PROJECT FINANCING: DEAL OR NO DEAL

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ABSTRACT

This paper proposes a model that shows the influence of the major factors on the choice between project financing versus internal corporate financing. Most research on the subject of project finance focuses on structuring and financing issues. In contrast, we incorporate the effects of the management efforts on market outcomes into the model framework and examine the issue from the perspective of managerial incentives. The model highlights a set of conditions under which corporations prefer off-balance-sheet project financing. The choice is driven by the required amount of investment and the extent of the prevailing uncertainty. Companies tend to choose project financing when managers' efforts have a significant impact on the magnitude and likelihood of favorable outcomes. In addition, the larger the capital size, the more likely outside project financing is employed.

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1. INTRODUCTION

From the standpoint of a company, project finance is not only a financing decision but is also an investment decision. Compared with traditional corporate finance, project financing can be more costly due to its operational complexity. Adopting a similar approach of the adjusted-present-value for project financing valuation was first advocated by D.L. Lessard (1979). The idea is to understand the overall benefit as well as how component values are derived. Such a proposition helps to pinpoint the underlying driving forces of project finance. Following this path, several theoretical models of project finance have been developed in literature; they include John and John (1991), Finnerty (1996), Nevitt and Fabozzi (2000) and Esty (2003a, b), to name a few.

The overwhelming contractual arrangements really set aside project financing from traditional corporate financing. The parties involved in structuring of a typical project financing arrangement take the contract as a device designed for different purposes. To explain the economic importance of project financing, most existing literature is based on agency or moral hazard problems, either from the capital assets or the sponsoring firm. For example, the asset-specific agency conflicts addressed in the paper of Habib and Johnsen (1996) can be avoided with project finance. Blanchard, Lopez-de-Silanes (1994) argue that the short-lived project financing arrangement resolves the inefficient investment with free cash flows. With incomplete information, the joint evaluation of the projects and existing assets can be problematic. For this reason Shah and Thakor (1987) propose that the primary motivation for project finance is to reduce the information search cost.

Another stream of research interprets project finance as one of the risk management strategies taken by the sponsoring firm. Although the interaction of financing and capital investment has been addressed by Froot, Scharfstein and Stein (1993), using project finance as a risk hedging tool is re-examined recently by Parrino, Poteshman and Weisbach (2002) to prevent sub-optimal investment strategies. Using project finance for bankruptcy protection of a low-risk project from high-risk projects is found in the work of Chemmanur and John (1992); Lamont (1997) shares a similar view.

At a practical level, it is also the belief of Brealey, Cooper, and Habib (1996) that risk management motivation can lead to an agency conflict between ownership and control. However, the main focuses are still on the financing dimension.

Our paper attempts to provide justification for project finance from a more integrated and broaden perspective than those in the existing studies. In addition to the financing aspect, there are extra concerns in managerial decision that would affect investment values. While managers must understand other issues such as competitive strategy, marketing, ethic, human management, and so on, we have built a model to show their inter-relationships. Factors such as market condition, the firm's operational, capital and ownership structures are at the heart of this paper. Importantly, we examine how managerial incentives may influence the choice of off-balance-sheet project financing versus internal corporate financing. Our main analysis of project financing along this direction has received no attention.

Our approach differs substantially from other precedent theoretical and empirical models on project financing in which the inter-linkage of managerial decision-making never arises without contractual arrangements. Incorporating industrial and organizational aspects has given a new impetus to the analysis of project finance. Whereas in our model formulated with four key features presenting various operational issues for firms, the choice between internal financing and project financing is explained by the effort incentive from managers. First, the investment project consisting of the sale of product in a quasi-stochastic market characterizes the risk exposures to parties involved. Second, market outcomes can be influenced by the effort of management showing the inter-activeness of managerial decision-making. Third, the risk aversion of companies points out the conflict between insurance protection and correct incentive. Lastly, the abundance of risk-neutral lenders who can fund projects with positive expected value creates a sustainable environment for project financing. With all these features, we can adequately describe the real-world project finance situations.

Interestingly, rather than using financial derivatives, the new idea of transforming the attributes of the firm to manage risk occurs in our model, but with very different implications through managerial incentive structures. Shifting the risk of a capital project to the outside-investors may discourage the appropriate level of effort required to operate the project. Such a general problem of the conflict between risk spreading and providing appropriate incentives to agents has earned a wide discussion.[2] In contrast to the majority of discussion, our model works on cases where investors are many and the outside financing market is competitive. Such an approach recognizes that companies engaging in project financing may anticipate earning economic rent since competition to provide funds by outside-investors sets a limit on the cost of project financing. As a result, the project sponsors (those who have an ownership stake in the project) are still seriously committed to the project and have a vested interest in seeing the project succeed.

Given the risk aversion assumption, firms will always think of project finance as a help to reduce risk if outside investors are available. However, the compatibility between work incentive and pay scheme has a profound implication for contract designs while market power is present. As mentioned above, the abundance of outside financing does not interfere with the incentives of the firm providing a low level of effort. Nevertheless, when outside investors have larger bargaining power by forming a syndicate in negotiation, they can impose stronger influence on designing contracts that attempt to induce high effort. Casual observation suggests that outside investors can at least detect the minimum work effort. Thus, the ultimate contract design will be dictated by the difference in expected profit between high and low effort and the difference in cost between the two efforts. A smaller difference in costs between the two effort levels encourages a higher level in an optimal contract. Similarly, a larger difference in profits also promotes a greater effort.

Our main findings are summarized as follows. First, firms will use traditional corporate financing when managerial effort has a significant impact on both the magnitude and the probability of favorable outcomes. Second, the funding requirement or the scale of the project is directly related to the decision of choosing project finance. Third, market size has ambiguous effects depending on the size of the capital investment.

[2] There have been considerable thoughts on the incentive schemes to reward managers within a firm and whether to provide managerial rewards tied to firm profits or to provide fixed salaries. Managers in general will have more limited opportunities to capture economic rents that company owners may potentially earn.

The paper is organized as follows. Section 2 introduces the basic model framework and presents an analysis of different financing forms. Section 3 discusses the comparative static results and the testable predictions from the model. Section 4 contains a few concluding remarks.

2. THE MODEL

Consider a company who owns the franchise rights for an investment project. There is large and long-term market risk inherently involved in this project. Revenue depends on output, q, and the inverse demand curve, $P = a - bq$, for the firm's product.

$$R(q) = Pq = (a - bq)q + R_0. \tag{1}$$

Total cost is given by:

$$C(q,e) = c_1 q^2 + c_2 q - c_3 eq + K + e, \tag{2}$$

where R_0 is the minimum revenue that is independent of output, $e \in (e_L, e_H)$ corresponds to low or high effort and $K > 0$ represents the fixed initial capital investment.[3]

To ensure the firm's cost is always an increasing function of output, we need to impose the condition, $c_2 > c_3 e_H$. The parameter c_3 reflects the reduction in marginal and average costs from each unit of effort.

The cash flow of the project, W, is primarily determined by the difference between revenue and cost through production, which is subject to market risk u in a simple multiplicative fashion. That is

$$W = u[R(q) - c(q,e)], \tag{3}$$

where $u \in [u_1, u_2]$ is a two-state random variable with $u_2 > u_1$. By assuming multiplicative uncertainty on the cash flows, the company output level will be chosen independently of the state of the world.

It is further assumed in the model that the probability of state occurrence is influenced by the level of effort undertaken by the management in the new business

[3] R_0 reflects the fact that as long as there is a basic need of the services to provide steady cash inflows, market will not be completely stochastic. We are grateful to a referee for pointing this out. Interestingly, it

entity. For low effort, $\text{Prob}(u = u_1 \mid e_L) = \alpha$; and high effort, $\text{Prob}(u = u_1 \mid e_H) = \psi\alpha$, where $0 < \psi \leq 1$. ψ indicates the impact of high effort on the likelihood of favorable outcomes, and the smaller the ψ , the higher the impact.

Effort in our analysis simply reflects general managerial competence and attentiveness. It is understandable to categorize effort into two groups: one can be clearly specified and one cannot be specified. The effort that can be specified through contracts is observable from outside investors and is the minimum level of effort managers must provide. High effort includes this low level effort and the part that cannot be contracted for. As a result, outsider investors cannot determine whether high effort is being supplied or not.

The company's utility function is assumed to exhibit Arrow-Pratt constant relative risk aversion, which is denoted by *R*.

$$U(W) = W^{1-R} \tag{4}$$

Being risk averse, $0 < R < 1$, the company maximizes the expected utility of cash flow, *W* from the investment project.

Two forms of financing and compensations are considered. The first option is self-financing, or corporate-funded by the company. The cash flow varies depending on the market outcome. The other alternative is to use project financing with outside investors. The company then gets a fixed reward that is independent of market outcome. Since the high level of effort cannot be contracted for, the company will only supply low effort. However, companies may benefit even more from the risk reduction than the monetary compensation generated by the project.

2.1 Corporate Self-Financing

For a low level of effort, the expected utility of cash flow is given by:

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does not affect the optimal output decision and our findings regarding the effects of various variables remain the same as those when it is zero. From now on, we assume R_0=0

$$EU\left(W\middle|e_L\right) = \alpha u_1^{1-R}\left[(a-bq)(q) - (c_1q^2 + c_2q - c_3e_Lq + K) - e_L\right]^{1-R}$$
$$+(1-\alpha)u_2^{1-R}\left[(a-bq)(q) - (c_1q^2 + c_2q - c_3e_Lq + K) - e_L\right]^{1-R} \tag{5}$$

Correspondingly, a high level of effort yields

$$EU\left(W\middle|e_H\right) = \psi\alpha u_1^{1-R}\left[(a-bq)(q) - (c_1q^2 + c_2q - c_3e_Hq + K) - e_H\right]^{1-R}$$
$$+(1-\psi\alpha)u_2^{1-R}\left[(a-bq)(q) - (c_1q^2 + c_2q - c_3e_Hq + K) - e_H\right]^{1-R} \tag{6}$$

The company must choose both effort and output before the state of the world is known. To determine the optimal level of effort, the company calculates the maximum expected utility under the high and the low effort level comparing the two.

For low effort, $\max EU(W|e_L)$ gives an optimal output $q^* = \dfrac{a - c_2 + c_3e_L}{2(b+c_1)}$. Substituting q^* into equation (5) yields

$$EU^*(W|e_L) = \left[\alpha u_1^{1-R} + (1-\alpha)u_2^{1-R}\right]\left[\frac{(a-c_2+c_3e_L)^2}{4(b+c_1)} - (K+e_L)\right]^{1-R}. \tag{7}$$

To simplify the notation, replace (b + c_1) with A and (a – c_2) with B. The above expression then becomes

$$EU^*(W|e_L) = \left[\alpha u_1^{1-R} + (1-\alpha)u_2^{1-R}\right]\left[\frac{(B+c_3e_L)^2}{4A} - (K+e_L)\right]^{1-R}. \tag{8}$$

Similarly, high effort will have an optimal output and expected utility as below.

$q^* = \dfrac{a-c_2+c_3e_H}{2(b+c_1)} = \dfrac{B+c_3e_H}{2A}$ and

$$EU^*(W|e_H) = \left[\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}\right]\left[\frac{(B+c_3e_H)^2}{4A} - (K+e_H)\right]^{1-R}. \tag{9}$$

The optimal expected utility will always be positive no matter whether a high or low level of effort is provided. Otherwise, the project will not be financed. Under some specific conditions, it can be shown unambiguously that the firm will choose either a high level of effort or a low level of effort. These are demonstrated in theorems 1 and 2.

Theorem 1: A company will always choose a high level of effort if $e_L \geq \dfrac{(2A - Bc_3)}{c_3^2}$.

Proof: Managers will choose a high level of effort if $EU^*(W \mid e_H) \geq EU^*(W \mid e_L)$. The above inequality holds if $\left[\frac{(B+c_3e_H)^2}{4A}-(K+e_H)\right]^{1-R} \geq \left[\frac{(B+c_3e_L)^2}{4A}-(K+e_L)\right]^{1-R}$, as $\psi\alpha u_1^{1-R}+(1-\psi\alpha)u_2^{1-R} > \alpha u_1^{1-R}+(1-\alpha)u_2^{1-R}$ is always true for $\psi < 1$.

Consider function $T1(e)=\frac{(B+c_3e)^2}{4A}-(K+e)$ with $\frac{\partial T1(e)}{\partial e}=\frac{(Bc_3+c_3^2e)}{2A}-1$ and $\frac{\partial^2 T1(e)}{\partial e^2}=\frac{c_3^2}{2A}>0$. Since $\frac{\partial^2 T1(e)}{\partial e^2}>0$, solving for e where $\frac{\partial T1(e)}{\partial e}=0$ yields a minimum expected utility; that is, $e^*=\frac{2A-Bc_3}{c_3{}^2}$. Consequently, $T1(e)$ is an increasing function of e for $e>e^*$. This implies that $T1(e_H)>T1(e_L)$ if $e_L>e^*$. In other words, if $e_L>e^*$ then inequality $\left[\frac{(B+c_3e_H)^2}{4A}-(K+e_H)\right]^{1-R} \geq \left[\frac{(B+c_3e_L)^2}{4A}-(K+e_L)\right]^{1-R}$ will hold, and it follows that a high level of effort increases the expected utility above that of a low level of effort.

Corollary: If $(2A - Bc_3) < 0$, then high effort will always be preferred.

Proof: As long as $e_L > 0$, conditions of theorem 1 are satisfied automatically. The circumstance is favored by A being small or Bc_3 being large.

Interpretation: The term $A = b + c_1$ is small if the market size is huge (i.e., small b) or diseconomies of scale is moderate (i.e., small c_1). The term $Bc_3 = (a - c_2)c_3$ is large if the maximum willingness to pay, a, is high or the unit variable cost, c_2, is small or the impact of effort on reducing unit variable cost, c_3, is significant.

Theorem 2: If high effort has no influence on the cash flow occurrence (i.e., ψ =1), then low effort will yield higher expected utility whenever $e_H \leq \frac{(2A-Bc_3)}{c_3^2}$.

Proof: From the proof of Theorem 1, we know that if $e<e^*=\frac{2A-Bc_3}{c_3^2}$ then $T1(e)$ is a decreasing function of e. Therefore, if $e_H<e^*$, the following holds

$$(\alpha u_1^{1-R}+(1-\alpha)u_2^{1-R})\left[\frac{(B+c_3e_H)^2}{4A}-(K+e_H)\right]^{1-R}\leq(\alpha u_1^{1-R}+(1-\alpha)u_2^{1-R})\left[\frac{(B+c_3e_L)^2}{4A}-(K+e_L)\right]^{1-R}$$

i.e., $EU(W\,|\,e_H)<EU(W\,|\,e_L)$.

The critical condition, ψ = 1 is necessary because otherwise, the high likelihood of favorable outcomes as a result of the high effort may compensate for the negative impact that high effort has on cash flow in a given state of the world.

The relationship between effort and expected utility can be represented by an U-shaped curve. Sufficiently high effort, if available, ultimately leads to greater cash flows than lower effort because there are no diminishing returns to effort in the model. Each additional amount of effort contributes a constant reduction in marginal and average cost. The reduction in cost encourages greater output, which magnifies the rewards of greater effort. For all possible effort levels, constant improvement in average cost from effort is unrealistic. However, by assumption, the analysis will consider only two discrete effort levels whose relevant range is characterized by effort making a constant improvement in average cost due to additional effort.

2.2 Project Financing

Instead of accepting variable returns through corporate financing, the company can contract out the project to a risk-neutral external investor and act as a managing agent. The results derived for the company's arrangement of project financing are similar to the setup of an appropriate incentive structure for rewarding managers within a company under the standard principal-agent relationship. There are, however, two main differences. First, the assumption of a large number of potential investors implies that all the negotiating power goes to the company in question and the outside-investors only earn a competitive rate of return. Second, the on-going relationship leads the firm to have strategic considerations throughout its involvement. This is why a company prefers not to have an outright sale for outside-investors and to have management in the project.

The fixed management fee may include economic rent that the company would expect to earn when corporate financing is used. Since the capital market of project financing is assumed to be competitive, the expected return for external investors only needs to be *K*, the capital investment. While the investors commit a fixed payment to the company, they assume all the risks of the project. A standard and common practice of project financing is that lenders do not look to the project's sponsor to make up any shortfalls that may occur throughout the life of the project. In the case of a poor market outcome, investors may earn less than *K* and earn more than *K* as a premium when market is favorable.

As argued earlier, the outside investors cannot monitor whether or not high effort has been provided. Therefore, the payment that investors offer will be based on the low effort expectation. Expected cash flow, $E(W)$, from the project is the fixed management fee received by the company regardless of the state of the world, netting out the cost of effort.[4] Given the optimal output q^*, the expected cash flow from the project can be calculated as $E(W) = [\alpha u_1 + (1-\alpha)u_2]\left[\frac{(B+c_3e_L)^2}{4A} - (K+e_L)\right]$. The corresponding utility becomes $U(E(W)\,|\,e_L) = [\alpha u_1 + (1-\alpha)u_2]^{1-R}\left[\frac{(B+c_3e_L)^2}{4A} - (K+e_L)\right]^{1-R}$.

Theorem 3: Given $e_L \geq \frac{(2A - Bc_3)}{c_3^2}$, project financing is preferred if and only if

$$\frac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} > \frac{\left(B^2 + 2Bc_3e_H + c_3^2e_H^2 - 4AK - 4Ae_H\right)^{1-R}}{\left(B^2 + 2Bc_3e_L + c_3^2e_L^2 - 4AK - 4Ae_L\right)^{1-R}}$$

Proof: By definition, a company prefers seeking project financing to providing its own funds if $U(E(W)\,|\,e_L) > \text{Max}(EU(W\,|\,e_H), EU(W\,|\,e_L))$. According to Theorem 1, if $e_L \geq \frac{(2A - Bc_3)}{c_3^2}$, high level of effort will be chosen and $EU(W\,|\,e_H) > EU(W\,|\,e_L)$. So, in order for the company to prefer project financing, $U(E(W)\,|\,e_L) > EU(W\,|\,e_H)$ must be true. Substituting the parameterized functions for this relationship yields the following requirement.

[4] The extra cost of creating an independent entity can be assumed to be proportional to the expected cash flow from the project. Integrating such a feature into the model would adversely restrict the choice of project financing. However, conclusions regarding the effects of other factors remain.

$$\left[\alpha u_1 + (1-\alpha)u_2\right]^{1-R}\left[\frac{(B+c_3e_L)^2}{4A} - (K+e_L)\right]^{1-R} > \left[\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}\right]\left[\frac{(B+c_3e_H)^2}{4A} - (K+e_H)\right]^{1-R}$$

Rearranging terms yields the following relationship:

$$\frac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} > \frac{\left(B^2 + 2Bc_3e_H + c_3^2e_H^2 - 4AK - 4Ae_H\right)^{1-R}}{\left(B^2 + 2Bc_3e_L + c_3^2e_L^2 - 4AK - 4Ae_L\right)^{1-R}}$$

Theorem 4: A company prefers project financing if low effort is already the optimal action for self-financing.

Proof: Because $U(W)$ is a concave function, $U(E(W)\,|\,e_L) > EU(W\,|\,e_L)$ must hold. If low effort is the optimal action for self-financing, then $EU(W\,|\,e_L) > EU(W\,|\,e_H)$. These two inequalities imply $U(E(W)\,|\,e_L) > \text{Max}(EU(W\,|\,e_H), EU(W\,|\,e_L))$.

Lemma 1: Given $e_L \geq \frac{(2A - Bc_3)}{c_3^2}$, if project financing is chosen, then $\frac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} > 1$, and this term will always be less than $\frac{u_2}{u_1}$.

Proof: From Theorem 1, if $e \geq e^* = \frac{(2A - Bc_3)}{c_3^2}$, then $\frac{\partial T1(e)}{\partial e} > 0$. This implies that $\left(B^2 + 2Bc_3e_H + c_3^2e_H^2 - 4AK - 4Ae_H\right)^{1-R} > \left(B^2 + 2Bc_3e_L + c_3^2e_L^2 - 4AK - 4Ae_L\right)^{1-R}$. It follows from Theorem 3 that $\frac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} > 1$.

For the second claim, $\frac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} < \frac{u_2}{u_1}$, rewrite the expression as $\frac{\max[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\min[\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}]} = \frac{u_2}{u_1}$, since $\max[\alpha u_1 + (1-\alpha)u_2]^{1-R} = u_2$ with α = 0 and R = 0 and $\min[\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}] = u_1$ with α = 1, R = 0, and ψ = 1. Furthermore, as the numerator cannot be at a maximum while the denominator is at a minimum, therefore, $\frac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} < \frac{u_2}{u_1}$.

Lemma 2: For $e_L \geq \frac{(2A - Bc_3)}{c_3^2}$, if $G(\alpha, R, \psi, u_1, u_2) = \frac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} > 1$, then a critical e_H^* exists such that for all levels $e_H < e_H^*$ project financing will be favored.

Proof: Let $G(\alpha, R, \psi, u_1, u_2) = 1 + \gamma$ with $\gamma > 0$, project financing is preferred for all e_H that satisfy

$$H(a, c_2, c_3, A, K, e_L, e_H) = \frac{\left(B^2 + 2Bc_3e_H + c_3^2e_H^2 - 4AK - 4Ae_H\right)^{1-R}}{\left(B^2 + 2Bc_3e_L + c_3^2e_L^2 - 4AK - 4Ae_L\right)^{1-R}} \leq 1 + \gamma.$$

If $e_H = e_L$, then the above expression must be satisfied since the right hand size will be equal to one. We can prove that $H(a, c_2, c_3, A, K, e_L, e_H)$ is an increasing function of e_H for $e_H > e_L \geq \frac{(2A - Bc_3)}{c_3^2}$. As e_H increases, the numerator increases so that an $e_H^* = e_L + \lambda$ exists where $H(a, c_2, c_3, A, K, e_L, e_H^*) = 1 + \gamma$.

Theorem 3 and the above two lemmas together imply certain restrictions where a company will choose project financing.

3. COMPARATIVE STATIC DISCUSSIONS

The preceding section describes a rather special world in which capital investment financing is analyzed. Now, we will argue that this special setup can be used for a number of further issues. Under the conditions specified by Theorem 3 and Lemma 2, we can draw implications from some key factors influencing the choice between internal corporate financing and off-balance-sheet project financing. While our comparative static exercise tries to provide a convenient format for analyzing changes in the structural attributes, it focuses how the utility of cash flows for project financing is affected relative to corporate funding of capital projects. The critical point is the value satisfying

$$G(.^*) = \frac{G_n(.^*)}{G_d(.^*)} = \frac{H_n(.^*)}{H_d(.^*)} = H(.^*),$$

where $G_n = [\alpha u_1 + (1-\alpha)u_2]^{1-R}$,

$$G_d = \psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R},$$

$$H_n = (B^2 + 2Bc_3e_H + c_3^2e_H^2 - 4AK - 4Ae_H)^{1-R}, \text{ and}$$

$$H_d = (B^2 + 2Bc_3e_L + c_3^2e_L^2 - 4AK - 4Ae_L)^{1-R}.$$

A company will be indifferent when utility of outside project financing equals utility of internal financing, $G_n(.^*)H_d(.^*) = G_d(.^*)H_n(.^*)$. If either G increases or H decreases, then off-balance-sheet project financing is favored. However, if a gain in utility from outside project financing arises, $G_n(.^*)H_d(.^*) - G_d(.^*)H_n(.^*) > 0$, an increase in G or a decrease in H alone does not necessarily lead to a rise in utility from external financing. Although the discussion confirms the belief that financing structures do affect investment decisions, our results do not indicate over a broad range whether profits from one type of financing or another are increased or decreased with a particular parameter. It means that no single reason can fully explain how project finance is adopted.

Given $e_L \geq \dfrac{(2A - Bc_3)}{c_3^2}$ and $G(\alpha, R, \psi, u_1, u_2) = \dfrac{[\alpha u_1 + (1-\alpha)u_2]^{1-R}}{\psi\alpha u_1^{1-R} + (1-\psi\alpha)u_2^{1-R}} > 1$, project financing through outside-investors will generally be favored by:

(1) increasing ψ, the impact effort has on raising the likelihood of favorable outcomes for market.

(2) decreasing u_2, the magnitude of the favorable outcome for market.

(3) increasing (or decreasing) B, the potential monetary benefit from producing one unit of output.

(4) increasing (or decreasing) A, the change of market size b or diseconomies of scale c_1.

(5) decreasing (or increasing) c_3, the change in average cost per unit of effort.

(6) increasing K, the size of investment in the project.

(7) decreasing e_H, the high level of effort.

As suggested above, factors such as how much extra effort that better management can contribute, the value of additional effort in reducing risk, the size of capital investment and the unrecognizable hard work have clear effects. These findings run parallel with some propositions from Finnerty (1996) about managerial discretions, but challenge some precepts of Brealey's (1996) agency cost through work incentives. Also, the above analysis argues that factors such as market size, average variable costs, and average cost impact of effort have ambiguous effects.

As we have considered the industrial and organizational issues in the analysis, there are a number of testable hypothesis arising from our model.

First, the smaller the contribution of unobservable effort in determining expected utility of cash flows, the more likely a company will choose project financing. The impact of unobservable effort may be reduced when

i) effort is less important in determining favorable outcomes represented by an increasing ψ.

ii) unfavorable market outcome prevails indicated by a decreasing u_2.

iii) the high level of effort available above the effort that can be contracted for is small denoted by a decreasing e_H.

Second, another major factor encouraging project financing is K, the fixed capital investment required. As K increases, other factors being constant, the riskiness of the project is increased with no compensating benefits. Higher risk with no additional benefits increases the relative advantage of using project financing to mitigate costly capital market imperfections.

Third, the impact of market size on the decision of whether or not going for project finance hinges on the interaction of two factors: fixed investment, K, and the market reward, $B = a - c_2$. When firms produce one unit of output, market reward provides a measure of the potential monetary benefits to the capital suppliers from the services. The relationship between market reward and investment cost drives the condition under which how the capital investment is undertaken in larger or smaller markets. If fixed investment requirements are large, relative to the market reward, then project financing will tend to be favored when markets are small. On the other hand, if investment size is small compared with the market reward, then increasing size of the market will favor project financing.

Interestingly, the relationship between fixed investment costs and market reward is also an indicator of how the relationship between risk and reward will be influenced by the changes of market size. In a case where fixed capital costs are large and market reward is little, relative risk rises as market size gets smaller. Conversely, when fixed capital costs are small and potential market reward is large, the relative riskiness of cash flows increases as market size becomes bigger. In practice, since the input risk and the market risk affect the basic viability of the project, both are frequently evaluated in project finance. Our observations provide another thought of the risk management motivation for project finance, put forward by Esty (2003a).

To summarize, our model predicts that project financing is preferred when fixed capital costs are high relative to other costs or when the potential return on the project is less sensitive to unobservable levels of managerial efforts

4. CONCLUSIONS

This paper proposes a model and examines a company's project financing versus internal financing decisions, placing the perspective on the manager's incentives. The model highlights the conditions under which a particular way of financing is best suited for carrying out a capital investment.

A wide range of organizational factors may influence the decision of a firm to choose internal financing versus project financing. Companies will tend to prefer corporate financing of investment when effort has a significant impact on the magnitude and likelihood of favorable outcomes. Regarding investment size, the larger the capital investment required, the more likely outside project financing will be employed. The impact of the market size will depend on how large the fixed capital investment is, relative to the market reward (i.e., the difference between maximum willingness to pay and average variable cost) available from production. If fixed capital costs are large compared with the market reward, then project financing is favored in smaller markets. Conversely, if fixed capital costs are smaller relative to the market reward available, project financing will be supported by larger markets.

The analysis in this paper has focused on two extreme cases: all internal corporate financing versus complete project financing by outside investors. An interesting area of future research would be an intermediate case, where the company shares the financing with an outside investor, each putting up part of the investment funds. This arrangement would attempt to balance benefits in risk reductions with incentives for managerial effort by the company.

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