Default Risk, Shareholder Advantage, and Stock Returns

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Third Credit Risk Conference
Moody's Corporation & The Salomon Center, NYU Stern
May 16, 2006

Motivating Questions

1. **Q:** How should **default risk** affect **equity returns**?

   A: With a **proper** measure of default risk,

   $$\uparrow \textbf{ default risk} \Rightarrow \uparrow \textbf{ expected return}$$

2. **Q:** What is the **empirical evidence** on this relationship?

   A: Pervasive evidence:

   $$\uparrow \textbf{ default probability } \not\Rightarrow \uparrow \textbf{ expected returns}$$

3. **Q:** Is this an **arbitrage opportunity**? Or is it attributable to some overlooked **economic mechanisms**?

Objective

Understand the link: **default probability** $\leftrightarrow$ **equity returns**. **Three steps:**

1. Revisit empirical evidence using a unique dataset from Moody's KMV (**EDF^{TM}**) as a default probability indicator

2. Use a **contingent claim valuation model** that allows for **shareholders' advantage** in distressed firms
   - shareholder advantage: ability of shareholders to extract rents in renegotiation with other claim-holders in the event of financial distress (e.g., APR violations).

3. **Empirically test** cross-sectional predictions of the model

Preview of Results

1. Using Moody's KMV **EDF** measure, we **confirm**:

High default probability $\not\Rightarrow$ **High future returns**

2. Using the valuation **model** with shareholder advantage, we **show**:

- **Recovery** for shareholders upon default **alters equity risk**
- **Empirical predictions** (consistent with **risk/return trade-off**):

Shareholder advantage $\uparrow$ {
1. **Returns vs. EDF** $\searrow$ **or** $\curvearrowright$
2. **Returns given EDF** $\downarrow$

3. Using **proxies** for shareholder advantage, we **confirm** the predictions

Previous Evidence

- **Dichev (1998)**
  - High Olsen's 'O' or low Altman's 'Z' $\longrightarrow$ **low** future returns
- **Griffin and Lemmon (2002)**
  - Low B/M and high 'O' $\longrightarrow$ **low** future returns
- **Campbell, Hilscher and Szilagyi (2005)**
  - Use a hazard model to construct default probability
  - Find that high default probability $\longrightarrow$ **low** future returns
- **Vassalou and Xing (2004)**
  - Construct an EDF-mimicking measure for default probability
  - Conclude that default risk is **positively** priced

Data

- **Moody's KMV EDF: Expected Default Frequency™**
  - Inspired by the Black-Scholes-Merton Model (Kealhofer (2003))
  - Time period: January 1969–December 2003
  - Number of observations: 1,430,713 firm-month
  - No financial firms
- **CRSP**
  - Equity Returns
- **COMPUSTAT**
  - Accounting variables

Evidence from Moody's KMV EDF (Table 2)

	Low EDF 1	2	3	4	High EDF 5	High-Low	t-value
Raw returns							
EW	1.14	1.23	1.26	1.25	1.65	0.51	**1.50**
VW	0.96	1.11	1.08	0.95	0.82	-0.14	**-0.38**
DGTW-adjusted returns							
EW	0.03	0.08	0.08	0.09	0.74	0.72	**2.95**
VW	-0.01	0.07	-0.02	-0.18	-0.23	-0.22	**-0.84**

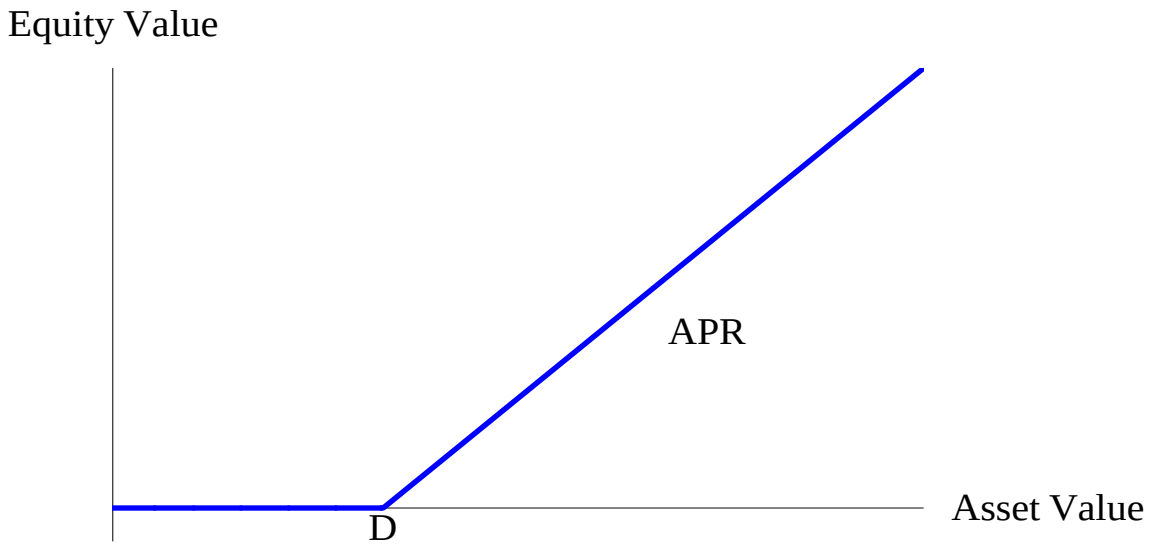
- EW $\neq$ VW even **after** DGTW adjustment!
- Possible **cross-sectional variation** in the relation **Returns vs. EDF**

Shareholder Advantage in Default: Basic mechanism

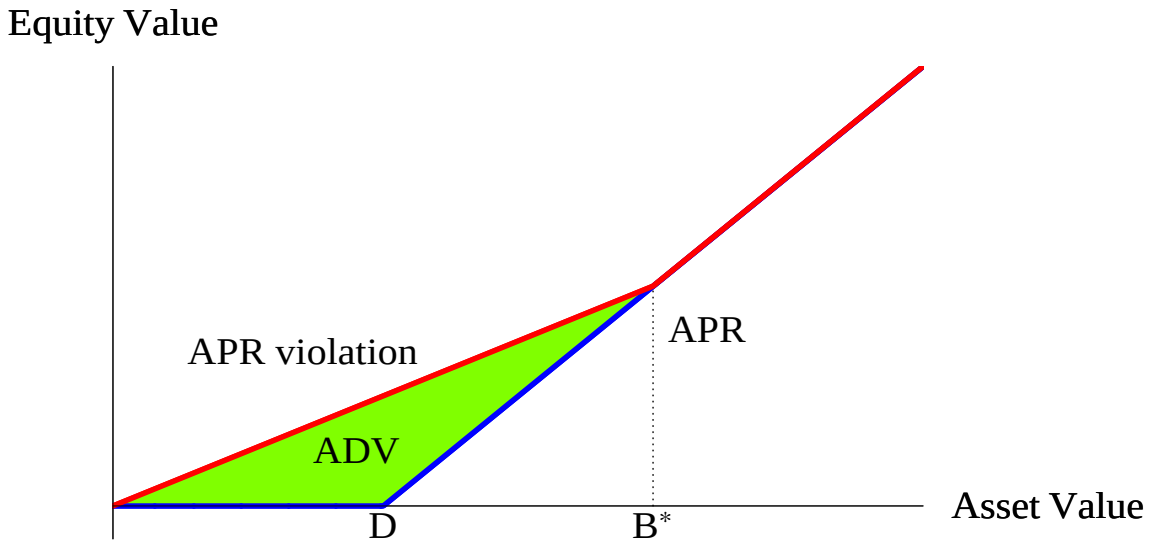
- **Equity** = **Call Option** on firm's asset value
- **Default** $\neq$ **liquidation:** **Chapter 11** filings and **APR deviations**
- Black-Merton-Scholes **contingent claim framework** with
  - **Endogenous default**
  - **Non-zero expected payoff** to shareholder upon default
- Shareholder advantage captures different **cash-flow realizations**.
  - **NOT a new pricing factor!**

Equity Payoff without Shareholder Advantage

$$E_T = \max[V_T - D, 0]$$



Equity Payoff with Shareholder Advantage



- **Equity payoff** $\propto$ **assets** if APR violations in default

Research Design

1. Start from existing valuation models of **strategic debt service**
   Anderson and Sundaresan (1996), Mella-Barral and Perraudin (1997), Fan and Sundaresan (2000), François and Morellec (2004), Acharyam, Huang, Subrahmanyam and Sundaram (2004)

2. Derive **equity returns** and **default probabilities** within the model

3. **Simulate** data from the model

4. Analyze the effect of **shareholder advantage** on simulated data

5. Use the model insights to design **empirical tests on true data**

Example: Fan and Sundaresan (2000) model

- Valuation model with **endogenous default** and **renegotiation**

$$V : \textbf{given} \text{ asset value}; \quad \tilde{E}(V) = \tilde{\theta} V, \quad \tilde{D}(V) = (1 - \tilde{\theta}) V,$$

- $\tilde{\theta}$ **sharing rule**, from a **Nash bargaining game**:

$$\tilde{\theta}^* = \arg\max \underbrace{\left[\tilde{\theta} V - 0\right]^{\eta}}_{\textbf{Shareholders}} \cdot \underbrace{\left[(1 - \tilde{\theta}) V - (1 - \alpha) V\right]^{1-\eta}}_{\textbf{Debtholders}} = \eta \alpha$$

η: **Shareholder bargaining power**
α: **Liquidation cost**

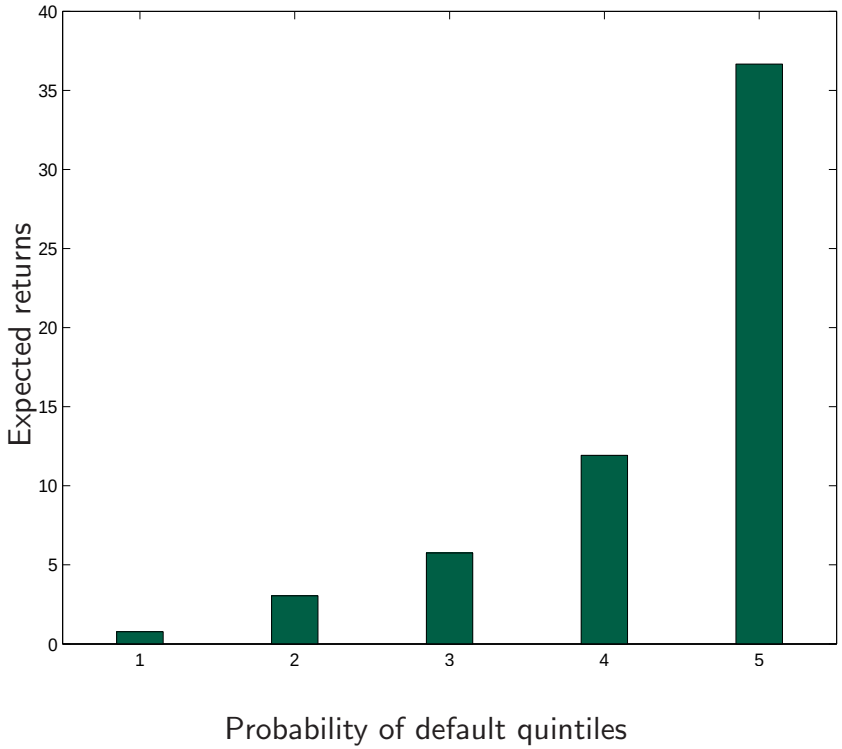
} **Shareholder Advantage (ADV)**

- Closed-form expressions for **equity returns** and **default probability**

Simulations

Role of shareholder Bargaining Power (η)

$\eta = 0$, α



Simulations

Role of shareholder Bargaining Power (η)

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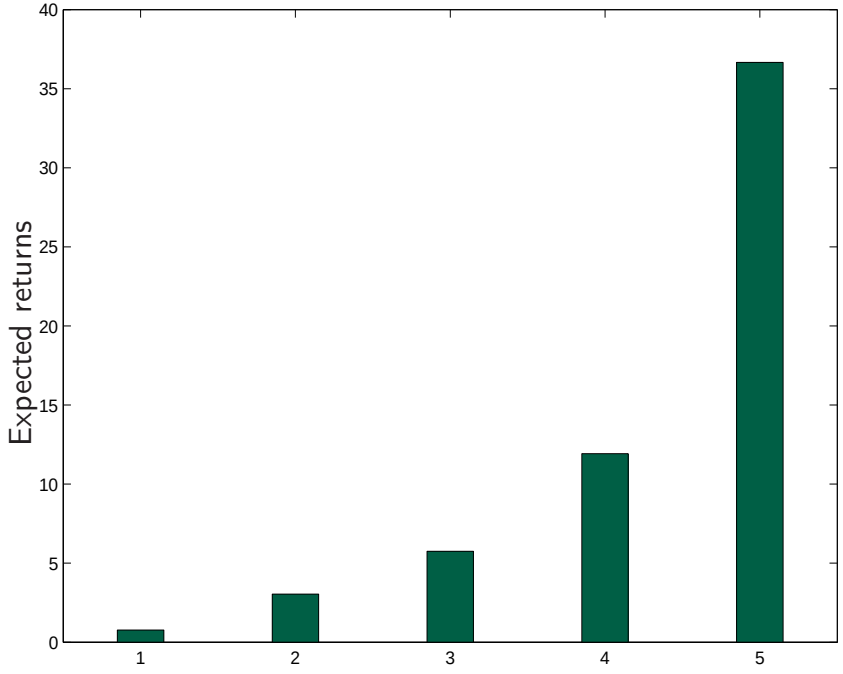
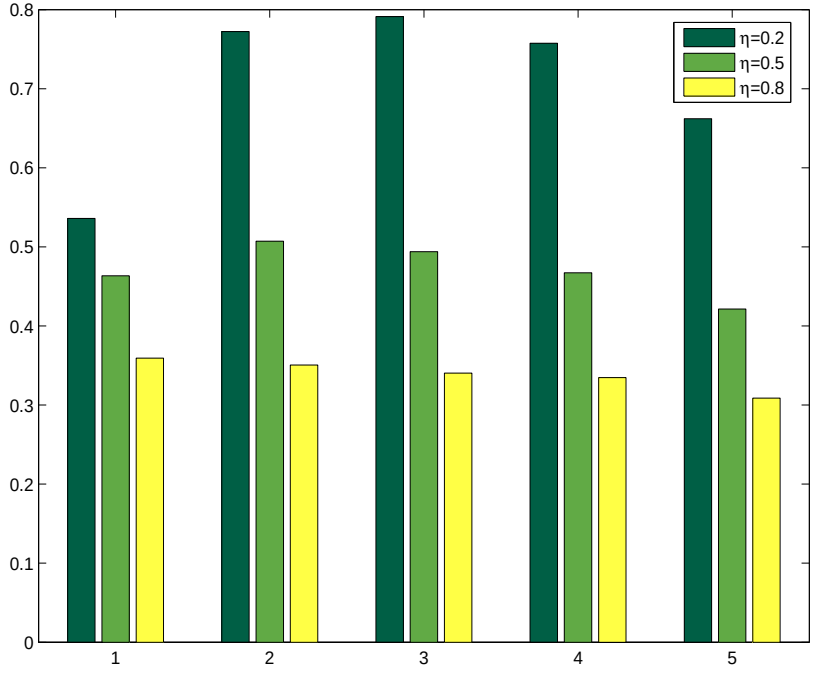


Probability of default quintiles

$\alpha = 0.5$

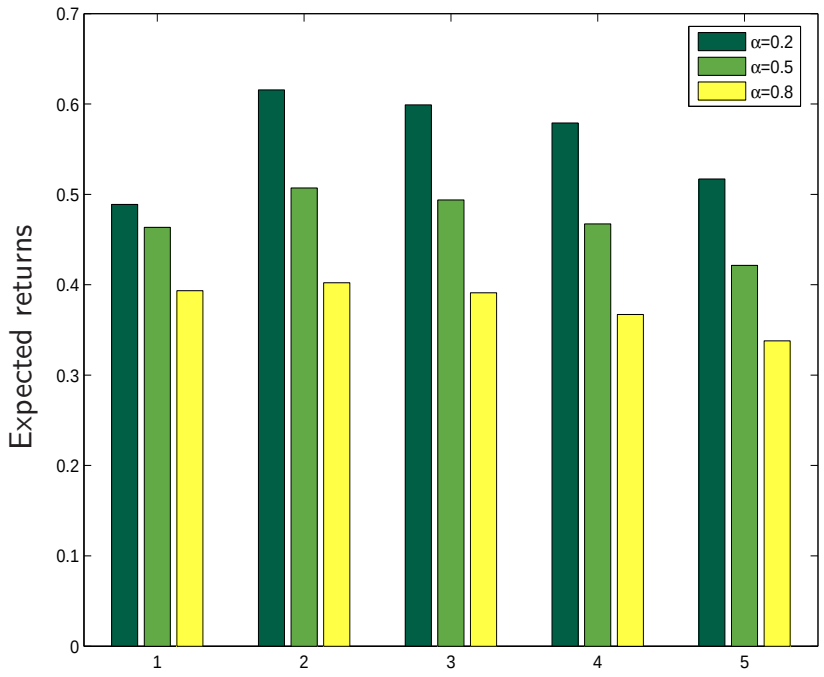


Probability of default quintiles

Simulations

Role of Liquidation Costs (α)

$\eta = 0.5$



Testable Implications from the Model

- **Hypothesis 1.** The relationship between default probability and expected return should be
  - **Upward-sloping** for firms with **minimal** shareholder advantage
  - **Downward sloping and hump-shaped** for firms with **substantial** shareholder advantage.

- **Hypothesis 2.** For a **given** default probability the expected return should be **lower** for firms in which
  - shareholders have **stronger** bargaining power and/or
  - the economic gains from renegotiation are **larger**.

Empirical Proxies - Shareholders' Bargaining Power

1. Asset size ($\uparrow \Rightarrow$ ADV $\uparrow$)

- Information Asymmetry. Small firms tend to have more concentrated creditors (Diamond (1991) and Sufi (2005))
- Moral Hazard. Large borrowers in default have better bargaining position.

2. R&D expenditures/assets ($\uparrow \Rightarrow$ ADV $\downarrow$)

- Empirically. High R&D expenditure makes firm susceptible to cash flow constraints (Opler and Titman (1994))
- Theoretically. Cash flow-based covenants (Fan and Sundaresan (2000))

Empirical Proxies - Liquidation Costs

1. Herfindahl Index of sales ($\uparrow \Rightarrow$ ADV $\uparrow$)

- Indirect measure of asset specificity
- High Industry concentration$\longrightarrow$ High likelihood of "fire sale" $\longrightarrow$ high liquidation cost (Shleifer and Vishny (1992))

2. Asset Tangibility ($\uparrow \Rightarrow$ ADV $\downarrow$)

- Direct measure of asset specificity
- Asset liquidation value (Berger, Ofek and Swary (1996))

$$Tang = Cash + 0.715 \times Receivables + 0.547 \times Inventory + 0.535 \times Capital$$

3. Book-to-Market Ratio ($\downarrow \Rightarrow$ ADV $\uparrow$)

- Loss of **intangible** assets in liquidation$\longrightarrow$Scope for bargaining

Empirical Predictions

Shareholder advantage (ADV) ↑

1. **Returns vs. EDF ↘ or ↷**
2. **Returns given high EDF ↓**

Empirical Methodology

- **Sub-portfolio analysis**
- **Regression analysis**

Summary of Results from Sub-Portfolio Analysis

Hypothesis 1: Returns vs. EDF

DGTW-adjusted returns (% per month)

	$ret^{high\ EDF} - ret^{low\ EDF}$		
	High ADV	Low ADV	Diff.
	(−)	(+)	(−)
Bargaining power			
- Asset Size	-1.02^{*}	0.73^{*}	-1.74^{***}
- R&D expenditures	-0.42	0.78^{*}	-1.19^{***}
Liquidation costs			
- Industry concentration	-0.59^{**}	-0.02	-0.57^{*}
- Asset tangibility	-0.46	0.30	-0.76^{**}
- Book-to-Market ratio	-0.91^{**}	0.34	-1.24^{***}

(*,** ,*** = significant at 10%, 5%, 1%)

Summary of Results from Sub-Portfolio Analysis

Hypothesis 2: Returns given EDF

DGTW-adjusted returns (% per month)

	$ret^{\text{high ADV}} - ret^{\text{low ADV}}$	
	Low EDF	High EDF
	(−/0)	(−)
Bargaining power		
- Asset Size	0.21	-1.54^{***}
- R&D expenditures	−0.13	-1.32^{***}
Liquidation costs		
- Industry concentration	−0.03	-0.60^{*}
- Asset tangibility	-0.24^{*}	-1.00^{***}
- Book-to-Market ratio	0.13	-1.11^{***}

(*,** ,*** = significant at 10%, 5%, 1%)

Cross-Sectional Regression Analysis (Table 9)

$$R_i = F(\beta_i, \text{Size}_i, \text{BM}_i, \text{MOM}_i, \text{EDF}_i, X_i * \text{EDF}_i)$$

β_i	:	**firm i's beta**
Size_i	:	**asset size**
BM_i	:	**B/M ratio**
MOM_i	:	**past six-month returns**
EDF_i	:	**MKMV EDF measure**
X_i	:	proxy for **bargaining power/liquidation cost**

- **Univariate** regression with each X_i;
- **Multivariate** regression with all X_i's.

Models	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Beta	0.0001	-0.0024*	-0.0007	-0.0011	-0.0008	-0.0019
t-stat	0.08	-1.86	-0.50	-0.88	-0.62	-1.49
Ln(AVL)	0.0005	-0.0012***	-0.0017***	-0.0017***	-0.0019***	0.0011**
t-stat	1.25	-3.02	-4.18	-4.28	-4.33	2.32
Ln(BM)	0.0047***	0.0053***	0.0044***	0.0045***	0.0023**	0.0040***
t-stat	5.94	7.42	5.37	5.98	2.12	3.89
Ret(-6,-1)	0.0208*	0.0194*	0.0175	0.0166	0.0174	0.0193*
t-stat	1.86	1.75	1.54	1.50	1.48	1.75
EDF	0.1026***	-0.0107***	0.0040	-0.0154***	-0.0025	0.0855***
t-stat	5.62	-3.12	0.97	-3.98	-0.79	4.06
R&D		0.0001				0.0005**
t-stat		0.32				2.42
Hfdl			0.0007***			0.0001
t-stat			4.74			0.08
Tang				-0.0006***		0.0001
t-stat				-2.98		0.54
Ln(AVL)×EDF	-0.0058***					-0.0051***
t-stat	-6.14					-4.86
R&D×EDF		0.0019***				0.0031**
t-stat		4.44				2.04
Hfdl×EDF			-0.0016***			-0.0007*
t-stat			-5.28			-1.85
Tang×EDF				0.0021***		0.0020***
t-stat				6.41		4.29
Ln(BM)×EDF					0.0039***	0.0007*
t-stat					3.06	1.92
Average Adj. R^2	0.0461	0.0548	0.0492	0.0471	0.0441	0.0575

Robustness Checks

- Returns over **different holding periods** (liquidity issues)
- **Other proxies** used in the literature for
  - **Default probability**
    - ⋆ Z-score, O-score, and Shumway's hazard model
  - **Bargaining power**
    - ⋆ Managerial Shareholdings
    - ⋆ Institutional Holdings
  - **Liquidation cost**
    - ⋆ Non-fixed assets
    - ⋆ Market-to-book assets

Conclusions

- Propose a **novel economic explanation** for the relationship:

  Default risk $\longrightarrow$ Equity returns

  that is based on **shareholder advantage** and is consistent with the **risk-return** trade-off

- Provide additional **empirical support** for the cross sectional predictions of the model

- Demonstrate the importance of **shareholder advantage** in strategic interactions among stake-holders for equity returns.