changes inferred from firm actions. Interestingly, financial policies were the leading cause of rating upgrades, followed by dispositions and acquisitions. On April 14, 2004, Yum! Brands was upgraded to BBB- by Standard and Poor's. Quoting an S&P analyst, the upgrade was attributed to "consistently high free cash flow, and S&P's expectation that the company [would] maintain a prudent financial policy (Lemos 2004)." Here, both management actions and economic and operating factors played a significant role in the upgrade[20].

Among economic causes of upgrades, industry fundamentals was most common, although not necessarily as the singular driver of the upgrade. In August 2003, S&P raised the investment-grade BBB- credit rating on Northrop Grumman[21] because of the company's position within the "generally attractive defense sector, but also because the firm was expected to pursue a more "'moderate' financial policies (AFX UK Focus 2003)."

Conclusion

Credit rating changes can be driven by either market conditions or management actions. For downgraded firms, 24% of changes are primarily or substantially caused by management action. For upgraded firms, 41% of changes are primarily or substantially caused by management action. Structural models of credit risk, which assume capital structure is not

[20] The 2004 rating change for Yum! Brands was scored as a three to reflect the significant impact of both management and favorable operating factors.

[21] The 2003 rating change for Northrop Grumman was scored as a three to reflect the significant impact of both management choices and the favorable economic environment.

actively changed, have significant limitations when a substantial fraction of rating changes are coming through management action. This sheds light on the mechanism through which corporate governance affects credit spreads.

Table 4-1. Credit rating change data by year.

Year	Downgrades	Assignable downgrades	Upgrades	Assignable upgrades
2004	127	101	103	70
2003	183	136	94	58
2002	142	119	38	27
2001 and before	84	62	37	31
All years	536	418	272	186

Table 4-2. Potential causes of credit rating changes.

Cause	Management, economics or operations	Explanation
Competition	Economics	
Costs	Economics	
Demand, prices or revenue	Economics	
Economy	Economics	
Fines, lawsuits and criminal law actions	Economics	
Industry fundamentals	Economics	
Market position	Economics	
Market share	Economics	
Public utilities commission and similar regulatory issues	Economics	
Reporting and/or SEC issues	Economics	
Sovereign or country issues	Economics	
Acquisitions	Management	Acquiring large capital assets, divisions or entire companies.
Aggressive growth	Management	The firm is either undertaking or ceasing a period of aggressive growth.
Capital expenditures	Management	Refers to significant capital expenditures outside ordinary renewal and replacement levels
Dispositions	Management	Dispositions of either large capital assets or divisions.
Dividends	Management	Significant changes in dividend policy or payment of an extraordinary dividend.
ESOP	Management	Establishment or curtailment of an employee stock ownership plan.
Financial policy	Management	
Integration risks or benefits	Management	Integration of large acquisitions.
Refinancing or issuance of preferred stock	Management	Refinancing preferred stock with regular debt or using preferred stock to reduce regular debt leverage.
Repurchase or issuance of common stock	Management	Using cash on hand or debt issuance to repurchase common stock or issuing common stock to reduce leverage or increase cash on hand. Leveraged buyouts are included here.
Family ownership changes	Management	
Operations restructuring costs or benefits	Operations	
Operations restructuring risks	Operations	
Strategic uncertainty	Operations	
Cash flows	Operations	
Earnings or losses	Operations	
Earnings predictability	Operations	
General operations	Operations	
Operating risk changes	Operations	

Table 4-3. Summary of overall scoring criteria.

Score	Underlying factors
1	Management actions were the only or the overwhelming cause of the rating change.
2	Management actions were the primary cause of the rating change, but economic or operating factors contributed.
3	Both management actions and either economic or operating factors were a significant and proximate cause of the rating change.
4	Economic or operating factors were the primary cause of the rating change, but management actions contributed.
5	Economic or operating factors were the only or the overwhelming cause of the rating change.

Table 4-4. Causes of downgrades by investment versus speculative grade.

Cause of downgrade	Score	All downgrades	Investment grade	Speculative grade	Transition to speculative grade
All management	1	57	35	12	10
Primarily management with some economics or operations influence	2	18	9	5	4
Management and economics or operations were significant	3	27	14	13	0
Primarily economics or operations with some management influence	4	34	14	16	4
All economics or operations	5	282	81	160	41
All causes		418	153	206	59

Table 4-5. Causes of upgrades by investment versus speculative grade.

Cause of upgrade	Score	All upgrades	Investment grade	Speculative grade	Transition to investment grade
All management	1	35	11	17	7
Primarily management with some economics or operations influence	2	12	3	7	2
Management and economics or operations were significant	3	30	7	18	5
Primarily economics or operations with some management influence	4	31	7	21	3
All economics or operations	5	78	31	40	7
All causes		186	59	103	24

Table 4-6. Frequency of substantial management influence by credit quality and direction of ratings change.

	Management dominates		Both influences significant		Economic and operating factors dominate	
	Number	Percentage	Number	Percentage	Number	Percentage
Downgrades within investment grade	44	29	14	9	95	62
Upgrades within investment grade	14	24	7	12	38	64
Downgrades to speculative grade	14	24	0	0	45	76
Upgrades to investment grade	9	38	5	21	10	42
Downgrades within speculative grade	17	8	13	6	176	85
Upgrades within speculative grade	24	23	18	17	61	59
All Downgrades	75	18	27	6	316	76
All Upgrades	47	25	30	16	109	59

Table 4-7. Incidence of selected specific causes of downgrades and upgrades.

	Downgrades	Upgrades
Fines, lawsuits and criminal law actions	15	2
Industry fundamentals	112	16
Public utilities commission and similar regulatory issues	7	4
Sovereign or country issues	8	6
Acquisitions	67	19
Aggressive growth	5	0
Dispositions	11	20
Dividends	11	0
ESOP	1	0
Financial policy	19	32
Integration risks or benefits	2	11
Refinancing or issuance of preferred stock	2	0
Repurchase or issuance of common stock	26	10

LIST OF REFERENCES

Acharya, Viral V., and Jennifer N. Carpenter, 2002, Corporate bond valuation and hedging with stochastic interest rates and endogenous bankruptcy, *Review of Financial Studies* 15, 1355-1383.

AFX UK Focus, 2003, S&P upgrades Northrop Grumman's credit ratings, August 18.

Berkovitch, Elazar and E. Han Kim, 1990, Financial contracting and leverage induced over- and under-investment, *Journal of Finance* 45, 765-794.

Besanko, David and Anjan Thakor, 1987a, "Competitive equilibria in the credit market under asymmetric information, *Journal of Economic Theory* 42, 167-182.

Besanko, David and Anjan Thakor, 1987b, "Collateral and rationing: Sorting equilibria in monopolistic and competitive credit markets, *International Economic Review* 28, 671-689.

Bester, Helmut, 1985, Screening vs. rationing in credit markets with imperfect information, *American Economic Review* 75, 850-855.

Bhojraj, Sanjeev, and Partha Sengupta, 2003, Effect of corporate governance on bond ratings and yields: The role of institutional investors and outside directors, *Journal of Business* 76, 455-475.

Billet, Matthew T., Tao-Hsien Dolly King, and David C. Mauer, 2007, Growth opportunities and the choice of leverage, debt maturity, and covenants, *Journal of Finance* 62, 697-730.

Black, Fischer, and Myron Scholes, The pricing of options and corporate liabilities, *Journal of Political Economy* 81, 637-654.

Brown, David T., Brian A. Ciochetti and Timothy Riddiough, 2006, Theory and evidence on the resolution of financial distress, *Review of Financial Studies* 19, 1357-1397.

Brown, David T., Christopher M. James and Robert M. Mooradian, 1994, Asset sales by financially distressed firms, *Journal of Corporate Finance* 1, 233-257.

Chan, Yuk-Shee and Anjan Thakor, 1987, Collateral and competitive equilibria with moral hazard and private information, *Journal of Finance* 42, 345-364.

Collin-Dufresne, Pierre, and Robert S. Goldstein, 2001, Do credit spreads reflect stationary leverage ratios?, *Journal of Finance* 56, 1929-1957.

Dow Jones Capital Markets Report, 2003, S&P cuts Zale Corp credit rtg to 'BB+', off watch, July 31.

Esty, Benjamin, and Aldo Sesia, Jr., 2005, An overview of project finance – 2004 update, *Harvard Business School*, Case 9-205-065.

Faulkender, Michael, and Mitchell A. Petersen, 2006, Does the source of capital affect capital structure?, *Review of Financial Studies*, 19, 45-79.

Flannery, Mark J., Joel F. Houston and Subramanyam Venkataraman, 1993, Financing multiple investment projects, *Financial Management,* 22, 161-172.

Helwege, Jean, and Christopher M. Turner, 1999, The slope of credit yield curve for speculative-grade issuers, *Journal of Finance* 54, 1869-1884.

Hovakimian, Armen, Tim Opler and Sheridan Titman, 2001, The debt-equity choice, *Journal of Financial and Quantitative Analysis*, 36, 1-24.

Howe, John and James Schilling, 1988, Capital structure theory and REIT security offerings, *Journal of Finance,* 43, 983-993.

John, Teresa and Kose John, 1991, Optimality of project financing: Theory and empirical implications in finance and accounting, *Review of Quantitative Finance and Accounting,* 1, 51-74.

Johnson, Shane, 2003, Debt maturity and the effects of growth options and liquidity risk on leverage, *Review of Financial Studies,* 16, 209-236.

Kahn, Charles and Andrew Winton, 2004, Moral hazard and optimal subsidiary structure for financial institutions, *Journal of Finance*, 59, 2537-2575.

Klock, Mark S., Sattar A. Mansi, and William F. Maxwell, 2005, Does corporate governance matter to bondholders?, *Journal of Financial and Quantitative Analysis,* 40, 693-718.

Kolasinski, Adam, 2006, Subsidiary debt, capital structure and internal capital markets, Working paper, University of Washington.

Lemos, Mara, 2004, S&P Upgrade puts Yum! Brands firmly in invest-grade land, Dow Jones Capital Market Reports, April 14.

Lewellen, Wilbur, 1971, A pure financial rationale for the conglomerate merger, *Journal of Finance,* 26, 521-537.

Ling, David and Wayne Archer, 2005, *Real Estate Principals: A Value Approach,* (McGraw-Hill Irwin).

Merton, Robert C., On the pricing of corporate debt: The risk structure of interest rates, *Journal of Finance* 29, 449-470.

Myers, Stewart, 1978, Determinants of corporate borrowing, *Journal of Financial Economics,* 5, 147-175.

Pulvino, Todd, 1998, Do asset fire sales exist? An empirical investigation of commercial aircraft transactions, *Journal of Finance,* 53, 939-978.

Riddiough, Timothy and Zhonghua Wu, 2006, Financial constraints, external-source liquidity, and investment, Working paper, University of Wisconsin.

Reuters News, 2004, Update 1 – S&P cuts Citizens' Communications' rating to junk, July 21.

Reuters New Service, 2003, Zale plans stock buyback, debt refinance, July 2.

Salas, Caroline, 2006, Bondholders lose in Heinz, Sprint stock buybacks, Bloomberg.com, August 15.

Stulz, Rene and Herb Johnson, 1985, An analysis of secured debt, *Journal of Financial Economics*, 14, 501-521.

Titman, Sheridan and Roberto Wessels, 1988, The determinants of capital structure choice, *Journal of Finance*, 43, 1-19.

Triantis, George, 1992, Secured debt under conditions of imperfect information, *Journal of Legal Studies*, 21, 225-258.

Williams, Joseph, 2001, Agency, ownership and returns on real assets, Working paper, Professors Capital.

Williamson, Oliver, 1988, Corporate finance and corporate governance, *Journal of Finance*, 63, 567-591.

BIOGRAPHICAL SKETCH

Hugh Marble III grew up in Rhode Island and completed his undergraduate work in economics at the University of Rhode Island. He received a Master of Business Administration from Rollins College and spent slightly over three years working in public finance before beginning doctoral studies at the University of Florida.