

## ***Credit Risk: the Altman Z-Score and Variations of the Original Model***

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## **Credit Risk**

- What is credit risk?
- Minimize defaults
  - Delinquent or non-existent coupon payments
- Typically rated by S&P, Moody's, and/or Fitch's
  - Both qualitative and quantitative

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## Rating Agencies

- S&P
  - Dates back to 1860
  - Most popular
    - IG - AAA to BBB-
    - SG - BB+ to D
- Moody's
  - Market Implied Ratings
- Fitch's
  - The Tiebreaker
  - Research Reports

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## Moody's MIR

### Market Implied Ratings (as of 3/25/2009)

	Rating	Gap
<b>Moody's Senior Unsecured or Equivalent</b>	B1	
<b>Moody's Loan Rating</b>	Ba1	
<b>Bond-Implied</b>	Baa2	5
<b>Credit Default Swap-Implied</b>	Ba3	1
<b>Equity-Implied</b> <small>Moody's I, K, M, V</small>	Ba3	1
<b>Moody's Default Predictor-Implied</b>	Ba1	3
<b>Loan Credit Default Swap-Implied</b>	Ba1	0

Bond, CDS, Equity, and MDP gaps are versus Moody's Sr. Unsecured or Equivalent Rating; Loan CDS Gap is versus Moody's Loan Rating.

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# Moody's LGD

7.375% GTD SR NOTES due 2017									
	Class Description	Curr	Rating	Rating Date	Rating Action	Watch Status	LGD Assessment Date	LGD	LGD 25
CUS:629377AX0	Senior Unsecured	USD	B1	3 NOV 2006	Assign	Possible Upgrade, 12 NOV 2008	28 APR 2008	LGD5	73%

  

7.25% GTD SR NOTES due 2014									
	Class Description	Curr	Rating	Rating Date	Rating Action	Watch Status	LGD Assessment Date	LGD	LGD 25
CUS:629377AT9	Senior Unsecured	USD	B1	6 JAN 2006	Assign	Possible Upgrade, 12 NOV 2008	28 APR 2008	LGD5	73%

  

7.375% SR NOTES due 2016									
	Class Description	Curr	Rating	Rating Date	Rating Action	Watch Status	LGD Assessment Date	LGD	LGD 25
CUS:629377AU6	Senior Unsecured	USD	B1	6 JAN 2006	Assign	Possible Upgrade, 12 NOV 2008	28 APR 2008	LGD5	73%

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# Altman Z-Score Model

Appendix A Listing of all Variables, Group Mean, and F-tests Based on one Period Prior to Bankruptcy Data (ZETA Model Sample)

No.	Variable Name	Population Means		Univariate
		Failed	Non-Failed	F-Test
(1)	EBIT/TA	-0.0055	0.1117	54.3
(2)	NATC/TC	-0.0297	0.0742	36.6
(3)	Sales/TA	1.3120	1.6200	3.3
(4)	Sales/TC	2.1070	2.1600	0.0
(5)	EBIT/Sales	0.0020	0.0070	30.2
(6)	NATC/Sales	-0.0153	0.0400	33.1
(7)	Log tang. Assets	1.9854	2.2220	5.5
(8)	Interest coverage	-0.5995	5.3410	26.1
(9)	Log no. (8)	0.9625	1.1620	26.1
(10)	Fixed charge coverage	0.2992	2.1839	15.7
(11)	Earnings/debt	-0.0792	0.1806	32.8
(12)	Earnings 5 yr. Maturities	-0.1491	0.6976	8.8
(13)	Cash/flow fixed charges	0.1513	2.9512	20.9
(14)	Cash flow/TD	-0.0173	0.3136	31.4
(15)	WC/LTD	0.3532	2.4433	6.0
(16)	Current ratio	1.5757	2.6040	38.2
(17)	WC/total assets	0.1498	0.3086	40.6
(18)	WC/cash expenses	0.1640	0.2467	5.2
(19)	Ret.earn/total assets	-0.0006	0.2935	114.6
(20)	Book equity/TC	0.2020	0.5260	64.5
(21)	MV equity/TC	0.3423	0.6022	32.1
(22)	5yr.MV equity/TC	0.4063	0.6210	31.0
(23)	MV equity/total liabilities	0.6113	1.8449	11.6
(24)	Standard error of estimate of EBIT/TA (norm)	1.6870	5.784	33.8
(25)	EBIT drop	-3.2272	3.179	9.9
(26)	Margin drop	-0.2173	0.179	15.6
(27)	Capital lease/assets	0.2514	0.178	4.2
(28)	Sales/fixed assets	3.1723	4.179	3.5



## Z-Score, cont.

$$\square Z = .012X_1 + .014X_2 + .033X_3 + .006X_4 + .999X_5$$

■ Where:

- $X_1$  = Working Cap. / TA
- $X_2$  = RE / TA
- $X_3$  = EBIT / TA
- $X_4$  = Market Cap. / TL
- $X_5$  = Sales / TA

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## F-Test Results on Selected Variables

- $X_1$  = Working Cap. / TA - 32.5
- $X_2$  = RE / TA - 58.86
- $X_3$  = EBIT / TA - 26.56
- $X_4$  = Market Cap. / TL - 33.26
- $X_5$  = Sales / TA - 2.84

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## Back Test the Model

- 66 Companies
  - 33 Poor Performing Companies
  - 33 Healthy Companies
- Financial Data from 1945-1965
- Outstanding Performance
  - 94% of companies with Z scores *less* than 2.7 went bankrupt
  - 97% of the non-bankrupt firms had Z scores *above* 2.7 this level

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## Why Revise the Model?

- Universal Comps
- Current Market Environment Adjustments
- Gain more predicting power

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## Z'-Score Model

$$\square Z' = .717X_1 + .847X_2 + 3.107X_3 + .42X_4 + .998X_5$$

■ Where:

- $X_1$  = Working Cap. / TA
- $X_2$  = RE / TA
- $X_3$  = EBIT / TA
- $X_4$  = Market Cap. / TL
- $X_5$  = Sales / TA

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## Z''-Score Model

$$\square Z'' = 3.25 + 6.25X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

■ Where:

- $X_1$  = Working Cap. / TA
- $X_2$  = RE / TA
- $X_3$  = EBIT / TA
- $X_4$  = Market Cap. / TL

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## 7 Variable Model

- $X_1 = \text{ROA} - \text{EBIT} / \text{TA}$
- $X_2 = \text{Stability of Earnings} - \text{Slope of 5 to 10 year Earnings Trendline}$
- $X_3 = \text{Debt Service} - \text{Interest Coverage Ratio}$   
 $\text{EBIT} / \text{Interest Expense}$
- $X_4 = \text{Cumulative Profitability} - \text{RE} / \text{TA}$
- $X_5 = \text{Liquidity} - \text{Current Ratio}$
- $X_6 = \text{Capitalization} - \text{Equity} / \text{Total Cap.}$
- $X_7 = \text{Size} - \text{Log(TA)}$

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## Data Adjustments and Implementation

- Various adjustments
  - Normalized EBIT vs. EBIT
  - Tangible Assets vs. Total Assets
- Excel Screenshots

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## Why use this?

- Predicting Power
  - 1999 Enron rated BBB by both the rating agencies and the Z" model
  - 2001 (just before bankruptcy)
    - Z" Model - B-
    - Rating agencies - BBB
- Risk Management
- Bond Screener

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