Collateral, Risk Management, and the Distribution of Debt Capacity

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Financing and Risk Management Trade-off

Punchline

• Financing and risk management are fundamentally linked
  • ... as both involve promises to pay
  • ... which are limited by collateral constraints

• This fundamental trade-off has important implications for
  • ... corporate risk management
  • ... the distribution of debt capacity
Main Results

Two main results

• Result 1: More constrained firms do less risk management!
  • ... contrary to received theory
  • ... consistent with empirical evidence

• Result 2: Distribution of debt capacity shifts to less productive/better capitalized firms.
  • More constrained firms may be forced to downsize.
  • Less capital deployed by more productive/poorly capitalized firms in downturns.
Model of Dynamic Collateralized Financing

Key: Collateral constraints

- **Collateral constraints** due to limited enforcement
  - We derive collateral constraints similar to Kiyotaki/Moore (1997)
    - ... from limited enforcement similar to Kehoe/Levine (1993)

- This talk: **Simplest version of model**
  - Skip derivation and start directly with collateral constraints
  - 2 periods, 2 states
  - Fixed price of capital
Model

Firm

- 3 dates: $t = 0, 1, \text{ and } 2$

- **Risk neutral firm’s objective:** expected present value of dividends
  \[
  E \left[ \sum_{t=0}^{T} \beta^t d_t \right]
  \]  
  (1)

- Internal funds $w_0$ at time 0

- Investment of $k_t$ at time $t$ yields cash flow
  \[ A_{t+1}(s)f(k_t) \]
  at time $t + 1$ where $f(\cdot)$ is concave production function, $A(s)$ is productivity in state $s$
Model (Cont’d)

Financiers

• Risk neutral and discount future at rate $\beta < 1$

• Large endowment of funds in all dates and states

• ... willing to lend in state-contingent way at expected return $R \equiv 1/\beta > 1$
Model (Cont’d)

Simplest case.

- **Two states at time 1:** State $s \in \mathcal{S} \equiv \{H, L\}$
- Cash flow either high or low: $A(H) > A(L) > 0$

![Time Line Diagram](image)
Financing with Collateral Constraints

Firm’s problem

• Maximize expected present value of dividends (1) by choosing
  • ... dividend, investment, financing, and risk management policy

subject to **budget constraints** at date 0, 1, and 2,

\[ w_0 + \sum_{s \in S} \pi(s)b_1(s) \geq d_0 + k_0 \]  \hspace{1cm} (2)

\[ A_t(s)f(k_{t-1}(s)) + k_{t-1}(s) + b_{t+1}(s) \geq d_t(s) + k_t(s) + Rb_t(s), \]  \hspace{1cm} (3)

• and **collateral constraints** for each date and state

\[ \theta k_{t-1}(s) \geq Rb_t(s), \]  \hspace{1cm} (4)

• and **limited liability constraints** (and non-negativity of capital)

\[ d_t(s) \geq 0, \quad k_t(s) \geq 0. \]  \hspace{1cm} (5)
Risk Management Subject to Short Sale Constraints

Equivalence

- Financing with state-contingent debt subject to collateral constraints (4) equivalent to non-contingent debt plus

  ... risk management with one-period Arrow securities subject to short sale constraints

\[ h_t(s) \geq 0 \]

where \( h_t(s) \equiv \theta k_{t-1}(s) - Rb_t(s) \)
Main result: Constrained firms hedge less!

- Firms with sufficiently low net worth do not engage in risk management (Proposition 7)
  - Or: ... exhaust debt capacity against all states
  - More generally: more constrained firms hedge less!

- Intuition:
  - Financing need for investment overrides hedging concerns.

- Consistent with the evidence:
  - Smaller (and low dividend paying) firms hedge less.

- But isn’t this the opposite of what received theory predicts? – Indeed.
Reconsidering Risk Management

Risk management as in Froot/Scharfstein/Stein (1993)

• They assume
  • ... complete markets, perfect enforcement at $t = 1$, and no financing need at $t = 0$

and show that optimal hedging policy implies “full hedging”

• ... and equalizes marginal value of net worth across states at $t = 1$

\[
\pi(H) \quad \text{No need for financing} \quad \pi(L) \\
\text{Complete hedging: } \mu_1(H) = \mu_1(L) \\
\]

\[
\pi(H) \quad s = H: \mu_1(H) \quad \pi(L) \quad s = L: \mu_1(L) \\
\]
Reconsidering Risk Management (Cont’d)

Financing and risk management subject to collateral constraints

• Our model assumes
  
  • ... complete markets subject to collateral constraints and financing need at $t = 0$

and implies that

• ... financing need can override hedging concern

$$
\mu_0 = R\mu_1(H) + R\lambda_1(H)
$$

\begin{align*}
\mu_0 &= R\mu_1(L) + R\lambda_1(L) \\
\pi(H) & \\
\pi(L) & \\
\end{align*}

No hedging: $\mu_1(H) \neq \mu_1(L)$
Distribution of Debt Capacity

Synopsis

• Productive borrowers exhaust debt capacity
  • ... because the opportunity cost of conserving debt capacity is foregone investment
  • Ditto for constrained firms!

• Such firms may be **forced to downsize**
  • ... exactly in times when cash flows are low but investment opportunities arise

• **Financial innovation** may aggravate these effects
  • ... as higher $\theta$ means firms can pledge more (leaving them with less net worth ex post)

• Infinite horizon model: Rampini/Viswanathan (2010) *Collateral and capital structure*
Conclusion

Financing and risk management are fundamentally linked

• Firms’ promises to pay are limited by collateral constraints

• New perspective on dynamic risk management
  • ... more constrained borrowers hedge less

• Productive/less well capitalized borrowers likely exhaust debt capacity
  • ... and may be forced to downsize