Manager Characteristics and Capital Structure: Theory and Evidence

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Introduction and Motivation

- **Dynamic tradeoff** models
  - capital structure determined by tradeoff between tax benefits of debt and costs of financial distress
  - manager behaves in the interests of shareholders
  - manager-specific characteristics have no effects on financing decisions

- **Dynamic agency** models
  - manager-shareholder agency conflicts—key determinant of capital structure
  - with some recent exceptions, all agents are risk-neutral
Introduction and Motivation

- Initial step towards unified theory—tradeoff and agency theories
- Capital structure reflects the effects of
  - external imperfections arising from taxes and bankruptcy costs
  - internal imperfections arising from agency conflicts between undiversified managers and diversified shareholders
- New implications for the effects on capital structure of
  - manager-specific characteristics—ability, risk aversion and disutility of effort
  - firm characteristics—long-term risk and short-term risk
Theoretically/empirically investigate—effects of managerial discretion on capital structure

Dynamic structural model
  - taxes, bankruptcy costs
  - managerial discretion in effort and financing

Derive manager’s dynamic incentive contract; implement it through financial securities
  - dynamic capital structure — inside equity, outside equity, long-term debt and short-term debt (or cash)
  - Testable implications linking manager characteristics to long-term and short-term debt

Empirically analyze testable implications
Overview of Results

- Testable implications
  - Long-term debt declines with manager ability and inside equity ownership
  - Short-term debt declines with manager ability and increases with inside equity ownership
  - Distinct components of firm risk—long-term risk and short-term risk—differing effects on debt structure
  - Long-term debt increases with short-term risk, but decreases with long-term risk
  - Short-term debt declines with short-term risk, but varies non-monotonically with long-term risk

- Significant empirical support
The Model—Basic Setup

- Date zero—owner-manager obtains external financing for investment $I > 0$
- Combination of equity and debt; amount raised could exceed $I$
- Manager’s initial ownership stake—$g_{\text{initial}} \in (0, 1)$
- Earnings before interest, taxes and manager compensation (EBITM)
  - manager, shareholders, debtholders, and government (through taxes)
  - No personal taxes; corporate tax rate $\tau \in (0, 1)$
- Symmetric taxation, negligible security issuance costs, constant risk-free interest rate
The Firm’s EBITM Flow

In any period \([t, t + dt]\), if the manager exerts effort \(e(t) > 0\), the EBITM flow is

\[
dQ(t) = \underbrace{P(t)dt}_{\text{EBITM flow from existing assets}} + \underbrace{\underbrace{P(t)\left[(\ell + e(t))dt + sdW(t)\right]}_{\text{Earnings generated by manager’s human capital}} - \underbrace{\lambda P(t)dt}_{\text{Short-term debt payments}}}_{\text{Incremental EBITM flow generated by manager}}
\]

- \(\ell > 0\) is the manager’s observable and constant ability
- \(s\)—risk of firm’s earnings—*short-term risk*
- \(\lambda P(t)dt\)—short-term debt financing of firm’s working capital requirements (inventories, accounts receivable, employee wages, etc.)
The Firm’s Long-Term Risk

- Process $P(\cdot)$—determines the level of EBITM flow
  
  $$dP(t) = P(t)[\mu dt + \sigma dB(t)],$$

- $\sigma$—firm’s long-term risk

- Long-term risk and short-term risk have differing effects on capital structure
The Objectives of Outside Investors and the Manager

- Outside investors risk-neutral, while manager is risk-averse

\[ U(c, e) = E \left[ \int_0^\infty \exp(-rt) \left( U(dc(t)) - \frac{1}{2} \kappa e(t)^2 dt \right) \right]. \]

- Manager has quadratic (mean-variance) preferences

\[ U(x) = x - \frac{1}{2} \gamma x^2. \]
Long-term debt—infinite maturity, non-callable, and completely amortized—coupon payment rate $\theta$

For now, firm’s capital structure—equity, long-term debt, and short-term debt associated with working capital requirements

Implementation of manager’s contract

- *dynamic* capital structure—equity, long-term debt, and cash reserve that offsets short-term debt
Dynamic incentives through contracts—contingent on contractible EBITM flow

Outside investors are competitive

Incomplete contracting—single-period contracts enforceable

In each period, contract between manager and competitive outside shareholders
  - division of earnings (net of taxes and interest payments)
Bankruptcy

- Debt payments serviced entirely when firm is solvent—dilution of equity in financial distress
- Bankruptcy occurs endogenously when equity value falls to zero (Leland, 1994)
- Firm controlled by debtholders as all-equity firm—manager continues
- Appendix B—modify model to allow for manager to continue servicing debt after equity value falls to zero
- Calibrate and numerically analyze modified model—implications unchanged
Bankruptcy Costs

- Bankruptcy costs—proportional reduction in future earnings

\[ P(T_b) = (1 - \zeta)P(T_b^-). \]

- market imperfections external to manager-firm relationship

- Post-bankruptcy period otherwise identical to pre-bankruptcy period
Contract: $\Gamma \equiv [d c_m(\cdot), e(\cdot)]$—manager’s compensation payments $d c_m(\cdot)$ and effort choices $e(\cdot)$, before and after bankruptcy.

Bankruptcy time $T_b$—stopping time

Dynamic participation constraints

- at each date, value of future payout flows to shareholders $\geq$ value of stream of reservation payout flows $P(t) dt$

Incentive compatibility—optimal for the manager to exert effort $e(\cdot)$
Long-term debt structure and contract maximize manager’s total expected utility.

Payoff at date zero—proportion $g_{initial}$ of total proceeds from financing net of investment outlay $I$.

Proceeds from debt and equity issuance—equal to their respective market values.
Manager’s payoff at date zero = $g_{initial}[D(0) + S(0) - I]$ and continuation value is $M(0)$.

The optimal long-term debt coupon $\theta^{opt}$ and the manager’s optimal contract $\Gamma^{opt}$ solve

$$(\theta^{opt}, \Gamma^{opt}) = \arg \max_{(\theta, \Gamma)} \left( \underbrace{U(g_{initial}(D(0) + S(0) - I))}_{\text{Initial Payoff}} + \underbrace{M(0)}_{\text{Continuation Value}} \right)$$
Derivation of Equilibrium

- Step one: Optimal contract for given long-term debt structure
- Step two: Optimal long-term debt structure
- For given long-term debt structure $\theta$

\[
dc_m(t) = \begin{cases} 
  a(t)dt & , t < T_b \\
  a(t)dt + b(t)(1 - \tau)(dQ(t) - \theta dt) & , t > T_b
\end{cases}
\]
Dynamic Capital Structure

- Equilibrium contract—implemented through "inside" equity and dynamic short-term lending or borrowing
- Manager’s compensation in period \([t, t + dt]\)

\[
dc_m(t) = b \left[ \underbrace{dc_{tot}(t)}_{\text{Total After-Tax Payout Flow}} - \underbrace{\lambda \theta dt}_{\text{Long-Term Debt Interest Payment}} - \underbrace{\left(1 - \tau\right)\lambda P(t) - \frac{a(t)}{b}}_{\text{Short-Term Debt Payments}} \right] dt.
\]
Manager’s optimal compensation structure—inside equity stake $b$ and additional payments

$$dc_{sd}(t) = \left( (1 - \tau)\lambda P(t) - \frac{a(t)}{b} \right) dt$$

incurred by all equity holders—inside and outside—in each period.

Dynamic short-term borrowing or lending

Capital structure—Inside equity, outside equity, long-term debt, and risk-free short-term debt (or cash)
Manager Characteristics and Long-Term Debt

- Long-term debt
  - declines with manager ability,
  - increases with her risk aversion,
  - increases with her disutility of effort
  - increases with short-term risk
Manager Characteristics and Long-Term Debt—Intuition

- Long-term debt structure maximizes sum of manager’s initial payoff and continuation value.
- For given long-term debt coupon $\theta$, manager’s initial payoff is $g_{initial}[F_\theta(0) - l] - F_\theta(0)$ is firm value *net of the manager’s stake*.
- Manager characteristics affect *surplus* in each period—captured by manager in equilibrium.
- Manager characteristics affect continuation value, but not her initial payoff.
Manager Characteristics and Long-Term Debt—Intuition

- Optimal long-term debt choice reflects tradeoff between
  - beneficial effects of *ex post* debt tax shields on initial payoff
  - increased likelihood of bankruptcy

- Surplus in each period increases with manager ability—increases *relative importance* of continuation value

- She chooses lower long-term debt—increases continuation value; lowers initial payoff

- Increase in risk aversion, disutility of effort, or short-term risk—lowers surplus manager generates in each period

- Marginal effect of continuation value lowered—manager “effectively" becomes more myopic
Model Calibration

Risk-Free Rate, Effective Corporate Tax Rate and Bankruptcy Costs

- $r = 4.5\%$, corporate tax rate $\tau = 0.15$ (Graham, JFE, 2000), bankruptcy costs $= 0.15$ (Andrade and Kaplan, JF, 1998)

Short-Term Risk and Long-Term Risk

- $\sigma = 0.29$; the median asset volatility for firms in our sample
- $s = 0.125$ to match median standard deviation of the after-tax return on assets in our sample
Manager Characteristics

- $g_{\text{initial}} = 0.035$ to match median CEO percentage ownership (including options) in our sample
- manager’s ability $\ell$, risk aversion $\gamma$, disutility of effort $\kappa$, and working capital financing parameter $\lambda$ chosen to match
  - median inside equity ownership,
  - median ratio of CEO cash compensation to assets,
  - median short-term debt ratio,
  - median long-term debt ratio,
  - median ratio of firm value to asset value.
The short-term debt ratio declines with ability:
- An increase in ability increases the "cash" portion of the manager’s compensation, which lowers short-term debt.

As the manager’s ability increases, the firm moves from holding positive short-term debt to holding surplus cash.

Short-term debt declines with the manager’s risk aversion:
- An increase in risk aversion increases the costs of risk-sharing.
- The manager’s cash compensation increases, which lowers short-term debt.
The Effects of Long-Term Risk

- The firm’s long-term risk has differing effects
- Long-term debt ratio declines with long-term risk
- Decline in long-term debt with long-term risk has positive effect on firm’s short-term debt
- The increased likelihood of bankruptcy—negative effect on short-term debt
- Short-term debt varies non-monotonically
The Effects of Short-Term Risk

- Long-term debt *increases* with short-term risk
  - Increase in short-term risk has negative effect on surplus in each period—costs of risk-sharing
  - Lowers marginal effect of continuation value on long-term debt structure choice
- Increase in short-term risk lowers power of incentives—increases “cash” portion of manager’s compensation
  - negative effect on short-term debt
- Long-term debt declines with long-term risk and increases with short-term risk
- Short-term debt declines with short-term risk, and varies non-monotonically with long-term risk
Testable Hypotheses

- **Hypothesis 1:** The long-term debt ratio declines with the manager’s ability.
- **Hypothesis 2:** The short-term debt ratio declines with the manager’s ability.
- **Hypothesis 3:** The long-term debt ratio declines with the manager’s inside equity stake.
- **Hypothesis 4:** The short-term debt ratio increases with the manager’s inside equity stake.
- **Hypothesis 5:** The long-term debt ratio declines with long-term risk.
- **Hypothesis 6:** The long-term debt ratio increases with short-term risk.
- **Hypothesis 7:** The short-term debt ratio declines with short-term risk.
Leverage and CEO Variables

- **Leverage Variables:** Firms’ long-term debt and short-term debt data from Compustat
- *CEO’s percentage equity ownership* from Execucomp—number of shares of common stock and options (weighted by respective ‘deltas’)
- **CEO Ability:** Five proxies
  - CEO Cash Compensation
  - CEO Cash Compensation to Assets Ratio
  - Industry-adjusted (4-digit SIC) return on assets
  - CEO Tenure
  - Ratio of CEO Tenure to CEO Age
Proxies for Long-Term and Short-Term Risk

- Long-Term Risk—firm value volatility
- Short-term Risk—standard deviation of quarterly return on assets
- Construct measures over different time horizons for robustness
Manager Ability and Debt Structure: The Empirical Evidence

- Long-term debt ratio declines with all five measures of manager ability
- Short-term debt ratio declines with all five measures of managerial ability
- Coefficients of control variables consistent with previous evidence

**Economic Significance**

- 1% increase in cash compensation—.11% decline in long-term debt, .38% decline in short-term debt.
- As point of comparison, a 1% increase in past stock returns is associated with a .03% decrease in the long–term debt ratio
Manager Ownership and Debt Structure: The Empirical Evidence

- Long-term debt ratio declines with manager’s inside equity stake
- The relation between short-term debt ratio and inside equity stake is negative and marginally significant
- Effects of manager ability on debt structure continue to hold even after controlling for manager ownership

Economic Significance

- A 1% increase in the manager’s equity stake—.04% decline in long-term debt.
Long-Term Risk, Short-Term Risk, and Debt Structure: The Empirical Evidence

- Negative relation between long-term debt ratio and long-term risk
- Positive relation between long-term debt ratio and short-term risk
- Negative relation between short-term debt ratio and short-term risk
Instrumental variables

\[ \text{CEO ownership}_{i,t} = f(\text{Average industry CEO ownership}_{i,t}, \text{LnAssets}_{i,t}, \text{Advertising and R&D expenses}_{i,t}, \text{Past stock returns}_{i,t}, \text{Market-to-Book}_{i,t}, \text{Long-term risk}_{i,t}, \text{Short-term risk}_{i,t}) \]  

Second stage: Use predicted value of CEO ownership from first stage

Conclusions from previous tests unchanged


Instrument validity: Hahn and Hausman (2002) test

Proper identification: Anderson-Rubin and Hansen-Sargan tests
Additional robustness tests: Incremental financing decisions of firms (Strebulaev, 2007)
Net new issuance of long-term and short-term debt
Effects of manager characteristics generally robust to these tests
Managerial discretion and manager-specific characteristics on dynamic capital structure

Structural model that incorporates managerial discretion in financing and effort

Implement manager’s dynamic contract through financial securities—dynamic capital structure—outside equity, inside equity, long-term debt and short-term debt

Long-term debt ratio declines with manager’s ability, increases with risk aversion, and increases with disutility of effort.

Numerical implementation and calibration
Conclusions

- Short-term debt declines with managerial ability
- Long-term risk and short-term risk have differing effects on long-term debt and short-term debt
- Long-term debt declines with long-term risk and increases with short-term risk
- Short-term debt declines with short-term risk and varies non-monotonically with long-term risk
- Empirical analysis—link between manager and firm characteristics to capital structure
- With the exception of relation between short-term debt and manager ownership, we show empirical support for all testable implications
- Managers play a central role in determining firms’ optimal financial policies