Stock Options and Capital Structure*

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Abstract

We show that value-maximizing CEOs compensated with stock options prefer debt to equity. Our pecking order result does not depend on managerial risk aversion, managerial firm-specific human capital, or asymmetric information. Moreover, our result holds (at least weakly) regardless of the distribution of firm cash flows and strictly as long as the support of the cash flow distribution is big enough to bring all features of the stock option contract into play with positive probability.

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1. Introduction

The empirical evidence on sources of corporate financing strongly suggests that firms prefer internally generated funds to debt and debt to equity in financing their investment activities (see for example table 14.1 in Ross, Westerfield and Jaffe (2005)). What is the economic rationale for this pecking order? Lambert, Lanen, and Larker (1989) have shown empirically that managers compensated with stock options prefer not to pay dividends, and thus prefer financing with internal funds. We show that *managers compensated with stock options prefer financing with debt to financing with equity or any mix of debt and equity.* Our pecking order result does not depend on managerial risk aversion, managerial firm-specific human capital, or asymmetric information. Moreover, our result holds at least weakly regardless of the distribution of firm cash flows and strictly as long as the support of the cash flow distribution is big enough to bring all features of the stock option contract into play with positive probability.

Explanations of the pecking order in the existing literature rest upon informational asymmetries between corporate managers and investors and the agency costs these asymmetries generate. For example, Myers and Majluf (1984) argue that if investors are less well-informed than the corporate manager about the value of the firm's assets, then new equity may be under-priced by the market. If firms are required to finance projects by issuing equity, under-pricing may be so severe that new investors capture more than the net present value of the project, resulting in a net loss to existing shareholders. In this case, the project will be rejected even if its net present value is positive. This under-investment problem can be avoided if the firm can finance the new project using a security that is not so severely undervalued by the market. For example, because internally generated funds or safe debt generate no agency cost, these methods of financing involve no under-valuation, and therefore will be preferred to equity by firms in this situation.

Despite the simplicity and appeal of Myers and Majluf's arguments, further theoretical analyses by Brennan and Kraus (1987), Noe (1988), and Constantinides and Grundy (1989) have cast doubt on the Myers and Majluf explanation of the pecking order.[1] These papers conclude that if the set of financing choices available to the firm is expanded, then when faced with the situation considered by Myers and Majluf, firms do not necessarily prefer issuing straight debt over equity. Moreover, these papers show that with the richer set of financing options, firms can resolve the under-investment problem through costless signaling.

We show that managers maximize the value of their compensation and that

[1] Harris and Raviv (1991) also provide a discussion of this literature.

under stock options the manager's objective is a nondecreasing, convex function of the residual returns generated by the investment project (i.e., a nondecreasing, convex function of the sum of the returns to current shareholders and the manager). Because convexity generates incentives for risk taking and because the project's residual returns are more risky (in the Rothschild-Stiglitz sense) under debt financing than they are under any mix of debt *and* equity financing, we conclude via classical second order stochastic dominance arguments that in general the manager will strictly prefer debt financing to any mix of debt and equity financing, as long as the exercise of the stock options is an uncertain event under the probability measure representing the valuation operator. This conclusion is corroborated by recent empirical findings in Cohen, Hall, and Viceira (2000), and Coles, Daniel, and Naveen (2004). Moreover, because a zero exercise price linearizes the manager's objective function over the project's residual returns, we also conclude that if the stock options have a zero exercise price (i.e., if the manager is compensated with a restricted stock grant), then the manager will be indifferent between debt and/or equity sources of external financing. In addition to our results on the stock-option induced managerial preferences over external financing sources, we confirm via first order stochastic dominance the conventional wisdom in finance that if a manager is compensated with stock options (with a nonnegative exercise price), then the manager will prefer internally generated financing to any mix of external debt and/or equity financing - including safe debt. An immediate corollary of this conventional wisdom is that if a manager is compensated with stock options, then the manager will prefer not to pay dividends. This corollary finds empirical support in Lambert, Lanen, and Larker (1989). While here we show that convexity induces a managerial preference for debt over all other sources of external financing, parallel conclusions have been reached in the literature with regard to project selection, namely, that convexity of executive compensation induces a managerial preference for riskier projects (see for example, Bizjak, Brickley, and Coles (1993), Defusco, Johnson, and Zorn (1990), Guay (1998), Harikumar (1996), Garvey and Mawani (1998)).

The paper is organized as follows: In section 2, we present the basic ingredients of our model and we discuss the valuation of debt, stock options, and equity. In section 3, we derive the manager's objective function. In particular, we show that the manager, in making financing decisions on the firm's behalf, will seek to maximize the value of his stock option package. In section 4, we restate the value of the manager's stock option package in terms of residual cash flows, we discuss in detail the basic intuition behind our compensation-based pecking order theory, and we present our results.

2. Basic Ingredients

Consider a competitive financial market operating over a single period, between time points $t = 0$ and $t = 1$. In this market, financial assets purchased at time 0 generate state-contingent returns at time 1. At time 0, each consumer can choose a portfolio of financial assets which determines the consumer's saving, and hence the consumer's consumption income at times 0 *and* 1. In addition, at time 0, each firm makes investment and financing decisions which determine the financial assets available to consumer's at time 0, as well as the time 1 state-contingent returns of these assets.

In this paper we shall focus on the decision making of the manager of the firm who at time 0 makes savings decisions for himself, *as well as* financing decisions on behalf of the firm. We shall model the uncertainty underlying the returns on the firm's financial assets via a probability space, $(\Omega, \Im, P)$, where Ω is the set of all possible states of nature, $\Im$ is a σ - field of events, and P is a probability measure defined on the events in $\Im$.[2]

2.1. The Corporate Manager's Preferences Over Consumption Income

Let

$$u(\cdot, \cdot) : \mathbb{R}_+ \times \mathbb{R}_+ \rightarrow \mathbb{R}$$

denote the corporate manager's utility function defined over consumption income at $t = 0$ and consumption income at $t = 1$.[3] Also, let c_0 denote consumption income at time $t = 0$, and $c_1(\omega)$ denote consumption income at time $t = 1$ in state $\omega \in \Omega$. Given time 0 consumption choices $(c_0, c_1(\cdot))$, the manager's expected utility is given by

$$\int_\Omega u(c_0, c_1(\omega)) dP(\omega).$$

We shall assume that

[A-1] the manager's utility function is concave and increasing on $\mathbb{R}_+ \times \mathbb{R}_+$.

2.2. Valuation

In order to compute the present value of uncertain future income, the manager takes as given a market-determined valuation function,

$$\nu(\cdot) : \Omega \rightarrow \mathbb{R}_+,$$

[2] Thus, given an event $E \in \Im$, $P(E)$ is the probability that state ω will be contained in E, or put differently $P(E)$ is the probability that event E occurs.

[3] Here, $\mathbb{R}$ denotes the real numbers, while $\mathbb{R}_+$ denotes the nonnegative real numbers.

that works as follows: given any event $E \in \Im$, an asset with time 1 state-contingent payoffs of one dollar in any state $\omega \in E$ and zero otherwise has present value

$$\int_E \nu(\omega) dP(\omega).$$

In general, the present value of any asset with time 1, state-contingent payoffs given by random variable

$$\omega \rightarrow x(\omega)$$

is

$$\int_\Omega \left(x(\omega) \cdot \nu(\omega)\right) dP(\omega).$$

Thus, the present value of consumption choices $(c_0, c_1(\cdot))$ is given by

$$c_0 + \int_E \left(c_1(\omega) \cdot \nu(\omega)\right) dP(\omega).$$

We shall assume that[4]

> **[A-2]** $\nu(\cdot) : \Omega \rightarrow \mathbb{R}_+$ is $\Im$-measurable and P-essentially bounded, and $\int_\Omega \nu(\omega) dP(\omega) = \frac{1}{1+r}$, where r is the rate of return on the riskless asset.

The function $\nu(\cdot)$ risk adjusts state-contingent payoffs and allows us to compute market values by simply computing the expected value of the risk adjusted payoffs with respect to the probability measure $P(\cdot)$. Rather than risk adjust payoffs, we can instead risk adjust probabilities - allowing us to compute market values by simply computing the discounted expected value of the original payoffs with respect to the risk adjusted probabilities. In particular, let the probability measure $\mu(\cdot)$ be defined on the state space $(\Omega, \Im)$ as follows:

$$\begin{gathered} \text{given any event } E \in \Im, \text{ let} \\ \mu(E) = \int_E (1+r)\nu(\omega) dP(\omega). \end{gathered} \tag{2.1}$$

Given assumption [A-2], $\mu(\cdot)$ is a probability measure on the state space $(\Omega, \Im)$. Moreover, given any random variable

$$\omega \rightarrow x(\omega)$$

[4] The function $\nu(\cdot) : \Omega \rightarrow \mathbb{R}_+$ is $\Im$ -measurable if for any Borel subset B of $\mathbb{R}_+$

$$\{\omega \in \Omega : \nu(\omega) \in B\} \in \Im.$$

The function $\nu(\cdot)$ is P-essentially bounded if for some $c \in \mathbb{R}_+$, $\nu(\omega) \leq c$ for all $\omega \in \Omega \backslash N$, where $P(N) = 0$. Thus, $\nu(\cdot)$ is P-essentially bounded if and only if $\nu(\cdot) \in L_\infty(\Omega, \Im, P)$.

representing the state-contingent, time 1 returns on some asset, the time 0 value of this asset is given by

$$\frac{1}{1+r}\int_\Omega x(\omega)d\mu(\omega) = \int_\Omega (x(\omega)\cdot\nu(\omega))dP(\omega). \tag{2.2}$$

Thus given the riskless rate r, the probability measure $\mu(\cdot)$ provides a risk-neutral representation of market valuation operator[5]

$$x(\cdot) \to \int_\Omega (x(\omega)\cdot\nu(\omega))dP(\omega).$$

2.3. The Value of Debt, Stock Options, and Equity

The starting point for computing the values of debt, stock options, and equity is the firm's time 1, state-contingent earnings. We shall assume that, at time 0, these time 1 earnings are given by a non-negative random variable

$$\omega \to \Pi_1(\omega).$$

In part, the firm's potential earnings, summarized via $\Pi_1(\cdot)$, are determined by the manager's time 0 investment decision. Here, in order to better focus on financing issues, we shall assume that

[**A-3**] the manager's time 0 investment decision is fixed at $I_0 > 0$, and $\frac{1}{1+r}\int_\Omega \Pi_1(\omega)d\mu(\omega) - I_0 \geq 0.$

Thus, we shall assume that an investment of I_0 generates a nonnegative net present value.

2.3.1. The Value of Debt

Let b denote the total dollar amount promised to bondholders at time 1. Given that earnings are uncertain, debt is risky. Let

$$\mathbb{B}(b) = \{\omega \in \Omega : \Pi_1(\omega) < b\} \tag{2.3}$$

denote the set of states in which bankruptcy occurs. We shall refer to $\mathbb{B}(b)$ as the bankruptcy event. The value of debt is given by

$$D(b) = \frac{1}{1+r}\left(\int_{\mathbb{B}(b)} \Pi_1(\omega)d\mu(\omega) + b\int_{\Omega\backslash\mathbb{B}(b)} d\mu(\omega)\right). \tag{2.4}$$

[5] Put differently, $\mu(\cdot)$ represents the market risk-neutral valuation operator.

2.3.2. The Value of Stock Options

Suppose now that the corporate manager's compensation package at $t = 0$ includes n stock options, each with time 1 exercise price of e. Each stock option issued by the firm at time 0 as compensation to the manager, entitles the manager to purchase at time 1 one share of the firm's stock for e dollars.[6] Letting,

$$\begin{aligned} N &= \text{number of shares of common stock outstanding at } t = 0, \\ m &= \text{number of new shares of common stock issued at } t = 0, \end{aligned}$$

the state-contingent payoff of each stock option is

$$\max\left\{0, \frac{\Pi_1(\omega)+en-b}{N+m+n} - e\right\}.$$

Note that at time 1, *if the options are exercised,* then the total number of shares outstanding is $N+m+n$ (rather than $N+m$). Thus, compensating the manager via stock options potentially leads to stock ownership dilution and alters the capital structure of the firm, as well as the per share earnings of all stockholders. Also, note that at time 1, *if the options are exercised,* then the firm's earnings, $\Pi_1(\omega)$, must be augmented by en the amount paid back to the firm by the manager upon the exercise of his stock options. In these two important respects, stock options *issued by the firm* as part of the manager's compensation package differ from free-standing call options *written by an individual* against the firm's stock.

Let

$$\mathbb{E}(e,m,b) = \{\omega \in \Omega : \Pi_1(\omega) \geq b + e(N+m)\}. \tag{2.5}$$

The set $\mathbb{E}(e,m,b)$ is the set of states in which the manager's exercises his stock options. We shall refer to this set as the exercise event. Note that the exercise event depends not only on the exercise price, but also on the level of debt, as expressed via b, and on the number m of new shares issued at $t = 0$ for financing purposes.

The price of a single stock option is given by

$$\begin{aligned} p_w(e,m,b) &= \tfrac{1}{1+r}\int_\Omega \max\left\{0, \tfrac{\Pi_1(\omega)+en-b}{N+m+n} - e\right\} d\mu(\omega) \\ &= \tfrac{1}{1+r}\int_{\mathbb{E}(e,m,b)} \left(\tfrac{\Pi_1(\omega)+en-b}{N+m+n} - e\right) d\mu(\omega). \end{aligned} \tag{2.6}$$

Thus, the total value of the manager's stock option package is

$$W(e,m,b) = \tfrac{1}{1+r}\int_{\mathbb{E}(e,m,b)} \left(\tfrac{n(\Pi_1(\omega)+en-b)}{N+m+n} - en\right) d\mu(\omega). \tag{2.7}$$

[6] It is possible to allow some trading in stock options at time 0 without affecting the results - as long as the manager is required to maintain some positive position in stock options. In practice, stock options granted as part of the manager's compensation cannot be exercised immediately (i.e., in our model they can be exercised only at time 1).

2.3.3. The Value of Equity

The price of a share of the firm's common stock, in addition to depending on time 1 earnings, depends on the level corporate indebtedness, the number of shares outstanding at $t = 0$, the number of shares issued at $t = 0$ for financing purposes, and the number of stock options issued $t = 0$ for compensation purposes. Let

$$\mathbb{N}(e, m, b) = \{\omega \in \Omega : b \leq \Pi_1(\omega) \leq b + e(N + m)\}. \tag{2.8}$$

The set $\mathbb{N}(e, m, b)$ is the set of states in which the corporation is not bankrupt *and* in which no stock options are exercised. Note that like the exercise event $\mathbb{E}(e, m, b)$, the set $\mathbb{N}(e, m, b)$ depends on the exercise price e, the level of debt, as expressed via b, and the number m of new shares issued at $t = 0$ for financing purposes.

The price of a share of common stock is given by

$$\begin{aligned} p_S(e, m, b) = {} & \tfrac{1}{1+r} \int_{\mathbb{N}((e,m,b)} \left(\tfrac{\Pi_1(\omega)-b}{N+m}\right) d\mu(\omega) \\ & + \tfrac{1}{1+r} \int_{\mathbb{E}(e,m,b)} \left(\tfrac{\Pi_1(\omega)+en-b}{N+m+n}\right) d\mu(\omega). \end{aligned} \tag{2.9}$$

3. The Manager's Objective Function

At time 0 the manager of the firm faces two decision problems: (1) choosing, on his own behalf, his time 0 and time 1 consumption incomes, and (2) choosing, on the firm's behalf, the level of current dividends and the firm's capital structure. In analyzing the manager's decision problems, we will assume that the manager's compensation package consists of n stock options each with exercise price e. The manager's dividend and capital structure problem reduces to choosing a level d_0 of current dividends, a level b of promised payments to bondholders, and a number m of new equity shares, so that together retained earnings $\pi_0 - d_0$ (internal funds), new debt $D(b)$, and new equity $m \cdot p_S(e, m, b)$ finance the firm's chosen level of investment I_0. Thus, the manager's dividend-capital structure decisions (d_0, m, b) must satisfy the financing constraint,

$$(\pi_0 - d_0) + D(b) + m \cdot p_S(e, m, b) = I_0. \tag{3.1}$$

Given his compensation package, the manager's choice of (d_0, m, b) will have a major impact on the set of consumption income choices available to the manager at time 0. In particular, given his choice of (d_0, m, b) and given his compensation package, the manager's consumption income choices $(c_0, c_1(\cdot))$ are given by the budget constraint,

$$c_0 + \tfrac{1}{1+r} \int_{\Omega} c_1(\omega) d\mu(\omega) = W(e, m, b). \tag{3.2}$$

The manager's decision problems (a) and (b) can now be stated formally as a single optimization problem as follows:

$$\begin{gathered}\max_{(c_0, c_1(\cdot), d_0, m, b)} \int_\Omega u(c_0, c_1(\omega)) dP(\omega) \\ \text{subject to: } c_0 + \tfrac{1}{1+r} \int_\Omega c_1(\omega) d\mu(\omega) = W(e, m, b), \\ \text{and} \\ (\pi_0 - d_0) + D(b) + m \cdot p_S(e, m, b) = I_0. \end{gathered} \tag{3.3}$$

It is easy to see from the structure of problem (3.3) that the manager's consumption income decision (on his own behalf) can be *separated* from the manager's dividend and financing decisions (on the firm's behalf). In particular, given assumption [A-1] concerning the manager's preferences over consumption incomes, it is clear that in choosing (d_0, m, b) on the firm's behalf, the manager will seek to maximize the value of his stock option package subject to the financing constraint (3.1). Thus, the dividend and financing problem faced by the manager can be stated separately as follows:[7]

$$\begin{gathered}\max_{(d_0, m, b)} W(e, m, b) \\ \text{subject to: } (\pi_0 - d_0) + D(b) + m \cdot p_S(e, m, b) = I_0. \end{gathered} \tag{3.4}$$

Note that the exogenously given parameters in problem (3.4) are the exercise price e, the level of current earnings π_0, and the level of current investment I_0. We shall assume that

[A-4] $e \geq 0$, $\pi_0 > 0$, and $I_0 - \pi_0 \geq 0$.

The separation of consumption and dividend-financing decisions carried out in problem (3.4) above has the flavor of the classical Fisher Separation result in corporate finance (see Fisher (1930) and Hirshleifer (1970)). However, note that the objective function followed by the manager in problem (3.4) is not consistent with the assumption that the manager maximizes current shareholder value, and

[7] Since at time 0 the manager selects dividends as well as raises funds to cover the chosen investment level of I_0 dollars, the exact sequence of events must be specified. Here, we will assume that the firm makes it dividend payment to the N shareholders of record and *then* issues new securities. Thus, all stock prices computed here are *ex-dividend* prices.

thus, will not lead to unanimity amongst stockholders with regard to the dividend and financing decisions made by the manager. The objective function in problem (3.4) is, however, consistent with the assumption that the manager, in making dividend and financing decisions on behalf of the firm, is guided by his own self-interest - and thus is consistent with the assumption that the manager behaves rationally.

4. The Compensation-Based Pecking Order Theory

We begin our analysis of the dividend-capital structure problem (3.4) by restating the value of the manager's stock option package in terms of residual cash flows (i.e., the cash flows generated by the investment project that go to current shareholders and the manager given the manager's financing decisions and compensation package). Because the value of the new owners' claims (i.e., the aggregate value of the project's cash flows that go to new debt holders and new equity holders) must equal the amount of the investment minus the amount financed internally, this restatement of stock option value will allow us to simplify the analysis of the manager's decision problem (3.4) and to make clear the economic intuition behind our compensation-based theory of the pecking order.

4.1. Residual Cash Flows and Stock Options

To begin, let π_1 denote possible realizations of the project return random variable $\Pi_1(\cdot)$. If the manager is compensated via n stock options with exercise price e, then given any dividend-financing decision, (d_0, m, b), residual cash flows are given by the function

$$R_{(e,m,b)}(\pi_1) := \max\{\pi_1 - b, 0\} - \min\left\{\tfrac{m\max\{\pi_1 - b, 0\} + en}{m+n+N}, \tfrac{m\max\{\pi_1 - b, 0\}}{m+N}\right\}, \tag{4.1}$$

Note that the dividend variable d_0 does not enter directly as an argument in the residual cash flow function, $R_{(e,m,b)}(\cdot)$. However, because dividend-financing decisions, (d_0, m, b), are required to satisfy the financing constraint,

$$D(b) + m \cdot p_S(e, m, b) = I_0 - (\pi_0 - d_0), \tag{4.2}$$

dividends enter into the determination of residual cash flows indirectly through the financing constraint by determining how much external financing will be required.

For a given dividend decision, d_0, the expected value of residual cash flows is the same for all financing decisions (m, b) satisfying the financing constraint. In particular, for all (m, b) satisfying (4.2),

$$\int_\Omega R_{(e,m,b)}(\Pi_1(\omega))d\mu(\omega) = \int_\Omega \Pi_1(\omega)d\mu(\omega) - (I_0 - (\pi_0 - d_0)). \tag{4.3}$$

Note that the expected value of residual cash flows is invariant with respect to the exercise price e of the manager's stock options. More importantly, note that the expected value of residual cash flows is a *strictly decreasing* function of the amount of external financing required - and thus, is a strictly decreasing function of the amount of dividends paid out.

Finally, given dividend-financing decision, (d_0, m, b), with corresponding residual cash flow function $R_{(e,m,b)}(\cdot)$, the value of the managers stock option package, given in expression (2.7), can be restated as follows:

$$W(e, m, b) = \frac{1}{1+r}\frac{n}{n+N}\int_\Omega \max\left\{R_{(e,m,b)}(\Pi_1(\omega)) - eN, 0\right\} d\mu(\omega). \tag{4.4}$$

4.2. The Intuition and the Results

The intuition behind our compensation-based pecking order theory begins with Figure 1. For a given dividend decision d_0, Figure 1 depicts three possible residual cash flow functions corresponding to three possible financing scenarios: all internal financing $(0, 0)$, internal plus debt financing $(0, b'')$, and a mix of internal, debt, and equity financing, (m', b'), assuming that the manager's compensation package consists of n stock options with exercise price $e > 0$.[8]

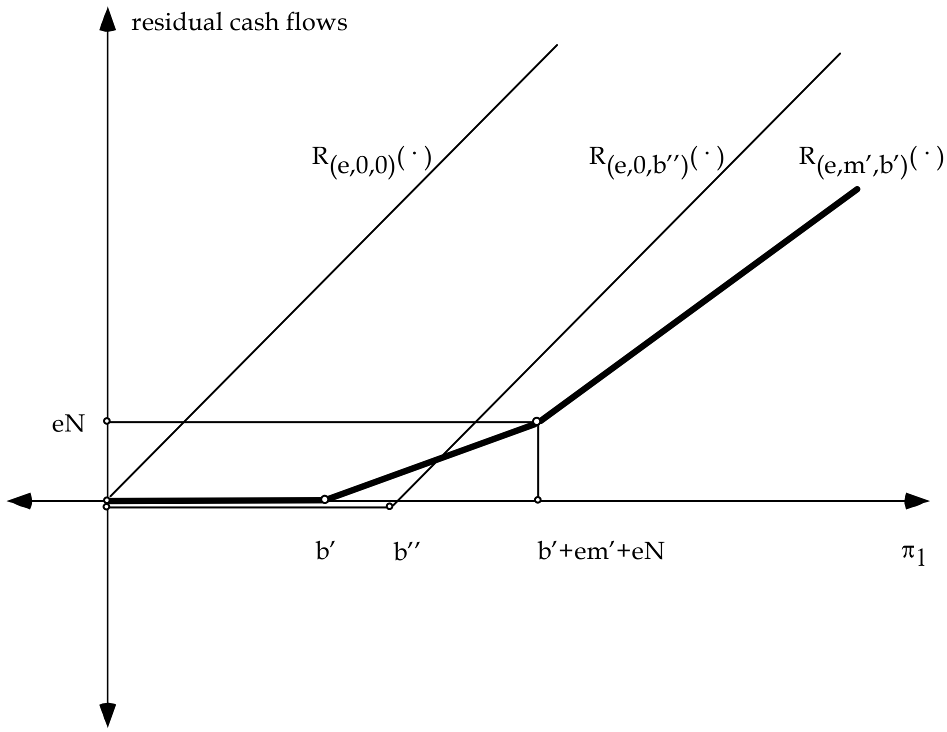

Figure 1: Residual Cash Flow Functions Under Three Financing Scenarios Assuming the Manager Holds n Stock Options with Exercise Price $e > 0$

Figure 1 is striking for two reasons. *First*, note that residual cash flows under all internal financing, $R_{(e,0,0)}(\cdot)$, dominate state-by-state the residual cash flows under debt financing, $R_{(e,0,b'')}(\cdot)$, as well as the residual cash flows under any mix of debt and equity financing, $R_{(e,m',b')}(\cdot)$. In particular, for any external financing decisions, $(m', b') \neq (0,0)$,

$$R_{(e,0,0)}(\pi_1) \geq R_{(e,m',b')}(\pi_1) \text{ for } \pi_1 \geq 0,$$
and
$$R_{(e,0,0)}(\pi_1) > R_{(e,m',b')}(\pi_1) \text{ for } \pi_1 > 0.$$

[8] Note that, in general, the promised payment b'' under debt financing $(0, b'')$ is greater than or equal to the promised payment b' under any mix (m', b') of debt and equity financing.

Moreover, for all promised debt payment levels b and $\bar{b}$ with $b < \bar{b}$, it is easy to see that

$$R_{(e,0,b)}(\pi_1) \geq R_{(e,0,\bar{b})}(\pi_1) \text{ for } \pi_1 \geq 0,$$
and
$$R_{(e,0,b)}(\pi_1) > R_{(e,0,\bar{b})}(\pi_1) \text{ for } \pi_1 > b.$$

Given the manager's objective function (4.4) we conclude from these first observations that if the manager is compensated with stock options, then the manager will prefer internal financing (retained earnings) to external financing (debt and/or equity) - and thus will prefer not to pay dividends.

Second, note that the graph of the residual cash flow function, $R_{(e,0,b'')}(\cdot)$, under debt *crosses once from below* the residual cash flow function, $R_{(e,m',b')}(\cdot)$, under debt and equity. This single-crossing-from-below property together with equal mean property (see expression (4.3)), imply that if exercise is an uncertainty event under any external financing decision (m', b') satisfying the financing constraint, then the residual cash flow function, $R_{(e,0,b'')}(\cdot)$, under debt is a *mean-preserving spread* of the residual cash flow function, $R_{(e,m',b')}(\cdot)$, under debt and equity (e.g., see Theorem 3 in Hanoch and Levy (1969) and Rothschild and Stiglitz (1970)). Thus, residual cash flows under debt are more risky (in the Rothschild-Stiglitz sense) than residual cash flows under any mix of debt and equity. Given that the manager's stock option payoffs, $\max\{R - eN, 0\}$, are a nondecreasing, convex function of residual cash flows, R, we conclude from these observations and classical arguments from stochastic dominance (e.g., see Rothschild and Stiglitz (1970) and Theorem 2.3 in Brumelle and Vickson (1975)) that the manager will prefer riskier residual cash flows to less risky residual cash flows - and thus, will prefer debt to any mix of debt and equity.

Finally, note that if the exercise price of the manager's stock option is zero (i.e., $e = 0$), then the manager's stock option payoffs are a nondecreasing, *linear* function of residual cash flows, and the value of the stock option package reduces to

$$\begin{aligned} &W(0, m, b) \\ &= \tfrac{1}{1+r} \tfrac{n}{n+N} \int_\Omega R_{(0,m,b)}(\Pi_1(\omega)) d\mu(\omega) \\ &= \tfrac{1}{1+r} \tfrac{n}{n+N} \left(\int_\Omega \Pi_1(\omega) d\mu(\omega) - (I_0 - (\pi_0 - d_0)) \right). \end{aligned}$$

Thus, if $e = 0$, then the manager still strictly prefers internal financing to external financing, but now is indifferent between debt and/or equity sources of external financing.

We formalize these observations in the following Theorem containing our main results on stock options and the pecking order.

Theorem *(The Compensation-Based Pecking Order)*
Under assumptions [A-1]-[A-4], if the manager's compensation package includes stock options with exercise price $e > 0$*, and if exercise is an uncertain event under any financing decision satisfying the financing constraint, then the manager will prefer retained earnings to debt, and debt to all combinations of debt and equity. Moreover, if the stock options have exercise price* $e = 0$ *(i.e., if the manager is compensated with a restricted stock grant), then the manager will still prefer retained earnings to debt, but will be indifferent to all combinations of debt and equity.*

The conclusion of our Theorem with regard to retained earnings and debt differs from that of Myers and Majluf (1984). In particular, Myers and Majluf conclude that retained earnings and riskless debt are equivalent in a pecking order. Since the Myers and Majluf pecking order theory uses a different objective function (i.e., current shareholder value) and is based on an assumption of asymmetric information, the equivalence of these two forms of financing follows easily because neither form is sensitive to the difference between insider and outsider information - hence neither form of financing generates an agency cost that determines a position in the pecking order. Our result is not based an assumption of asymmetric information. Rather it is based on the assumption that the manager pursues his own self interest as measured via his compensation package in choosing between retained earnings and debt. By using retained earnings to finance the investment rather than debt (or any combination of debt and equity), the manager generates greater stock option payoffs in all possible π_1-contingencies. Moreover, even if the time 1 exercise price of the warrants is set equal to zero (so that the stock options become time 1 stock), the conclusions of our Theorem are the same.

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