

Corporate Credit Scoring & Default Models;
Old & New Alternatives

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Presented by



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The Cedar Edward Altman Event

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Partners



Scoring Systems

- Qualitative (Subjective)
- Univariate (Accounting/Market Measures)
- Multivariate (Accounting/Market Measures)
 - Discriminant, Logit, Probit Models (Linear, Quadratic)
 - Non-Linear Models (e.g., RPA, NN)
- Discriminant and Logit Models in Use
 - Consumer Models - Fair Isaacs
 - Z-Score (5) - Manufacturing
 - ZETA Score (7) - Industrials
 - Private Firm Models (eg. Risk Calc (Moody's), Z'' Score)
 - EM Score (4) - Emerging Markets, Industrial
 - Other - Bank Specialized Systems

Scoring Systems

(continued)

- Artificial Intelligence Systems
 - Expert Systems
 - Neural Networks (eg. Credit Model (S&P), CBI (Italy))
- Option/Contingent Claims Models
 - Risk of Ruin
 - KMV Credit Monitor Model
- Blended Ratio/Market Value Models
 - Moody's *Risk Cal*
 - Bond Score (*Credit Sights*)
 - Z-Score (*Market Value Model*)
- Z-Metrics (MSCI)
 - Blended and Macro Approach

Key Industrial Financial Ratios

(U.S. Industrial Long-term Debt)

Three Year Medians (2005-2007)	AAA	AA	A	BBB	BB	B	CCC
EBIT Interest Coverage (x)	26.2	16.4	11.2	5.8	3.4	1.4	0.4
EBITDA Interest Coverage (x)	32.0	19.5	13.5	7.8	4.8	2.3	1.1
Funds from Operations/Total Debt (%)	155.5	79.2	54.5	35.5	25.7	11.5	2.5
Free Operating Cash Flow/Total Debt (%)	129.9	40.6	31.2	16.1	7.1	2.2	(3.6)
Total Debt/EBITDA (x)	0.4	0.9	1.5	2.2	3.1	5.5	8.6
Return on Capital (%)	27.0	28.4	21.8	15.2	12.4	8.7	2.7
Total Debt/Total Debt + Equity (%)	12.3	35.2	36.8	44.5	52.5	73.2	98.9

Source: Standard & Poor's, Creditstats: 2007 Adjusted Key US Industrial and Utility Financial Ratios

Problems With Traditional Financial Ratio Analysis

- 1 Univariate Technique
1-at-a-time
- 2 No “Bottom Line”
- 3 Subjective Weightings
- 4 Ambiguous
- 5 Misleading

Forecasting Distress With Discriminant Analysis

Linear Form

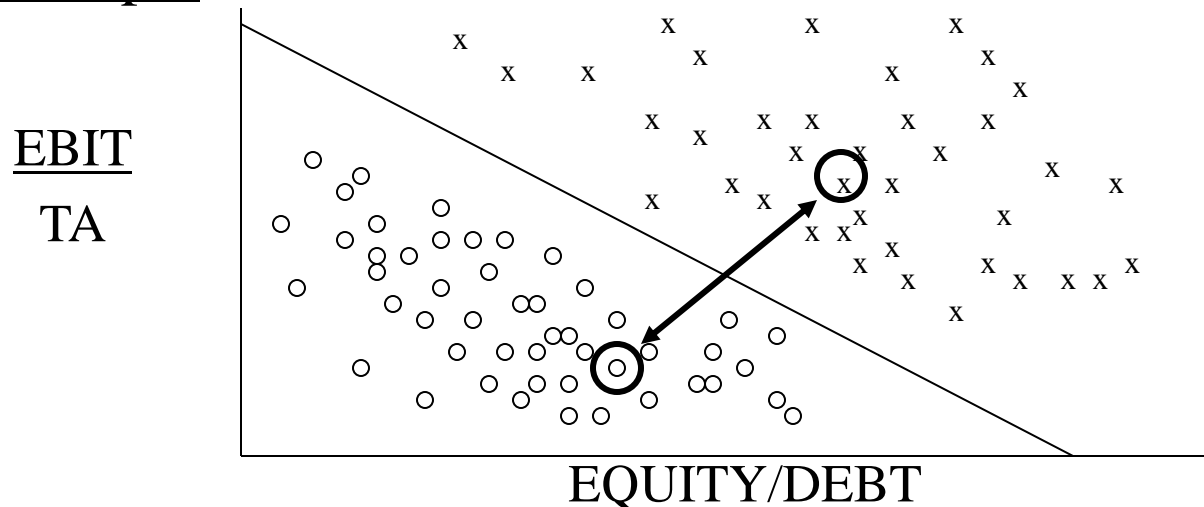
$$Z = a_1x_1 + a_2x_2 + a_3x_3 + \dots + a_nx_n$$

Z = Discriminant Score (Z Score)

$a_1 \rightarrow a_n$ = Discriminant Coefficients (Weights)

$x_1 \rightarrow x_n$ = Discriminant Variables (e.g. Ratios)

Example



“Z” Score Component Definitions

<u>Variable</u>	<u>Definition</u>	<u>Weighting Factor</u>
X_1 - - - - -	<u>Working Capital</u> Total Assets	1.2
X_2 - - - - -	<u>Retained Earnings</u> Total Assets	1.4
X_3 - - - - -	<u>EBIT</u> Total Assets	3.3
X_4 - - - - -	<u>Market Value of Equity</u> Book Value of Total Liabilities	0.6
X_5 - - - - -	<u>Sales</u> Total Assets	1.0

Z Score Bankruptcy Model

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

e.g. 20.0%

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + .6X_4 + .999X_5$$

e.g. 0.20

$$X_1 = \frac{\text{Current Assets} - \text{Current Liabilities}}{\text{Total Assets}}$$

$$X_4 = \frac{\text{Market Value of Equity}}{\text{Total Liabilities}}$$

$$X_2 = \frac{\text{Retained Earnings}}{\text{Total Assets}}$$

$$X_5 = \frac{\text{Sales}}{\text{Total Assets}} \quad (= \# \text{ of Times} \\ \text{e.g. 2.0x})$$

$$X_3 = \frac{\text{Earnings Before Interest and Taxes}}{\text{Total Assets}}$$

Zones of Discrimination: Original Z - Score Model

$Z > 2.99$ - “Safe” Zone

$1.8 < Z < 2.99$ - “Grey” Zone

$Z < 1.80$ - “Distress” Zone

Estimating Probability of Default (PD) and Probability of Loss Given Defaults (LGD)

Method #1

- Credit scores on new or existing debt
- Bond rating equivalents on new issues (Mortality) or existing issues (Rating Agency)
- Utilizing mortality or cumulative default rates to estimate marginal and cumulative defaults

or

Method #2

- Credit scores on new or existing debt
- Direct estimation of the probability of default
- Based on PDs, assign a rating

Average Z-Score by S&P Bond Rating

S&P 500: 1992 - 2005

<u>Rating</u>	<u>2004-2005</u>	<u>1996-2001</u>	<u>1992-1995</u>
AAA	5.31	5.60	4.80
AA	4.99	4.73	4.15
A	4.22	3.74	3.87
BBB	3.37	2.81	2.75
BB	2.27	2.38	2.25
B	1.79	1.80	1.87
B-	1.34	1.31	1.38
CCC+	0.90	0.82	0.89
CCC	0.45	0.33	0.40
D	-0.19	-0.20	0.05

Method #1

Marginal and Cumulative Mortality Rate Actuarial Approach

$$\mathbf{MMR}_{(t)} = \frac{\text{Total value of defaulting debt in year } (t)}{\text{total value of the population at the start of the year } (t)}$$

MMR = Marginal Mortality Rate

One can measure the cumulative mortality rate (CMR) over a specific time period (1,2,..., T years) by subtracting the product of the surviving populations of each of the previous years from one (1.0), that is,

$$CMR_{(t)} = 1 - \prod_{t=1} SR_{(t)},$$

here $CMR_{(t)}$ = Cumulative Mortality Rate in (t) ,
 $SR_{(t)}$ = Survival Rate in (t) , $1 - MMR_{(t)}$

Mortality Rate Concept (Illustrative Calculation)

For BB Rated Issues

Security No.	Issued Amount	Year 1 Default	Call	SF	Year 2 Default	Call	SF
1	50	--	--	5	--	--	5
2	50	50	--	--	NE	NE	NE
3	100	--	100	--	NE	NE	NE
4	100	--	--	--	100	--	--
5	150	--	--	--	--	--	15
6	150	--	--	--	--	--	--
7	200	--	--	20	--	--	20
8	200	--	--	--	--	200	--
9	250	--	--	--	--	--	--
10	250	--	--	--	--	--	--
Total	1,500	50	100	25	100	200	40
Amount Start of Period	1,500	-	175	-	1,325	- 340	= 985
Marginal Mortality Rate		Year 1			Year 2		
		50/1,500 = 3.3%			100/1,325 = 7.5%		
Cumulative Rate		3.3%			1 - (SR1 x SR2) = CMR2 1 - (96.7% x 92.5%) = 10.55%		

NE = No longer in existence
SF = Sinking fund

Mortality Rates by Original Rating

All Rated Corporate Bonds* 1971-2009

		1	2	3	4	5	6	7	8	9	10
AAA	Marginal	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%	0.01%	0.00%	0.00%	0.00%
	Cumulative	0.00%	0.00%	0.00%	0.00%	0.03%	0.05%	0.06%	0.06%	0.06%	0.06%
AA	Marginal	0.00%	0.00%	0.27%	0.12%	0.02%	0.01%	0.00%	0.01%	0.03%	0.01%
	Cumulative	0.00%	0.00%	0.27%	0.39%	0.41%	0.42%	0.42%	0.43%	0.46%	0.47%
A	Marginal	0.01%	0.08%	0.18%	0.19%	0.15%	0.12%	0.05%	0.22%	0.12%	0.08%
	Cumulative	0.01%	0.09%	0.27%	0.46%	0.61%	0.73%	0.78%	1.00%	1.11%	1.19%
BBB	Marginal	0.42%	2.86%	1.48%	1.12%	0.68%	0.30%	0.36%	0.19%	0.18%	0.38%
	Cumulative	0.42%	3.27%	4.70%	5.77%	6.41%	6.69%	7.02%	7.20%	7.37%	7.72%
BB	Marginal	1.09%	2.23%	4.11%	2.18%	2.58%	1.50%	1.57%	1.20%	1.63%	3.30%
	Cumulative	1.09%	3.30%	7.27%	9.29%	11.63%	12.96%	14.32%	15.35%	16.73%	19.48%
B	Marginal	3.08%	8.05%	8.08%	8.18%	6.11%	4.78%	3.85%	2.35%	1.94%	0.96%
	Cumulative	3.08%	10.88%	18.08%	24.78%	29.38%	32.76%	35.34%	36.86%	38.09%	38.68%
CCC	Marginal	8.78%	13.02%	18.68%	16.34%	4.64%	12.15%	5.65%	5.11%	0.77%	4.59%
	Cumulative	8.78%	20.66%	35.48%	46.02%	48.53%	54.78%	57.33%	59.51%	59.83%	61.67%

*Rated by S&P at Issuance
Based on 2,527 issues
Source: Standard & Poor's (New York) and Author's Compilation

Mortality Losses by Original Rating

All Rated Corporate Bonds* 1971-2009

		1	2	3	4	5	6	7	8	9	10
AAA	Marginal	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%
	Cumulative	0.00%	0.00%	0.00%	0.00%	0.01%	0.02%	0.03%	0.03%	0.03%	0.03%
AA	Marginal	0.00%	0.00%	0.04%	0.04%	0.01%	0.01%	0.00%	0.01%	0.01%	0.01%
	Cumulative	0.00%	0.00%	0.04%	0.08%	0.09%	0.10%	0.10%	0.11%	0.12%	0.13%
A	Marginal	0.00%	0.03%	0.09%	0.15%	0.09%	0.05%	0.03%	0.05%	0.08%	0.03%
	Cumulative	0.00%	0.03%	0.12%	0.27%	0.36%	0.41%	0.44%	0.49%	0.57%	0.60%
BBB	Marginal	0.33%	1.92%	1.26%	0.45%	0.44%	0.20%	0.15%	0.11%	0.11%	0.22%
	Cumulative	0.33%	2.24%	3.48%	3.91%	4.33%	4.52%	4.67%	4.77%	4.88%	5.09%
BB	Marginal	0.63%	1.29%	2.43%	1.27%	1.54%	0.79%	0.86%	0.52%	0.84%	1.18%
	Cumulative	0.63%	1.91%	4.30%	5.51%	6.97%	7.70%	8.49%	8.97%	9.74%	10.80%
B	Marginal	2.06%	5.63%	5.48%	5.46%	4.03%	2.63%	2.50%	1.32%	1.00%	0.69%
	Cumulative	2.06%	7.57%	12.64%	17.41%	20.74%	22.82%	24.75%	25.74%	26.49%	26.99%
CCC	Marginal	5.78%	9.34%	13.28%	11.95%	3.28%	9.15%	4.26%	3.96%	0.47%	2.94%
	Cumulative	5.78%	14.58%	25.92%	34.78%	36.92%	42.69%	45.13%	47.30%	47.55%	49.09%

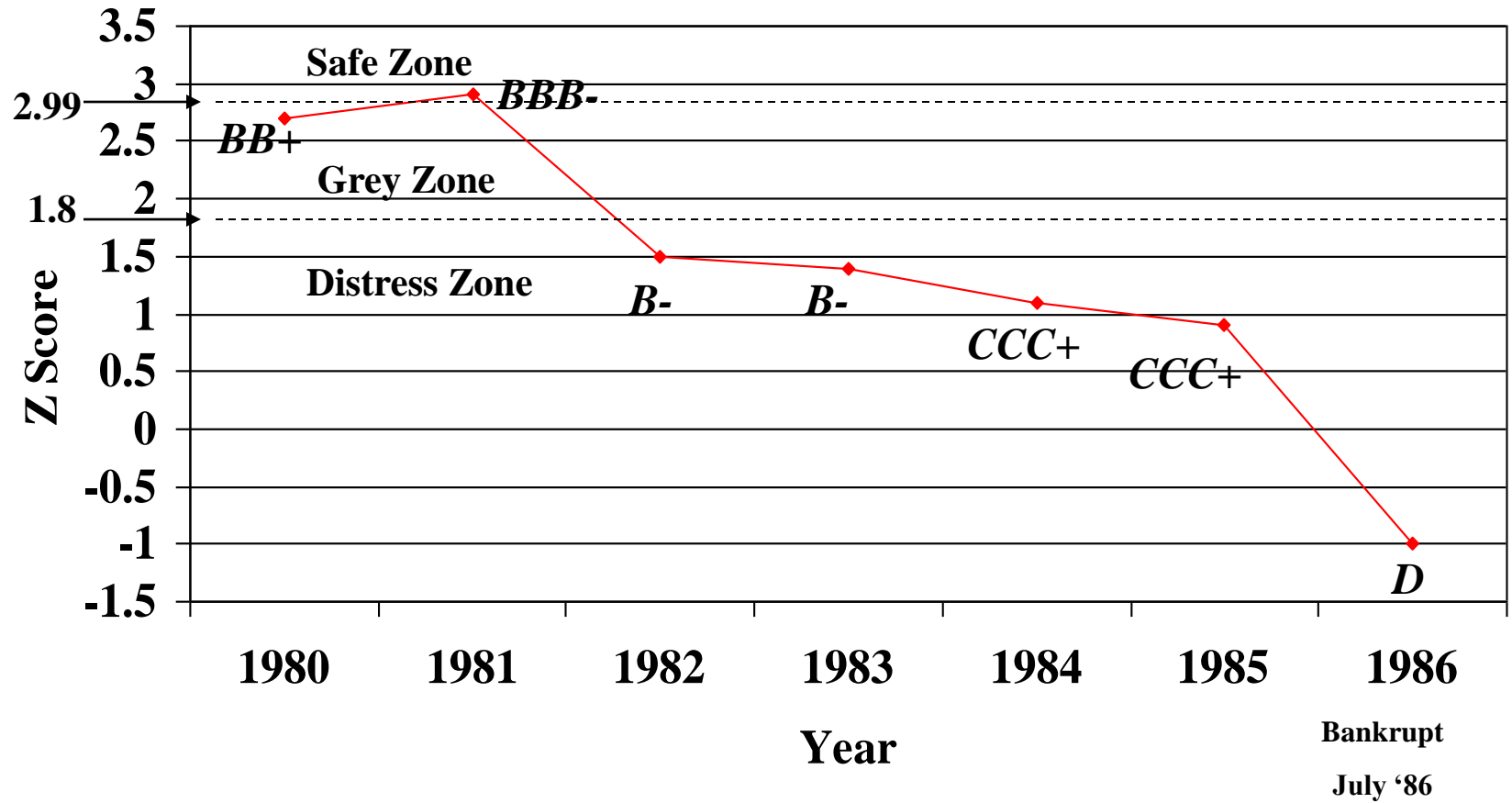
*Rated by S&P at Issuance
Based on 2,099 issues
Source: Standard & Poor's (New York) and Author's Compilation

Classification & Prediction Accuracy Z Score (1968) Failure Model*

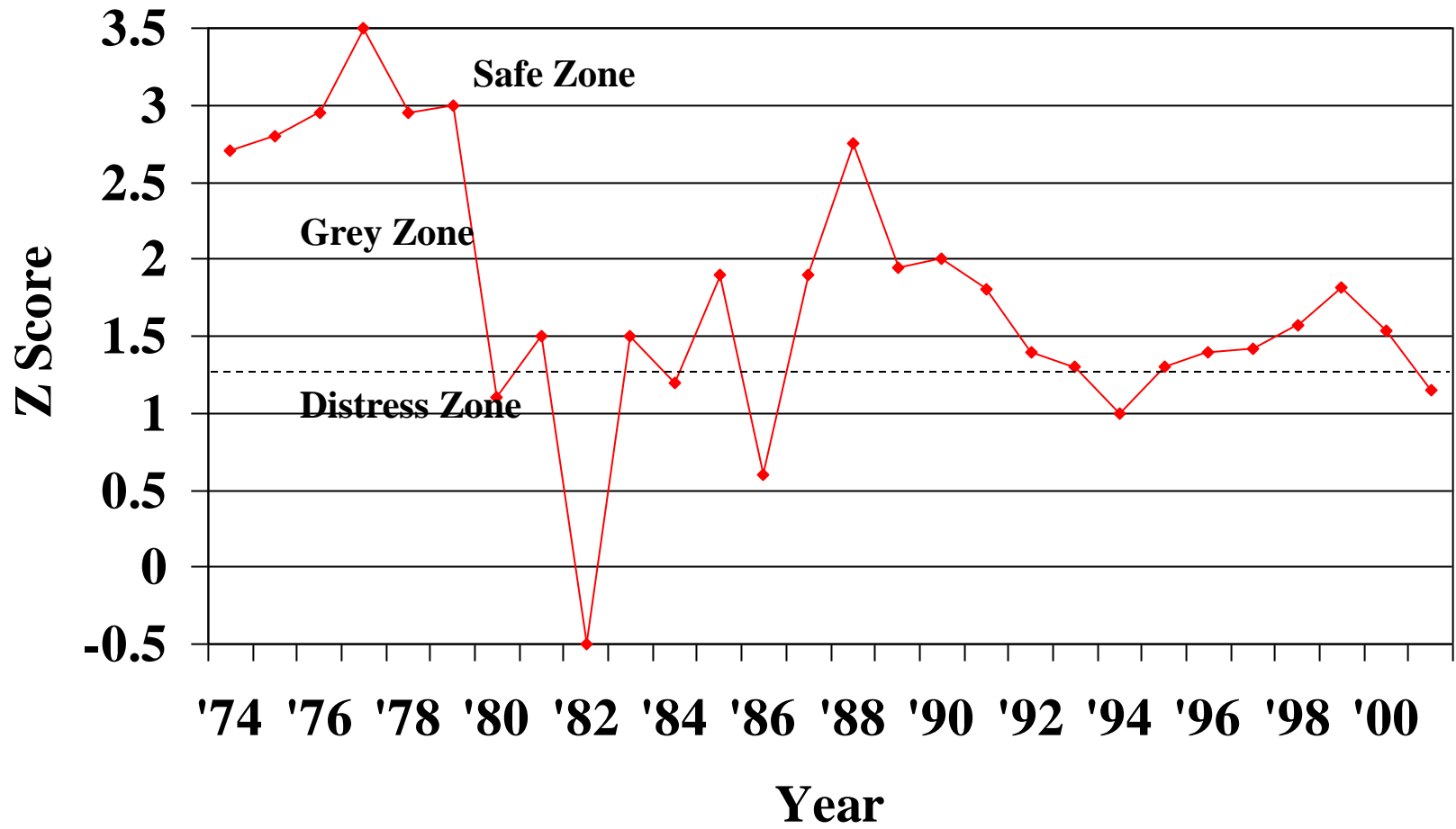
Year Prior To Failure	Original Sample (33)	Holdout Sample (25)	1969-1975 Predictive Sample (86)	1976-1995 Predictive Sample (110)	1997-1999 Predictive Sample (120)
1	94% (88%)	96% (72%)	82% (75%)	85% (78%)	94% (84%)
2	72%	80%	68%	75%	74%
3	48%	-	-	-	-
4	29%	-	-	-	-
5	36%	-	-	-	-

*Using 2.67 as cutoff score (1.81 cutoff accuracy in parenthesis)

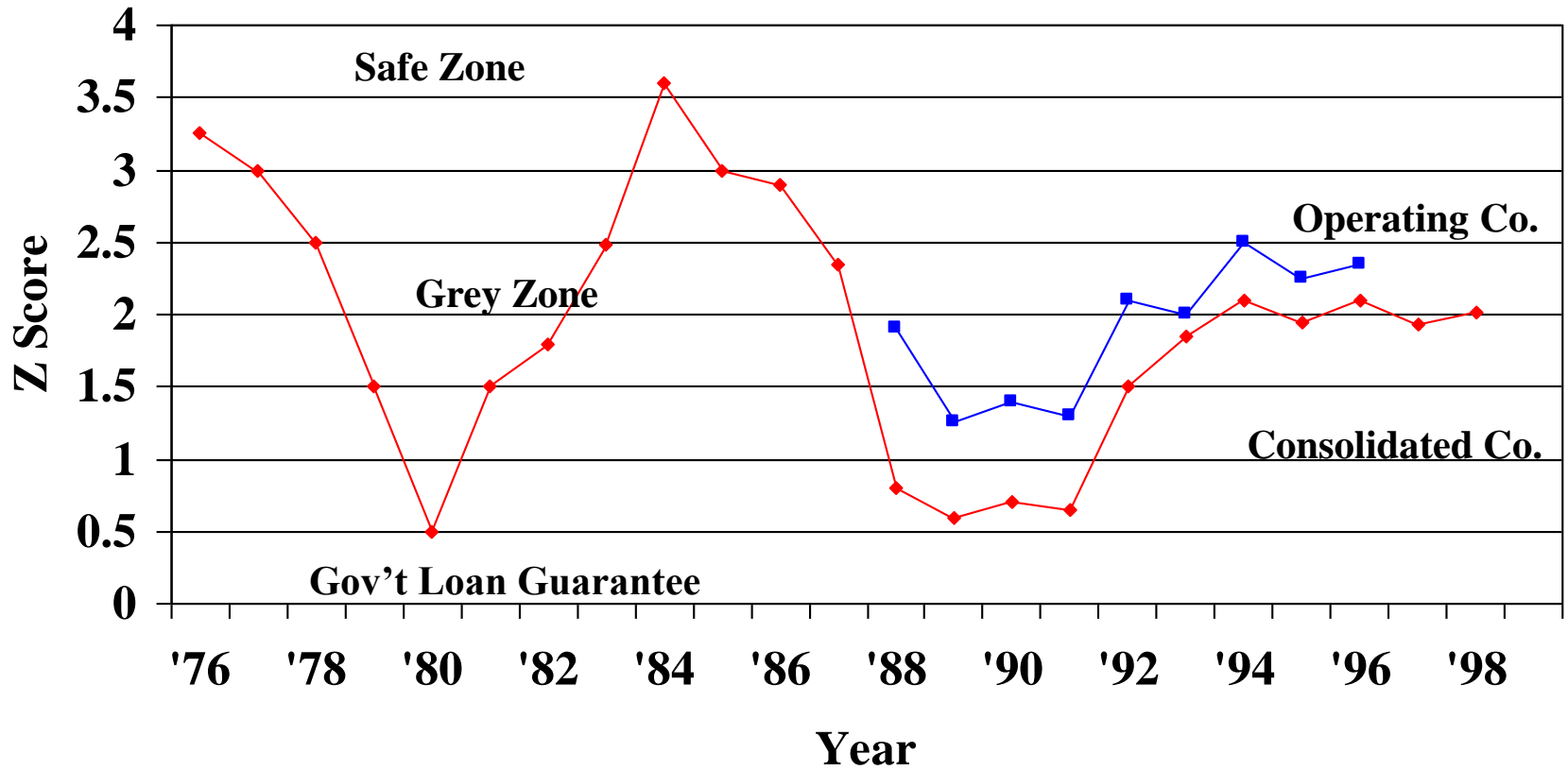
Z Score Trend - LTV Corp.



International Harvester (Navistar) Z Score (1974 – 2001)

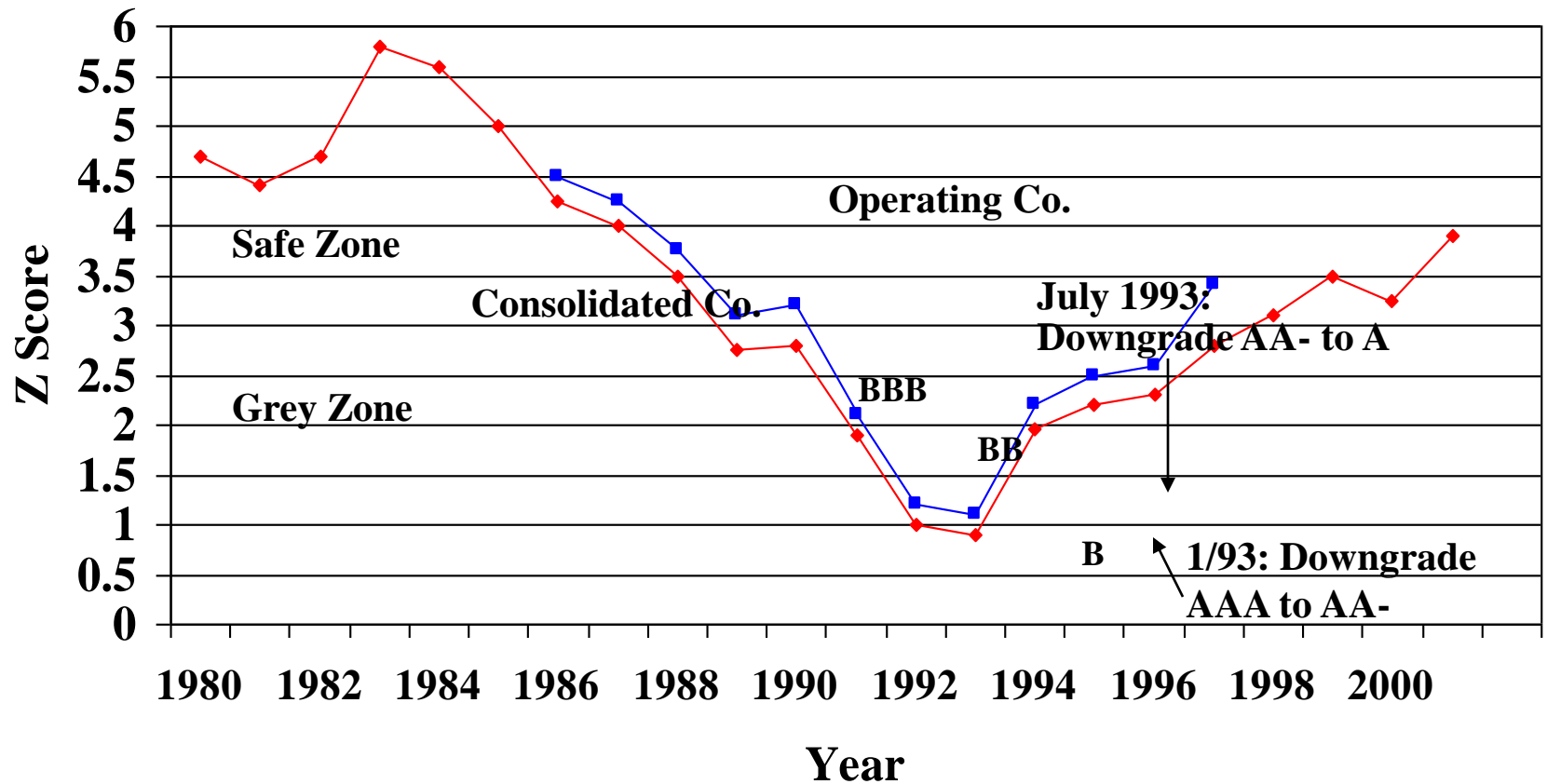


Chrysler Corporation Z Score (1976 – 3Q 1998*)

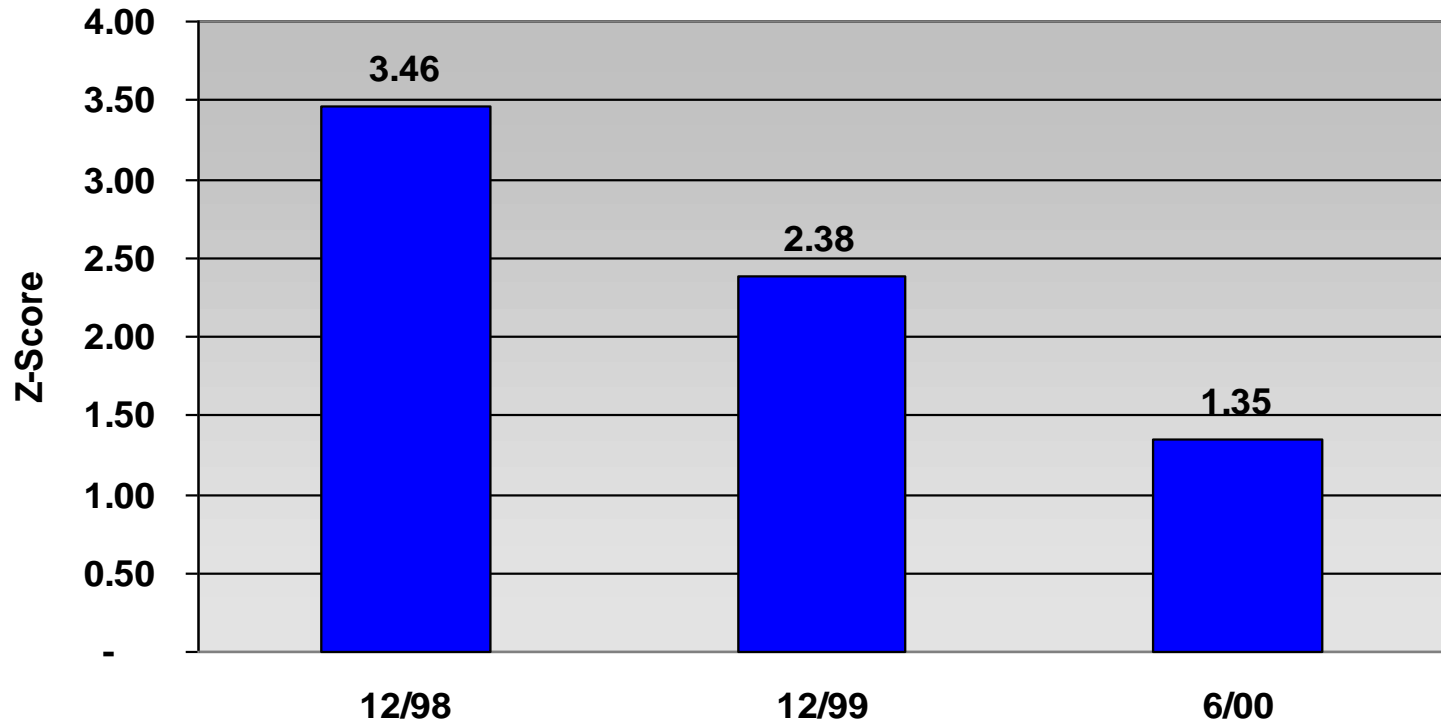


*Third quarter figures for 1998 are annualized

IBM Corporation Z Score (1980 – 2001)



Xerox Credit Quality: Z Score Analysis 1998-2000



Bond Rating Equivalents:

12/98 A

12/99 BB

06/00 B

Actual Rating (S&P / Moody's):

12/98 A / A2

12/99 A / A2

07/00 A- / A3

12/00 BBB- / Ba1

5/02 BB / B1

U.S. Automotive Industry: Z, Z''-Scores and Bond Rating Equivalents (BRE)

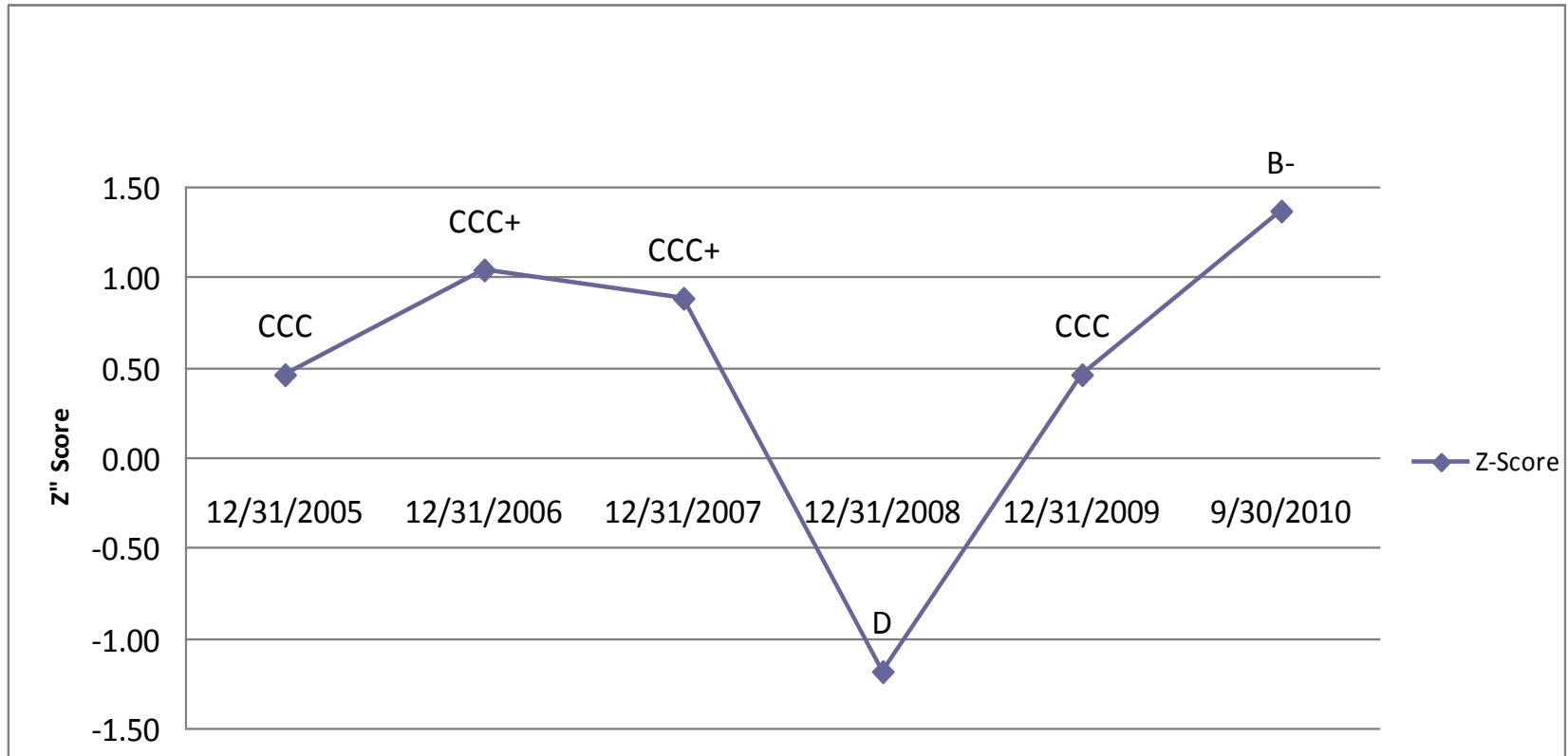
Ford and GM Z and Z'' Score Tracking				
	Ford		GM	
	<u>Z Scores</u>	<u>BRE</u>	<u>Z Scores</u>	<u>BRE</u>
12/31/09	0.88	CCC+	0.38	CCC
12/31/08	0.26	CCC-	(1.19)	D
12/31/07	0.58	CCC	0.88	CCC+
12/31/06	0.35	CCC	1.04	CCC+
12/31/05	0.64	CCC	0.46	CCC
12/31/04	0.61	CCC	0.36	CCC
	<u>Z'' Scores</u>	<u>BRE</u>	<u>Z'' Scores</u>	<u>BRE</u>
12/31/09	4.09	B-	2.65	CCC
12/31/08	2.01	CCC-	(5.10)	D
12/31/07	3.03	CCC+	1.94	CCC-
12/31/06	2.73	CCC	2.95	CCC+
12/31/05	2.92	CCC+	3.82	B-
12/31/04	2.86	CCC+	2.78	CCC

Data Source: Bloomberg

Note: Auto Business Only; Retained Earnings and Market Value on a Consolidated Basis

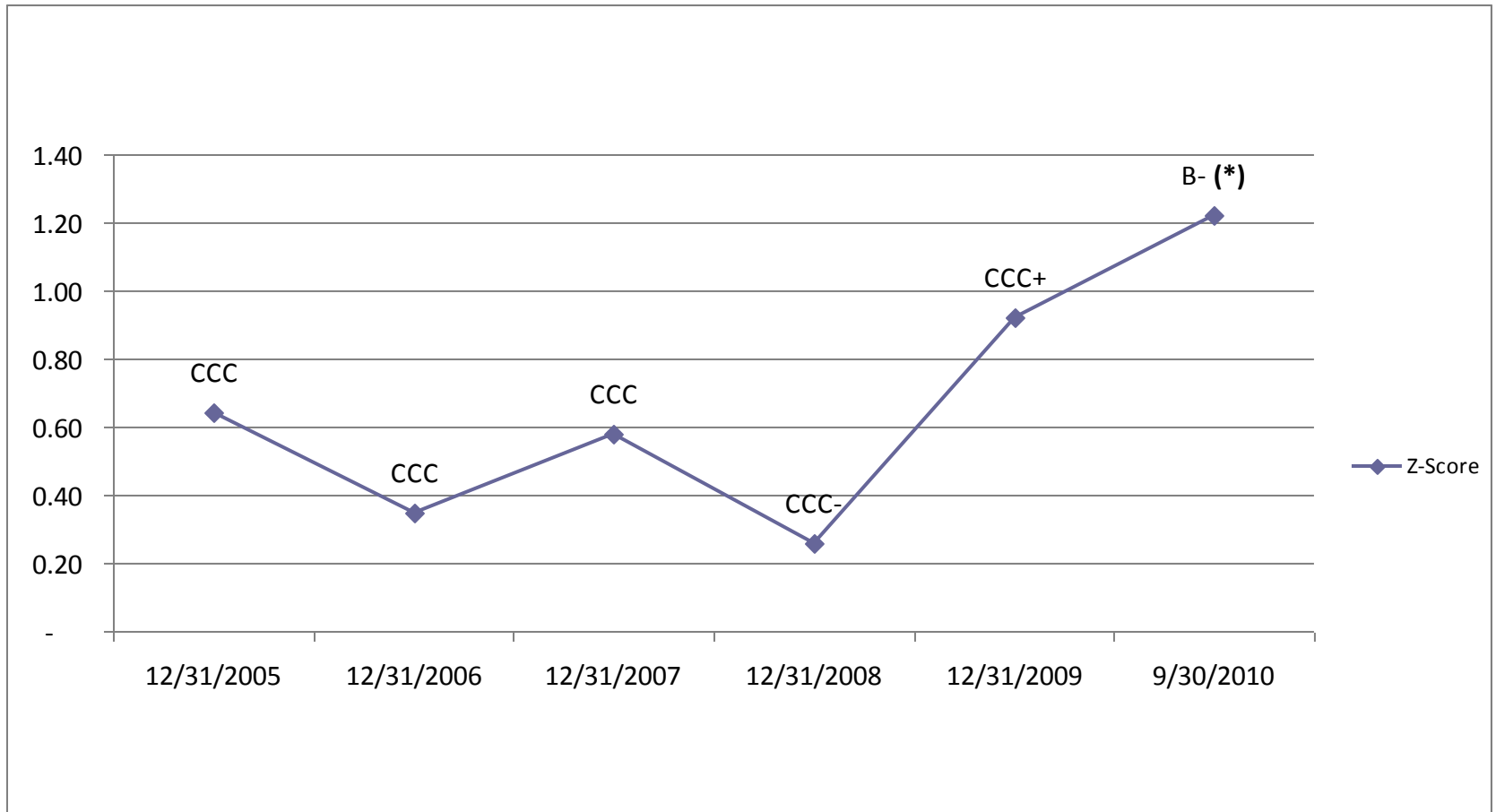
Z Model Applied to GM Shows a Decreasing Trend in the Bond Rating Equivalents from 2005 - 2010 (3Q)

Z- Score: General Motors Co.



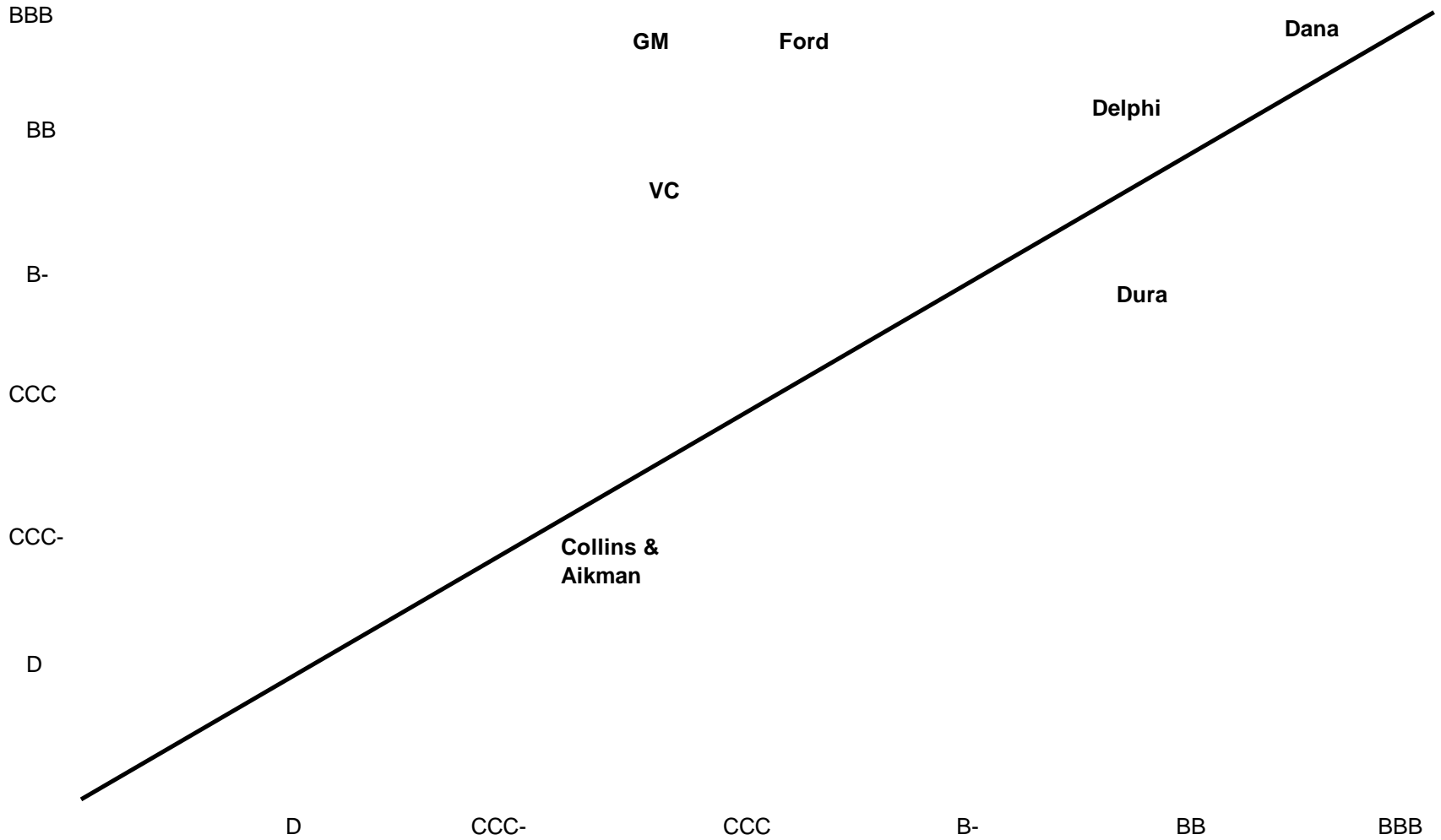
Z Model Applied to Ford Shows a Decreasing Trend in Z score from 2005 - 2010 (3Q)

Z- Score: Ford Motor Co.



Automotive Sector

Z"-Score Distressed Model vs S&P Ratings, 2006



Z' Score

Private Firm Model

$$Z' = .717X_1 + .847X_2 + 3.107X_3 + .420X_4 + .998X_5$$

$X_1 =$ Current Assets - Current Liabilities

Total Assets

$X_2 =$ Retained Earnings

Total Assets

$X_3 =$ Earnings Before Interest and Taxes

Total Assets

$X_4 =$ Book Value of Equity

Total Liabilities

$X_5 =$ Sales

Total Assets

$Z' > 2.90$ - “Safe” Zone

$1.23 < Z' < 2.90$ - “Grey” Zone

$Z' < 1.23$ - “Distress” Zone

Z'' Score Model for Manufacturers, Non-Manufacturer Industrials; Developed and Emerging Market Credits

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

$$X_1 = \frac{\text{Current Assets} - \text{Current Liabilities}}{\text{Total Assets}}$$

$$X_2 = \frac{\text{Retained Earnings}}{\text{Total Assets}}$$

$$X_3 = \frac{\text{Earnings Before Interest and Taxes}}{\text{Total Assets}}$$

$$X_4 = \frac{\text{Book Value of Equity}}{\text{Total Liabilities}}$$

$Z'' > 2.60$ - "Safe" Zone

$1.1 < Z'' < 2.60$ - "Grey" Zone

$Z'' < 1.1$ - "Distress" Zone

US Bond Rating Equivalent Based on Z" Score Model

$$Z''=3.25+6.56X_1+3.26X_2+6.72X_3+1.05X_4$$

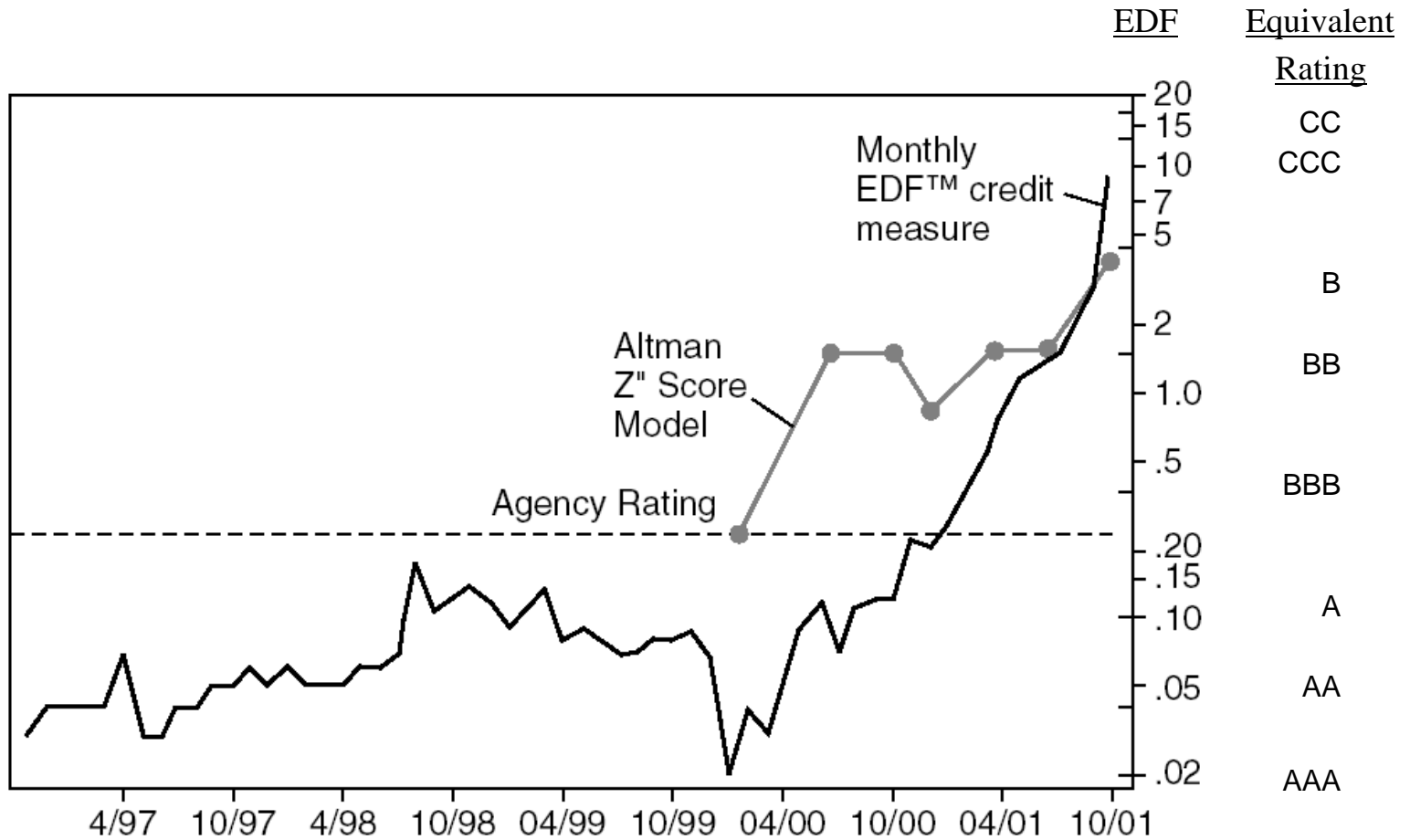
Rating	Average 1996 Z"-Score ⁽¹⁾	Average 2006 Z"-Score ⁽¹⁾
AAA/AA+	8.15 (8)	7.51 (14)
AA/AA-	7.16 (33)	7.78 (20)
A+	6.85 (24)	7.76 (26)
A	6.65 (42)	7.53 (61)
A-	6.4 (38)	7.10 (65)
BBB+	6.25 (38)	6.47 (74)
BBB	5.85 (59)	6.41 (99)
BBB-	5.65 (52)	6.36 (76)
BB+	5.25 (34)	6.25 (68)
BB	4.95 (25)	6.17 (114)
BB-	4.75 (65)	5.65 (173)
B+	4.5 (78)	5.05 (164)
B	4.15 (115)	4.29 (139)
B-	3.75 (95)	3.68 (62)
CCC+	3.2 (23)	2.98 (16)
CCC	2.5 (10)	2.20 (8)
CCC-	1.75 (6)	1.62 (0) ⁽²⁾
CC/D	0 (14)	-1.04 (5)

Sources: Compustat, Company Filings and S&P

⁽¹⁾ Sample Size in Parentheses

⁽²⁾ Interpolated between CCC and CC/D

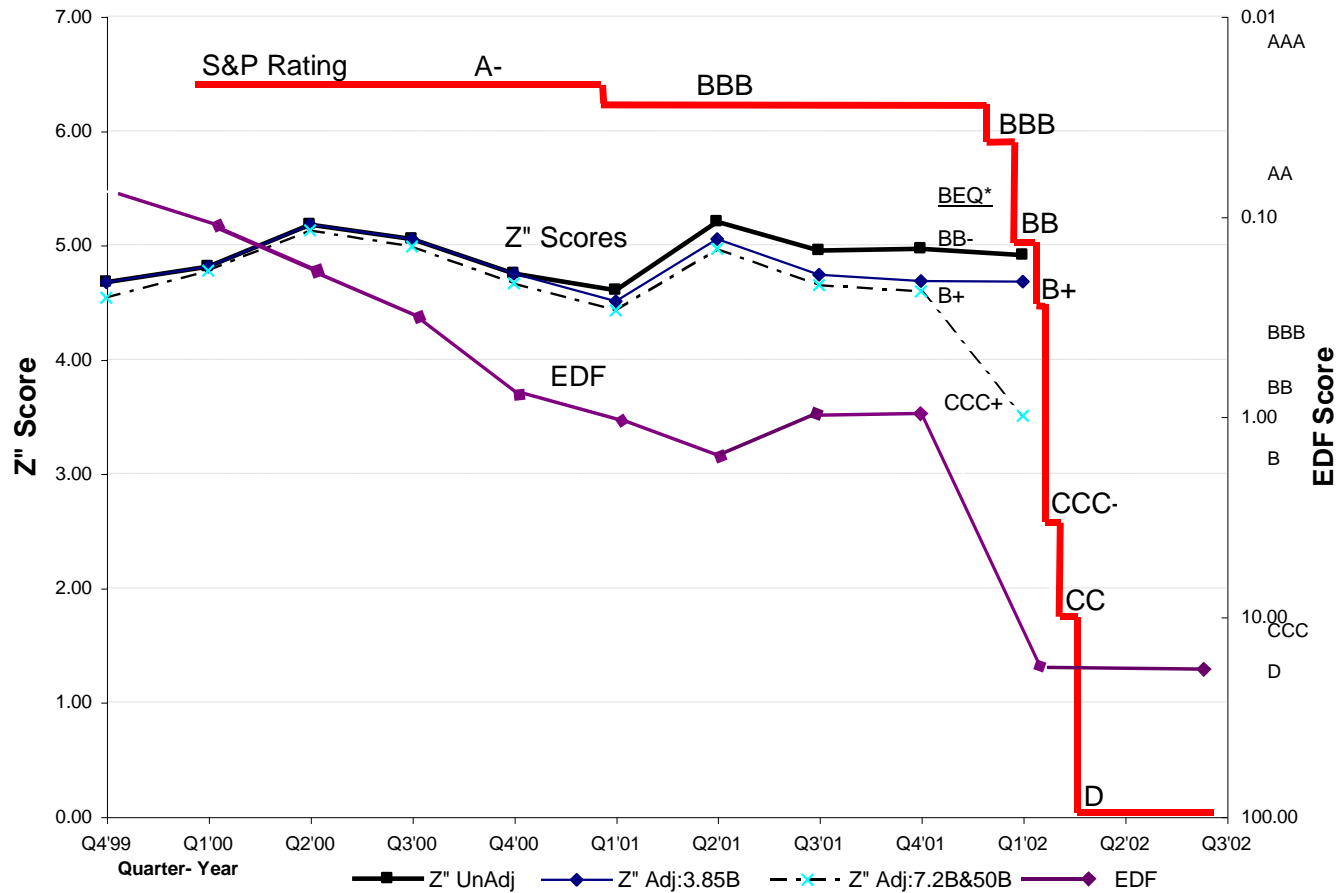
Enron Credit Risk Measures



Source: A. Saunders and L. Allen, *Credit Risk Measurement*; J. Wiley, 2002

Worldcom Credit Risk Measures

Z" SCORES AND EDF'S FOR WORLDCOM (Q4'1999 - Q1'2002)



*BEQ = Z" Score Bond Equivalent Rating

Sources: Compilation by the author (E. Altman, NYU Stern), the KMV (Moody's) Website and Standard & Poor's Corporation.

Recalibrating The Z-Score Model

- Despite the continuing excellent accuracy of the Z-Score models to predict corporate financial distress, the model could be improved by appropriate recalibrations due to:
 - Significant changes in corporate liquidity, leverage and solvency
 - The increase in Type II errors
 - Greater volatility of corporate financial performance
- Specifically, helpful transformations (logarithms) of several key variables enhanced the accuracy and predictive power of the models*
 - Retained Earnings / Total Assets
 - EBIT / Total Assets
 - Market Value of Equity / Total Liabilities

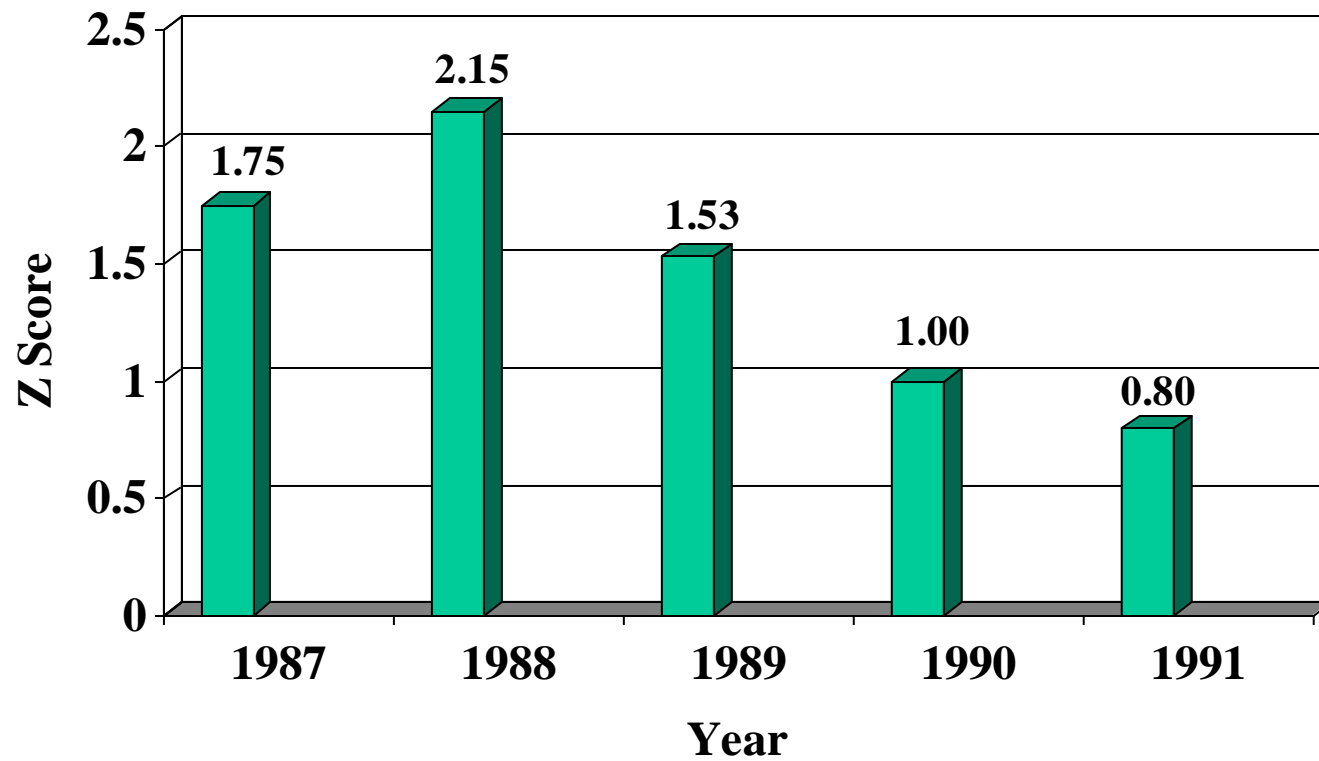
(*) This work is proprietary for Concordia Advises, LLC

Z-Score Variable Transformations

$$\begin{aligned} Z \text{ Credit Score} = & \alpha + \beta_1 \frac{WK}{TA} + \beta_2 - \ln(1 - RE / TA) + \\ & \beta_3 - \ln(1 - EBIT / TA) + \beta_4 \ln(ME / BL) + \beta_5 \ln(Size) + \beta_6 Age \end{aligned}$$

$$\text{Relative weight}_i = \frac{|\beta_i| \sigma_i}{\sum_{j=1}^6 |\beta_j| \sigma_j}$$

DAF Corporation Z Scores (Dutch Company Bankruptcy 1993)



AN EMERGING MARKET CORPORATE MODEL

An Emerging Market Credit Scoring System

- Step 1- Calculate the EM Score and its Bond Rating Equivalent (BRE) compared to the U.S. Bond Market
- Step 2 -Adjust (modify) the Bond Rating Equivalent for Forex Revaluation Vulnerability
 - High vulnerability = -1 rating class (3 notches)
 - Neutral vulnerability = -1 notch
 - Low vulnerability = no change
- Step 3 -Adjust BRE for Risk of Industry in the Emerging Market vs. Risk of the Industry in the U.S.
 - \pm - 1 or 2 notches

An Emerging Market Credit Scoring System

- Step 4 - Adjustment of BRE for Competitive Position
 - Dominant firm in industry = +1 notch
 - Average firm in industry = no change
 - Poor competitive position = -1 notch
- Step 5 - Special Collateral or Guarantees Impact on BRE
- Step 6 - Assess the yield in the U.S. market on the modified BRE of the emerging Market credit, then add the sovereign yield spread. Finally, compare the resulting required yield with the yield in the market.

Mexican Firms Z-Score Analysis

Mexican Corporate Issuers – EM Scores and Modified Ratings (December 1994)

Company	Industry	EM Score	Bond-Rating Equivalent	Modified Rating	Ratings M/S&P/D&P
Aeromexico	Airlines	-4.42	D	D	NR/NR/NR
Apasco	Cement	8.48	AAA	A	Ba2/NR/NR
CCM	Supermarkets	4.78	BB-	B+	NR/NR/NR
Cemex	Cement	5.67	BBB-	BBB-	Ba3/BB/BB
Cydsa	Chemicals	4.67	BB-	B+	NR/NR/NR
DESC	Conglomerate	4.23	B	BB+	NR/NR/NR
Empresas ICA	Construction	5.96	BBB	BB	B1/BB-/B+
Femsa	Bottling	6.37	A-	BBB+	NR/NR/NR
Gemex	Bottling	5.4	BB+	BB+	Ba3/NR/NR
GIDUSA (Durango)	Paper and Forest Products	4.61	B+	BB	B1/BB-/NR
GMD	Construction	4.85	BB	B-	B3/NR/NR
Gruma	Food Processing	5.56	BBB-	BBB+	NR/NR/NR
Grupo Dina	Auto Manufacturing	5.54	BBB-	BB+	NR/NR/B
Hylsamex	Steel	5.51	BBB-	BB-	NR/NR/NR
IMSA	Steel	5.45	BBB-	BB-	NR/NR/NR
Kimberly-Clark de Mexico	Paper and Forest Products	8.96	AAA	AA	NR/NR/NR
Liverpool	Retail	9.85	AAA	A+	NR/NR/NR
Moderna	Conglomerate	5.28	BB+	BB+	NR/NR/NR
Ponderosa	Paper and Forest Products	6.64	A	BB	NR/NR/NR
San Luis	Autoparts	2.69	CCC	CCC-	NR/NR/NR
Sidek	Conglomerate	4.68	BB-	B	NR/NR/CCC
Simec	Steel	4.42	B+	B-	NR/NR/CCC
Situr	Hotel and Tourism	5.17	BB+	B	NR/NR/CCC
Synkro	Textile/Apparel	1.59	CCC-	CCC	NR/NR/NR
TAMSA	Steel Pipes	3.34	CCC+	B	NR/NR/NR
TELMEX	Telecommunications	9.57	AAA	AA-	NR/NR/NR
Televisa	Cable and Media	7.29	AA	BBB+	Ba2/NR/NR
TMM	Shipping	5.34	BB+	BB+	Ba2/BB-/NR
Vitro	Glass	5.18	BB+	BB	Ba2/NR/NR

Presentation of the Firms

- We have calculated the Z'-score ratings of 13 major Mexican public companies from 1998 through 2002

	<i><u>Industry</u></i>
– America Movil SA de CV	<i>Telecommunications</i>
– Apasco SA de CV	<i>Construction Material</i>
– Cemex SA de CV	<i>Construction Material</i>
– Cintra SA de CV	<i>Airlines</i>
– Coca-Cola Femsa SA de CV	<i>Beverages</i>
– Fomento Economico Mexicano	<i>Beverages</i>
– Grupo Carso SA de CV	<i>Diversified</i>
– Grupo Televisa SA	<i>Media</i>
– Empresas ICA Sociedad	<i>Construction and Engineering</i>
– Kimberly-Clark de Mexico	<i>Paper</i>
– Telefonos de Mexico SA de CV	<i>Telecommunications</i>
– Vitro SA de CV	<i>Containers and Packaging</i>
– Wal-Mart de Mexico SA de CV	<i>Retail</i>

Z''-Score and Equivalent Bond Rating

$$Z''\text{-Score} = 3.25 + 6.56 * \frac{\text{Working Capital}}{\text{Total Assets}} + 3.26 * \frac{\text{Retained Earnings}}{\text{Total Assets}} + 6.72 * \frac{\text{EBIT}}{\text{Total Assets}} + 1.05 * \frac{\text{BV of Equity}}{\text{BV of Liability}}$$

	Z''-Score	Rating	Z''-Score	Rating	
Safe zone	8.15	> 8.15	AAA	Grey zone Distress zone	
	7.60	8.15	AA+		
	7.30	7.60	AA		
	7.00	7.30	AA-		
	6.85	7.00	A+		
	6.65	6.85	A		
	6.40	6.65	A-		
	6.25	6.40	BBB+		
5.85	6.25	BBB	Distress zone		
		BBB-			
		BB+			
		BB			
		BB-			
		B+			
		B			
		B-			
		CCC+			
		CCC			
		CCC-			
		D			
		< 1.75			

Z"-Score Distressed models and S&P Ratings

(As of December 31, 2002)

Mexico Credit Rating

(Foreign Currency LT Debt)

02/07/02	BBB-
03/13/00	BB+
02/10/95	BB
07/29/92	BB+

America Movil SA de CV
Apasco SA de CV
Cemex SA de CV
Coca-Cola Femsa SA de CV
Empresas ICA Sociedad Controladora
Grupo Televisa SA
Kimberly-Clark de Mexico
Telefonos de Mexico SA de CV
Vitro SA de CV

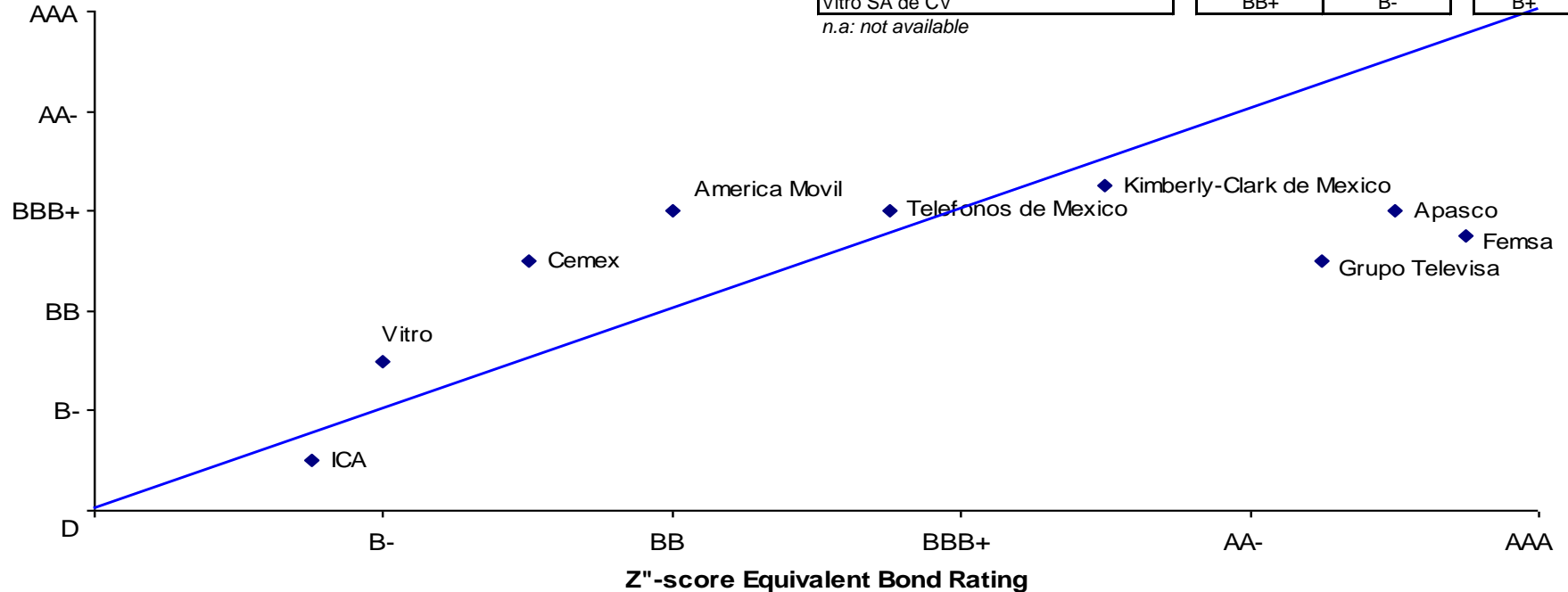
n.a: not available

Z"-Score Rating

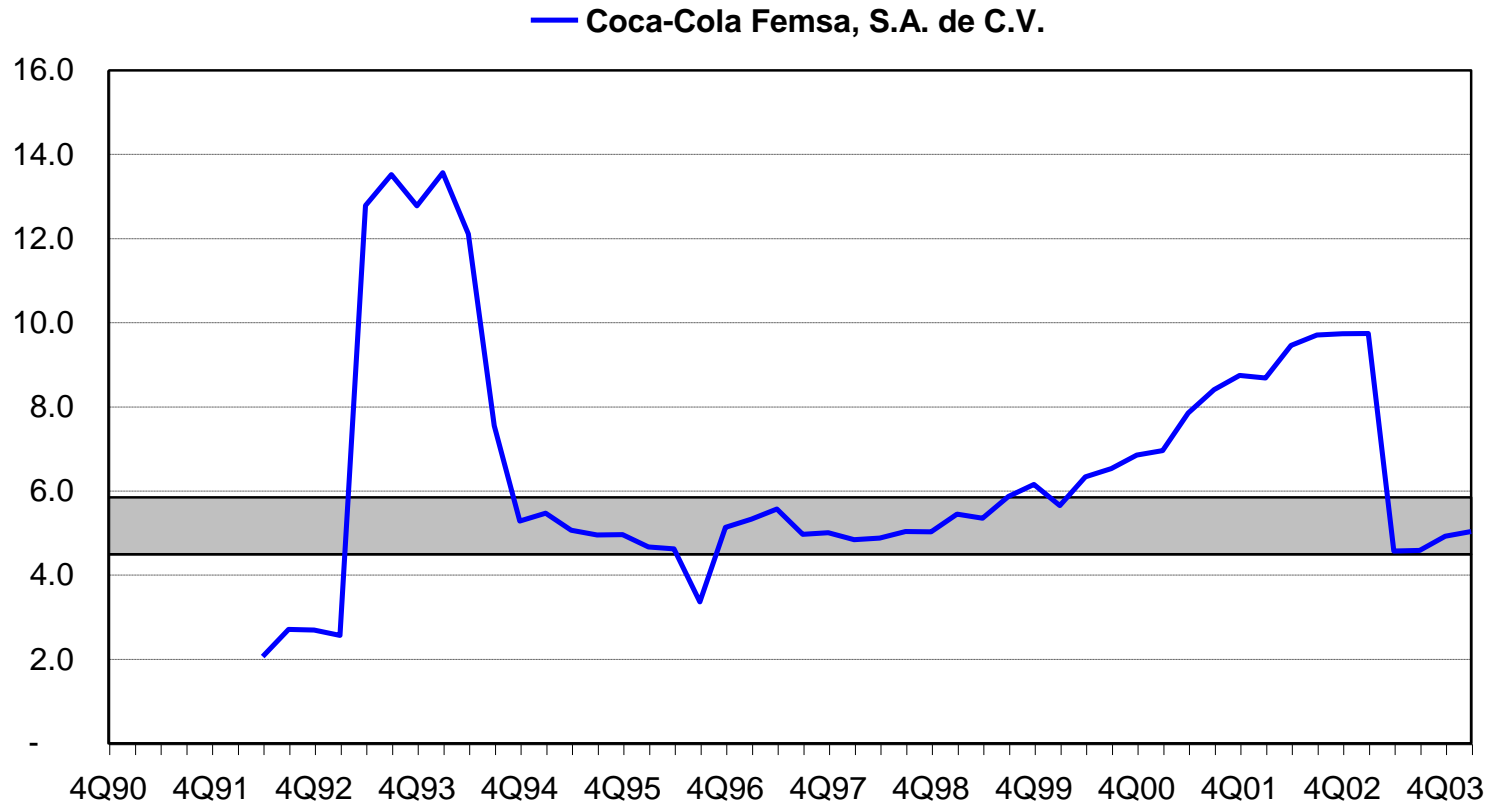
S&P Rating

Dec 94	Dec 02	Dec 02
n.a.	BB	BBB+
AAA	AA+	BBB+
BBB-	B+	BBB-
A-	AAA	BBB
BBB	CCC+	CCC
AA	AA	BBB-
AAA	A	A-
AAA	BBB	BBB+
BB+	B-	B+

S&P
Bond Rating



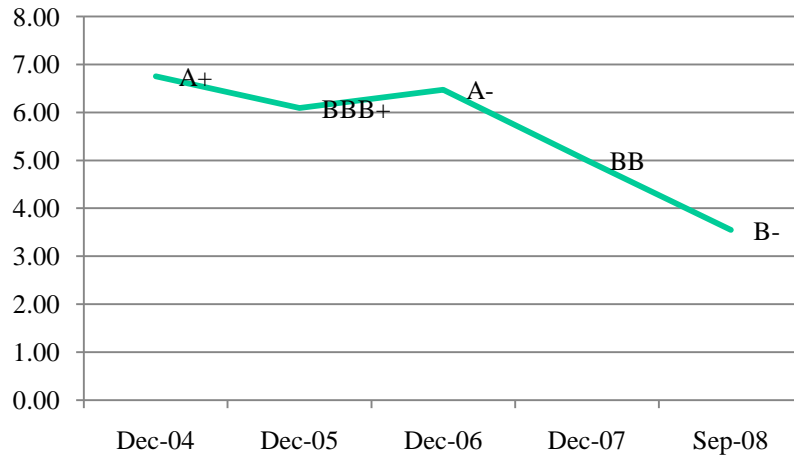
Coca-Cola Femsa, S.A. de C.V.



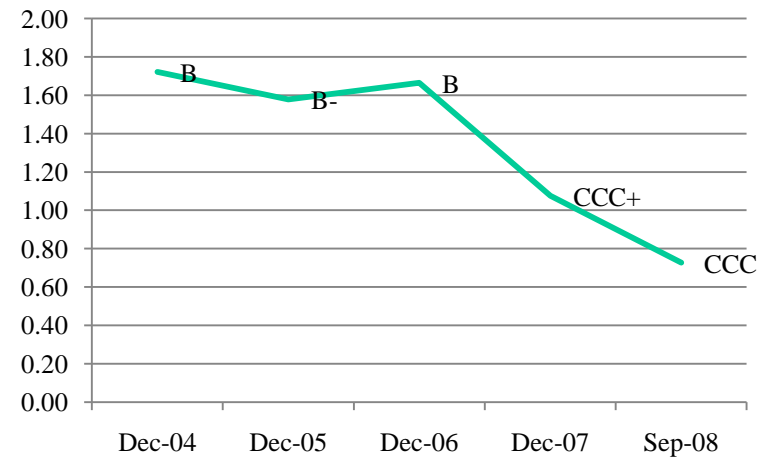
Cemex SA de CV

(production, distribution, marketing, and sale of cement)

Z'' Score



Z' Score



Distress Prediction Model For Indian Companies

Data Sample Summary for Z" Score Model Development (1/2)



#	Sector	Distressed Companies	Healthy Companies	Total
1	Auto	3	5	8
2	Beverages	1	NA	1
3	Cables	2	NA	2
4	Chemicals	1	NA	1
5	Computers - Accessories	1	NA	1
6	Computers - Software	2	4	6
7	Construction & Contracting	1	NA	1
8	Electric Equipment	1	NA	1
9	Engineering	1	1	2
10	Entertainment/Multi Media	5	NA	5
11	Telecommunications	4	1	5
12	Packaging	1	NA	1
13	Glass	1	NA	1
15	Transport - Air	2	NA	2
16	Pharmaceuticals	2	3	5

*Firms with two years consecutive, negative profits. Source: Cedar Consulting Ltd. calculations.

Data Sample Summary for Z" Score Model Development (2/2)



#	Sector	Distressed Companies	Healthy Companies	Total
17	Miscellaneous	1	NA	1
18	Textiles	4	NA	4
19	Forgings	1	NA	1
20	Petrochem	1	NA	1
21	Fertilisers	1	NA	1
22	Resorts	1	NA	1
23	Food Processing	1	1	2
24	Diversified	NA	3	3
25	Oil Drilling & Exploration	NA	3	3
26	Mining/Minerals	NA	2	2
27	Power	NA	4	4
28	Trading	NA	2	2
29	Paints/Varnishes	NA	1	1
30	Refineries	NA	1	1
31	Personal Care	NA	1	1
32	Metals	2	7	9
33	Real Estate	NA	1	1
TOTAL		40	40	80

*Firms with two years consecutive, negative profits. Source: Cedar Consulting Ltd. calculations.

Z" Score Model Results Summary



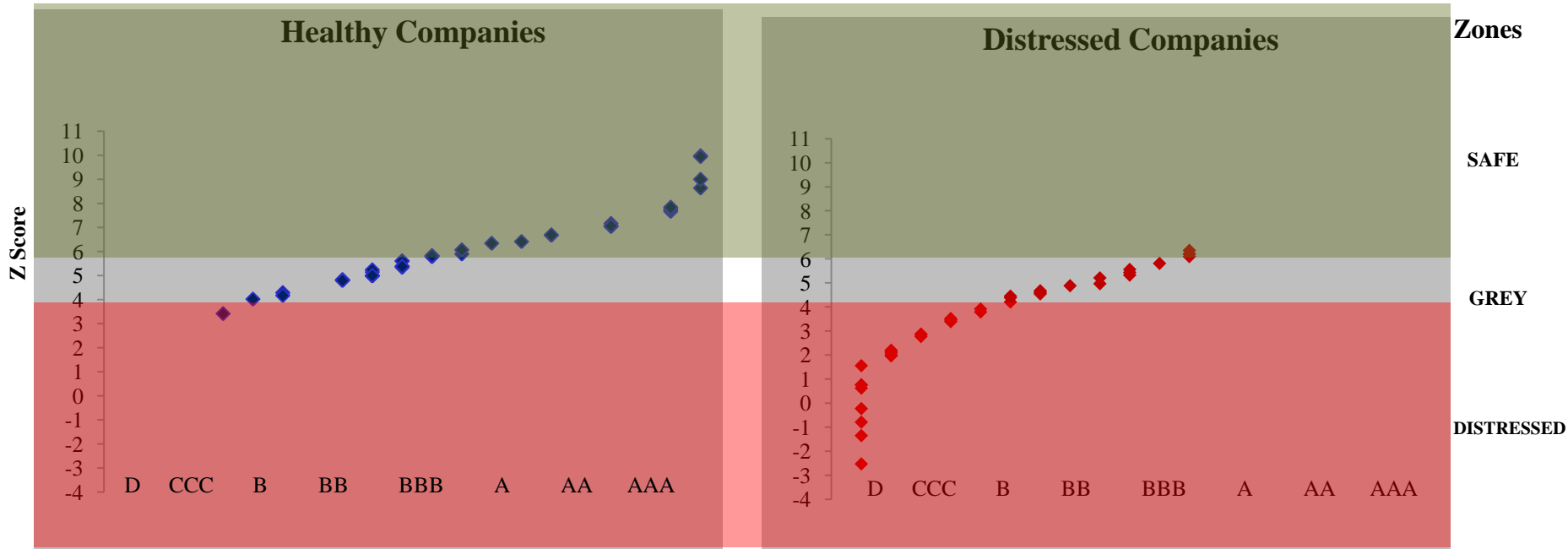
#	Zone	Rating	No. of companies	
			Distressed	Healthy
1	Low Risk	AAA	0	4
2		AA+	0	4
3		AA	0	0
4		AA -	0	4
5		A+	0	0
6		A	0	2
7		A-	0	1
8		BBB+	1	1
9		BBB	3	2
10		BBB-	1	4
11	Medium Risk	BB+	3	5
12		BB	2	5
13		BB-	1	4
15		B+	4	0
16		B	3	2
17		B-	2	1
18	High Risk	CCC+	4	1
19		CCC	3	0
20		CCC-	5	0
21		D	8	0
	TOTAL	0	40	40

*Firms with two years consecutive, negative profits. Source: Cedar Consulting Ltd. calculations.

Z" Score Model Results Summary

Healthy companies fall in Safe zone and Distressed companies in Grey/ Distressed zone

Distribution of Z" Scores across various zones



- Healthy Companies
- Distressed Companies

Distress Prediction Model For Chinese Companies

Z_{China} Model for Chinese Companies

Model Development and Test Results

- **Training: 30** “ST” (Special Treatment Distressed Companies) based on two consecutive years of negative earnings or NAV below par value listed on Sheuzhen or Shanghai Stock Exchanges (1998,1999).
Sample
30 “Non – ST” listed companies (Healthy)
60
- **Holdout (Test) : 21** “ST” Companies (1998,1999)
Sample 39 “Non – ST” Companies (Randomly Selected)
60
- **Variable Selection:** 15 Financial Ratios from one year before “ST,” including Profitability, Solvency, Liquidity and Asset Management Measures. Based on their acceptance in China as well as from several prior distress prediction models outside of China.

Based on a study, “Corporate Financial Distress Diagnosis in China,” L. Zhang, J. Yen and E. Altman, Summer 2007.

Model for Distress Prediction in China

$$Z_c = 0.517 - 0.388 (X_1) + 1.158 (X_2) + 9.320 (X_3) - 0.460 (X_4)$$

Where:

	<u>Mean "ST"</u>	<u>Mean "Non-ST"</u>
$X_1 = \text{Working Capital} / \text{Average Total Assets (ATA)} =$	• -0.17	0.12
		(F = 5.8)
$X_2 = \text{Retained Earnings} / \text{TA} =$	• -0.33	0.22
		(F = 19.8)
$X_3 = \text{Net Profit} / \text{ATA} =$	• -0.36	0.26
		(F = 139.1)
$X_4 = \text{Total Liabilities} / \text{TA} =$	• 0.75	0.42
		(F = 42.4)
Average $Z_c =$	<u>-3.50</u>	<u>2.96</u>

Classification Accuracy

Training Sample

<i>Actual Classification</i>		<i>Predicted Classification</i>	
		<u>Distressed</u>	<u>Non-Distressed</u>
Distressed ("ST")	30	30 (100%)	0
Non-Distressed	0	0	30 (100%)

Accuracy Over Time

<u>Years Prior to "ST"</u>	<u>Accuracy Level</u>
1	100%
2	87%
3	70%
4	60%
5	22%

Holdout Sample Accuracy

		Predictive Accuracy	
	<u># of Firms</u>	<u>(0.5) Cutoff</u>	<u>(0.3) Cutoff</u>
Distressed	21	21 (100%)	19 (90%)
Non-Distressed	39	34 (87%)	39 (100%)

Rating Distribution of Listed Chinese Companies

Rating Level	Z _c -Score Interval	Percentage Each Year							
		1998	1999	2000	2001	2002	2003	2004	2005
AAA	≥ 1.8	6.3%	4.3	2.3	0.9	1.0	1.2	2.8	2.5
AA	1.3 – 1.8	17.5	11.0	9.2	5.9	4.2	5.8	5.4	5.7
A	0.9 – 1.3	31.6	31.3	27.6	18.5	15.3	14.8	15.1	12.4
BBB	0.5 – 0.9	24.7	29.3	37.8	40.2	39.6	36.3	34.4	31.8
BB	0.0 – 0.5	10.7	16.1	15.2	22.4	25.6	28.8	28.2	28.8
B	-1.0 – 0.0	4.9	5.0	4.6	7.3	8.1	1.5	6.8	9.4
C	-2.0 – -1.00	2.7	1.6	1.6	2.6	2.8	1.0	2.6	3.7
D	Z _c < -2.0	1.6	1.6	1.7	2.2	3.5	10.6	4.6	5.8

Credit Ratings of “ST” Companies Announced in 2002

Rating Level	2002 (#)	2002 (%)	2001 (%)	2000 (%)	1999 (%)	1998 (%)
AAA	0	0	0	3.6	3.5	7.1
AA	0	0	0	3.6	7.1	7.1
A	0	0	0	10.7	3.6	10.7
BBB	1	3.6	0	14.3	21.4	28.6
BB	6	21.4	14.3	14.3	39.3	21.4
B	8	28.6	25.0	46.4	17.9	10.7
C	5	17.9	28.6	3.6	7.1	10.7
D	8	28.6	32.1	3.6	0.0	3.6

Total 28 Companies

Argenti (A Score System)

Symptoms

Weight

- _____ 5 - Financial signs, such as Z Score
- 4 - Creative accounting. Chief executive is the first to see signs of failure, and in an attempt to hide it from creditors and the banks, accounts are ‘glossed over’ by overvaluing stocks, using lower depreciation, etc.
- 3 - Non-financial signs, such as untidy offices, frozen salaries, chief executive ‘ill’, high staff turnover, low morale, rumors
- 1 - “Terminal signs”

Total Symptoms 13

Total Possible Score 100

Pass 25

Total Score

Prognosis

0-10	No Worry (High Pass)
0-25	Pass
_____ 10-18	Cause for Anxiety (Pass)
18-35	Grey Zone - Warning Sign
>35	Company “At Risk”

Comparing Z''-Scores For U.S. And Japanese Companies

Z"-Scores and Equivalent Bond Ratings for Japanese Industrial Companies (2000 & 2005)

Median Z"-score and equivalent bond ratings

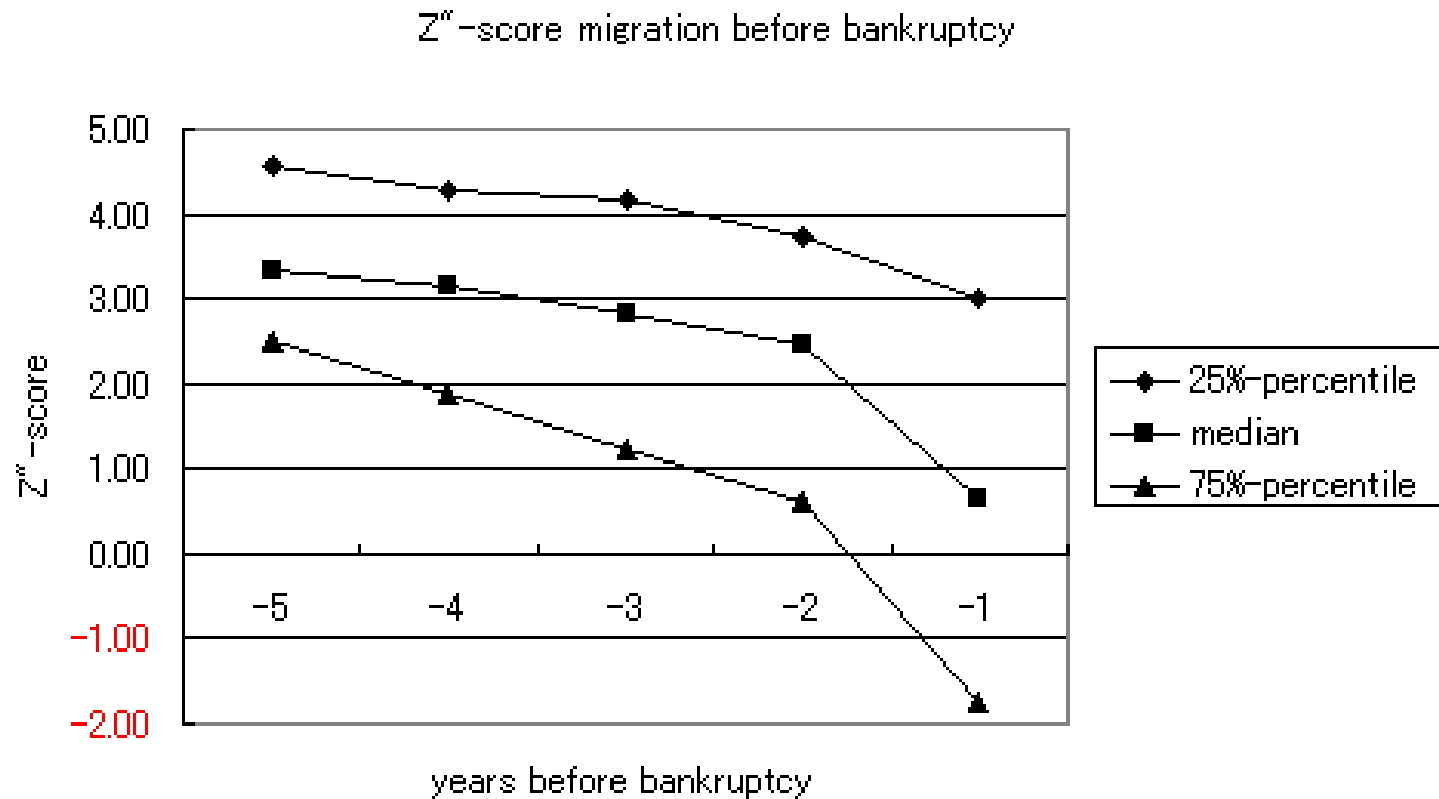
2000			2005		
Rating	Z"-score	sample	Rating	Z"-score	sample
AAA/AA+	6.66	14	AAA/AA+	7.80	11
AA	6.22	17	AA	6.90	19
AA-	7.17	24	AA-	6.36	24
A+	6.47	38	A+	7.41	39
A	6.37	54	A	7.18	65
A-	5.95	82	A-	5.86	71
BBB+	5.40	64	BBB+	6.65	53
BBB	5.63	69	BBB	5.75	64
BBB-	4.72	62	BBB-	4.90	28
BB+~BB-	3.47	44	BB+~BB-	4.09	13
B	2.06	5	B	1.78	1
median	5.65	473	median	6.18	388

Z''-scores for U.S. and Japanese Industrial Companies (2005)

Median Z''-score for US and Japanese Industrial companies (2005)

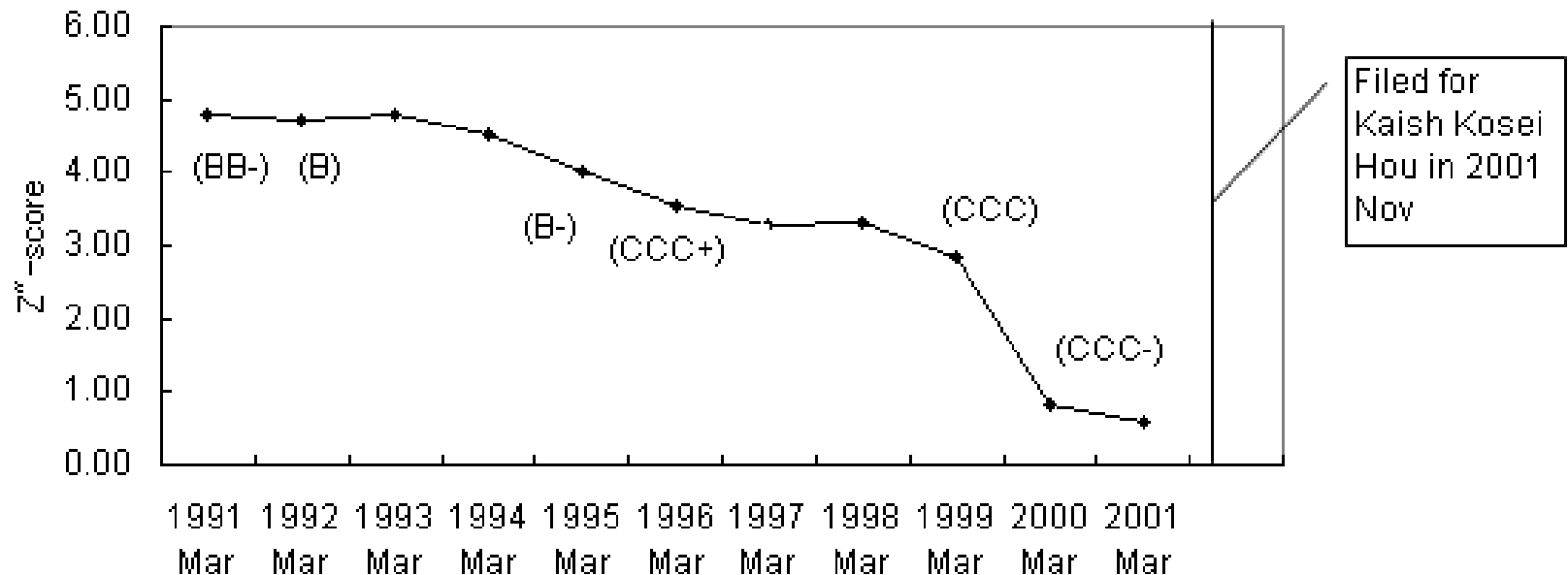
Rating	Z''-score		Rating	Sample size	
	Japan	US		Japan	US
AAA/AA+	7.80	8.15	AAA/AA+	11	8
AA	6.90	7.30	AA	19	18
AA-	6.36	7.00	AA-	24	15
A+	7.41	6.85	A+	39	24
A	7.18	6.65	A	65	42
A-	5.86	6.40	A-	71	38
BBB+	6.65	6.25	BBB+	53	38
BBB	5.75	5.85	BBB	64	59
BBB-	4.90	5.65	BBB-	28	34
BB+~BB-	4.09	4.90	BB+~BB-	13	168
B	-	4.15	B	-	115
B-	-	3.75	B-	-	95
CCC+	-	3.20	CCC+	-	23
CCC	-	2.50	CCC	-	10
CCC-	-	1.75	CCC-	-	6
D	0.65	0.00	D	50	14

Z''-Score Migration Before Bankruptcy

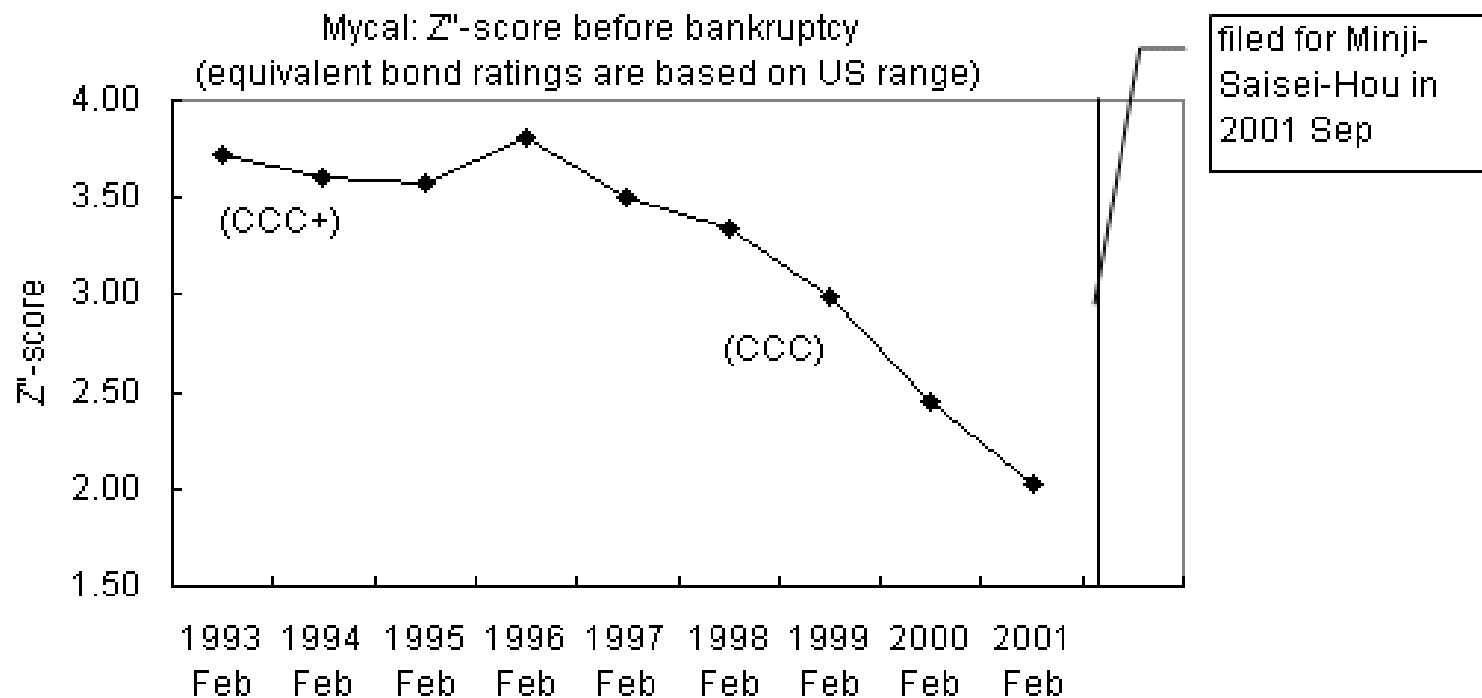


Niigata Tekkosho: Z''-Score Migration Before Bankruptcy

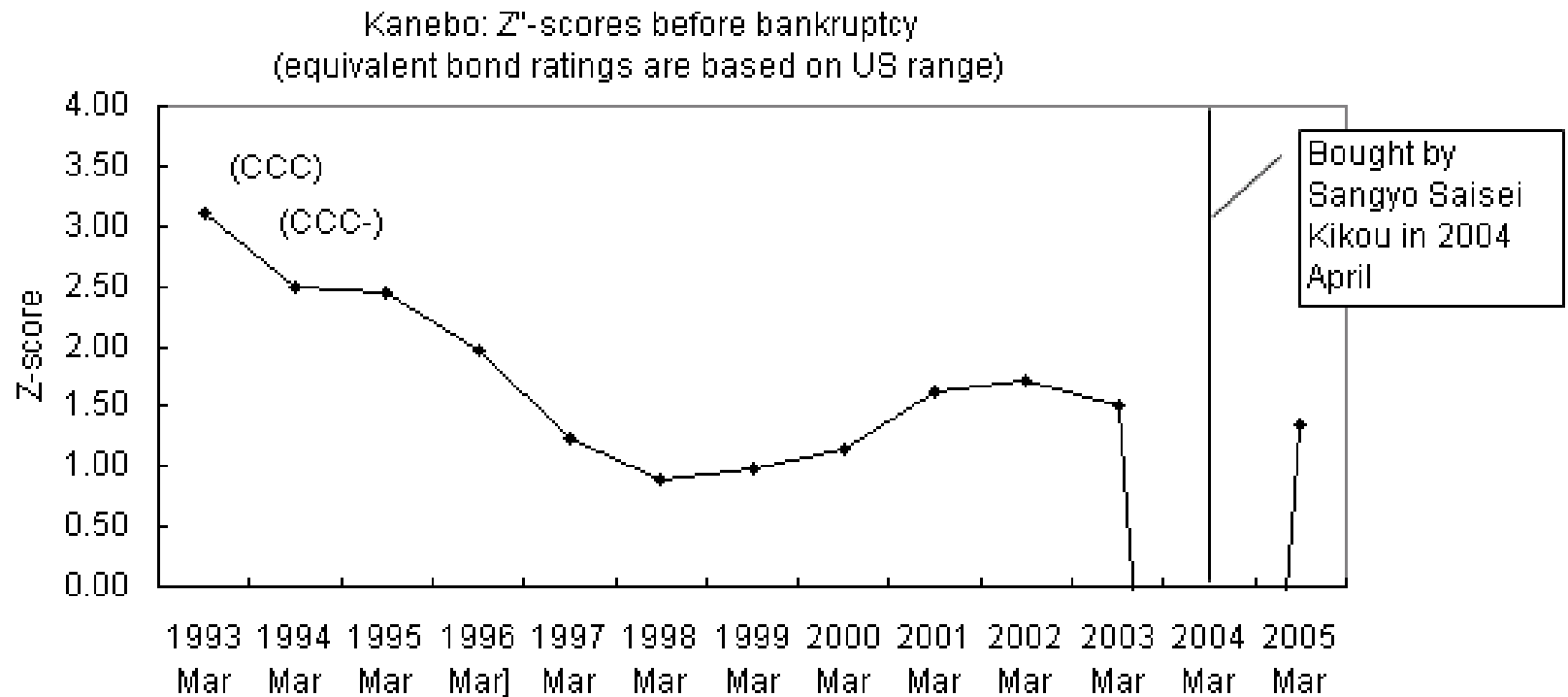
Niigata Tekkousho: Z''-scores before bankruptcy
(equivalent bond rating is based on US range)



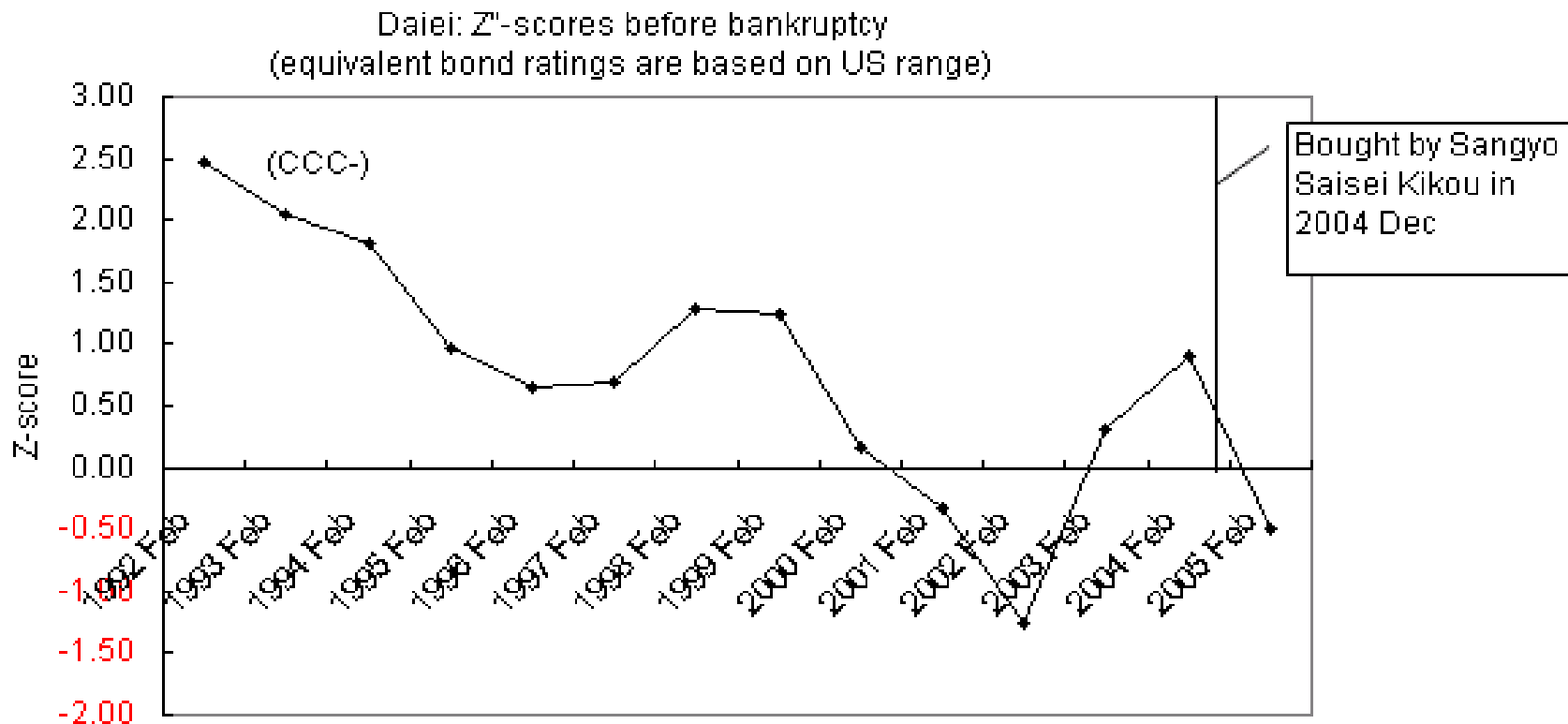
Mycal: Z''-Score Migration Before Bankruptcy



Kanebo: Z''-Score Migration Before Bankruptcy



Daiei: Z"-Score Migration Before Bankruptcy

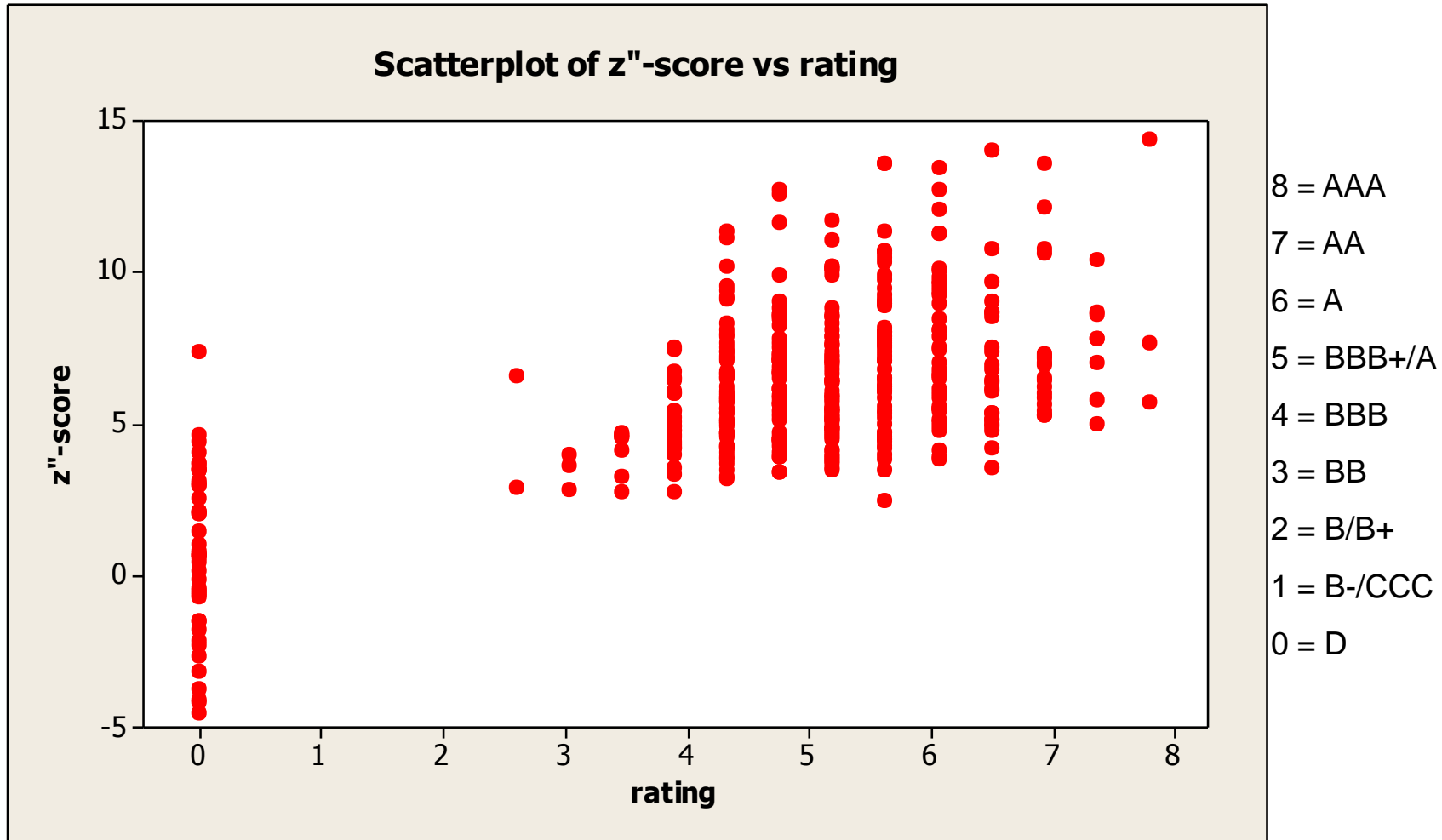


Z''-Scores and Variables of Each Industry (2005)

	Z'' score 2005				Z''-score	Sample
	X1	X2	X3	X4		
manufacture	0.18	0.23	0.05	0.93	6.58	1,182
retail	0.11	0.19	0.05	0.69	5.73	389
service	0.24	0.26	0.06	1.44	7.82	208
infrastructure	-0.11	0.15	0.04	0.34	3.77	46
others	0.09	0.16	0.04	0.53	5.32	311
median	0.16	0.21	0.05	0.82	6.34	2,136

others include logistics, telecommunication, real estate, agriculture and mining

The Correlation Between Z''-Score and Bond Rating (2005)



Can We Predict Chapter-22?

Z"-Scores for Chapter 22's

Z" Scores for Chapter 22's

This table lists a sample of firms that filed for bankruptcy protection at least two times and their Z"-Scores just after emergence and a year later

CHAPTER-22 Company Name	Effective Date	Z"-Score After Emergence	Bond Rating Equivalent	Z"-Score 1-Year Post	Bond Rating Equivalent	Re-filing Date	Period Between Emergence and Second Filing Years	Months	Days
1 American Banknote Corporation	11/21/00	0.34	D	0.35	D	04/08/05	4	4	18
2 Ames Department Stores, Inc.	12/18/92	4.74	BB-	6.31	BBB+	08/20/01	8	8	2
3 Anacomp Inc.	06/04/96	3.72	B-	2.93	CCC+	10/19/01	5	4	15
4 Anchor Glass Container Corp.	11/25/97	3.62	B-	3.73	B-	04/15/02	4	4	21
5 Anchor Glass Container Corp.	08/09/02	3.61	B-	4.05	B	08/08/05	2	11	30
6 ATA Holdings Inc.	01/31/06	3.18	CCC+	3.40	CCC+	04/02/08	2	2	2
7 Brendle's Inc.	12/20/93	6.65	A	6.60	A	04/16/96	2	3	27
8 Coho Energy	03/21/00	1.71	CCC-	(3.27)	D	02/24/03	2	11	3
9 Eagle Food Centers, Inc.	07/10/00	2.49	CCC	3.45	CCC+	03/25/04	3	8	15
10 Edison Brothers Stores Inc.	09/26/97	4.19	B	2.85	CCC	03/09/99	1	5	11
11 Galey & Lord	02/10/04	(0.66)	D	0.28	D	03/05/04	0	0	24
12 Grand Union Company	05/31/95	2.81	CCC	1.90	CCC-	06/24/98	3	0	24
13 Grand Union Company	08/05/98	3.41	CCC+	0.76	D	10/03/00	2	1	28
14 Harvard Industries	08/10/92	2.38	CCC	1.10	CCC-	05/08/97	4	8	28
15 Harvard Industries	10/15/98	1.21	CCC-	0.80	D	01/16/02	3	3	1
16 Heartland Wireless	03/15/99	3.87	B-	5.25	BB+	09/05/03	4	5	21
17 Homeland Holding Corp.	07/16/96	4.73	BB-	4.18	B	08/01/01	5	0	16
18 Ithaca Industries	12/16/96	7.21	AA/AA-	6.86	A+	05/09/00	3	4	23
19 Lamonts Apparels	12/18/97	2.83	CCC	2.16	CCC	01/04/00	2	0	17
20 McleodUSA Inc.	04/18/02	(2.77)	D	3.42	CCC+	12/16/05	3	7	28
21 Memorex Telex	02/07/92	(0.49)	D	1.37	CCC-	02/11/94	2	0	4
22 Memorex Telex	03/14/94	0.62	D	(1.30)	D	10/15/96	2	7	1
23 Payless Cashways Inc.	12/02/97	5.19	BB+	5.64	BBB-	06/04/01	3	6	2
24 Penn Traffic Company	05/27/99	4.39	B+	3.73	B-	03/17/05	5	9	18
25 Pillowtex Corporation	05/02/02	2.78	CCC	na	na	07/30/03	1	2	28
26 Planet Hollywood Int'l, Inc.	01/21/00	(8.24)	D	(6.77)	D	10/19/01	1	8	28
27 Rymer Foods	04/07/93	4.44	B+	4.14	B	07/08/97	4	3	1
28 Salant	07/30/93	6.52	A-	5.80	BBB	12/29/98	5	4	29
29 Smith Corona	02/28/97	5.36	BB+	3.92	B-	05/23/00	3	2	25
30 Solo Serve	07/06/95	2.98	CCC+	1.50	CCC-	01/20/99	3	6	14
31 Steakhouse Partners	12/19/03	1.41	CCC-	1.19	CCC-	05/15/08	4	4	26
32 Todays Man, Inc.	12/12/97	7.24	AA-	9.12	AAA	05/06/04	6	4	24
33 Tokheim Corp.	10/09/00	3.90	B-	(0.57)	D	11/21/02	2	1	12
34 Trans World Airlines	08/11/93	(1.33)	D	1.98	CCC-	06/30/95	1	10	19
35 Trans World Airlines	08/04/95	3.05	CCC+	2.09	CCC-	01/10/01	5	5	6
36 Trism	12/09/99	(2.06)	D	(1.02)	D	12/18/01	2	0	9
37 United Merchants	08/16/91	(1.51)	D	0.63	D	02/22/96	4	6	6
38 US Airways Group, Inc.	03/18/03	2.63	CCC	1.84	CCC-	09/16/05	2	5	29
39 USG Corp.	04/23/93	3.48	CCC+	3.82	B-	06/25/01	8	2	2
40 Westmoreland Coal Company	12/22/94	2.18	CCC	(4.36)	D	12/23/96	2	0	1
41 Wherehouse Entertainment, Inc.	12/16/96	7.59	AA/AA-	7.95	AA+	01/20/03	6	1	4
Number of Bankruptcies		41		40			Years	Months	Days
Average Z Score		2.67	CCC	2.45	CCC	Average	3	4	16
Median Z Score		3.05		2.51					
Standard Deviation		3.06		3.18					

Source: Authors compilation from CapitalIQ data

Z" – Scores for Chapter 11's

Z" Scores for Chapter 11's

This table lists a sample of firms, and their Z"-Scores that emerged from bankruptcy and did not file for bankruptcy protection a second time

CHAPTER-11 Company Name	Effective Date	Z"-Score After Emergence	Bond Rating Equivalent	Z"-Score 1-Year Post	Bond Rating Equivalent
1 Boonton Electronics	11/18/94	7.67	AAA/AA+	7.63	AA
2 CAI Wireless Systems, Inc.	10/14/98	2.12	CCC-	na	na
3 Cherokee Corp	06/01/93	4.00	B	2.09	CCC-
4 Consolidated Hydro, Inc.	11/07/97	3.90	B-	4.81	BB-
5 El Paso Electronic	02/12/96	4.38	B+	4.75	BB-
6 Elsinore Corporation	02/28/97	3.65	B-	4.18	B
7 Emcor	10/03/94	4.03	B	4.38	B+
8 Emerson Radio	08/09/94	5.42	BB+	4.08	B
9 Fansteel, Inc.	12/22/03	0.72	D	2.67	CCC
10 Flagstar Companies, Inc.	01/07/98	2.90	CCC+	(0.44)	D
11 Gantos	03/07/95	6.58	A	6.17	BBB+
12 Gentek, Inc.	10/07/03	4.51	B+	2.19	CCC
13 Grant Geophysical	09/30/97	4.49	B+	4.14	B
14 Harnischfeger Industries, Inc.	07/13/01	5.70	BBB-	5.30	BB+
15 Hayes Lemmerz International	05/12/03	4.38	B+	0.18	CC/D
16 Heartland Wireless Communications, Inc.	04/05/99	6.11	BBB+	5.01	BB
17 Hexcel Corporation	01/12/95	4.83	BB-	4.45	B+
18 Hvide Marine, Inc.	12/15/99	3.69	B-	3.64	B-
19 Imperial Sugar Co. TX	08/29/01	3.98	B	5.00	BB
20 Kaiser Group International, Inc.	12/18/00	6.94	A+	4.23	B
21 Kash N' Karry	12/12/94	4.20	B	4.60	B+
22 Kitty Hawk Inc.	09/30/02	6.19	BBB+	7.39	AA
23 Krystal Company	04/22/97	3.46	CCC+	9.41	AAA
24 Laidlaw, Inc.	02/28/03	4.40	B+	5.55	BBB-
25 Loehmann's Holdings Inc. DE	10/31/00	5.48	BBB-	6.24	BBB+
26 Loewen Group International, Inc.	01/02/02	3.09	CCC+	3.62	B-
27 Lone Star Industries	03/01/94	5.16	BB+	6.19	BBB+
28 Magellan Health Services, Inc.	10/08/03	4.96	BB	7.89	AAA/AA+
29 NRG Energy	11/24/03	3.75	B-	1.22	CCC-
30 Paragon Trade Brands, Inc.	01/28/00	5.72	BBB-	na	na
31 Pathmark Stores Inc.	09/18/00	4.12	B	2.47	CCC
32 Peregrine Systems, Inc.	07/18/03	4.28	B	3.47	CCC+
33 Petroleum Geo Services ASA	10/21/03	4.32	B	5.48	BBB-
34 PhoneTel	11/18/99	3.54	B-	4.30	B
35 Polymre Group, Inc.	01/03/03	2.35	CCC	2.09	CCC-
36 Redback Networks, Inc.	12/22/03	6.56	A	6.19	BBB+
37 Safety Components International	10/11/00	6.13	BBB+	5.13	BB+
38 Southern Mineral Corp.	08/01/00	5.38	BB+	na	na
39 Stage Stores Inc. NV	08/24/01	9.98	AAA	11.78	AAA
40 Sterling Chemicals Inc. New	12/19/02	4.98	BB	3.58	B-
41 Stratosphere Corporation	10/04/98	8.16	AAA	8.56	AAA
42 Telemundo	07/20/94	5.00	BB	4.98	BB
43 Teletrac, Inc.	09/15/99	3.82	B-	2.54	CCC
44 Vista Eyecare, Inc.	05/31/01	3.41	CCC+	3.34	CCC+
45 Warnaco Group, Inc.	01/16/03	4.27	B	4.62	B+
Number of Bankruptcies		45		42	
Average Z Score		4.73	B+	4.65	B+
Median Z Score		4.38		4.53	
Standard Deviation		1.63		2.55	

Source: Authors compilation from CapitalIQ data

KMV MODEL

KMV Credit Monitor Model

- Provides a quantitative assessment of the credit risk of publicly traded companies
- The model is theoretically rather than empirically based
- It is built around the market's valuation of a firm's creditworthiness
- The model can be applied to the universe of publicly-traded companies
- The universe consists of thousands of companies in the U.S.
- By contrast, only approximately 2000 companies have publicly-traded debt that is rated by the rating agencies. Even then, bond price data is often difficult to get.

The *Market's* Valuation of Debt

- The stock market's perception of the value of a firm's equity are readily conveyed in a traded company's stock price
- The information contained in the firm's stock price and balance sheet can be *translated* into an implied risk of default through two relationships:
 - The relationship between the market value of a firm's equity and the market value of its assets.
 - The relationship between the volatility of a firm's assets and the volatility of a firm's equity.

KMV Credit Monitor Output

- A quantitative estimate of the *default probability* called the expected default frequency (EDF).
- EDFs are calibrated to measure the probability of a borrower defaulting within one year.
- EDFs are reported in percentages ranging from 0 to 20.

KMV Model - Empirical Result

STEP 1 - Model Estimates Market Value and Volatility of Firm's Assets

STEP 2 - Then calculates the Distance-to-Default (# of Standard Deviations)

Distance-to-Default is a Type of Asset/Liability Coverage Ratio

STEP 3 - Distance-to-Default of a Firm is Mapped Against a Database of Empirical Frequencies of Similar Distance-to-Default Companies to Obtain Expected Default Frequency (EDF) for a Firm

Estimation of Market Value And Volatility of Firm's Assets

- Asset Values are Based on Underlying Value of Firm, Independent of Firm's Liabilities.
- Asset Volatility Calculated as the Annualized Standard Deviation of Percentage Changes in the Market Value of Assets.
- Equity Market Value and its Volatility, as Well as the Liability Structure, are Used as Proxies for the Asset's Value and Volatility.
- Option Theory of Assets Used to Value Assets Since MV of Debt is Not Known. If Debt MV is Known, then $A=E+D$ (MV). But, MV Assets are Calculated by Knowing Only the MV Equity and PV of Liabilities.

Estimation of Market Value And Volatility of Firm's Assets

(continued)

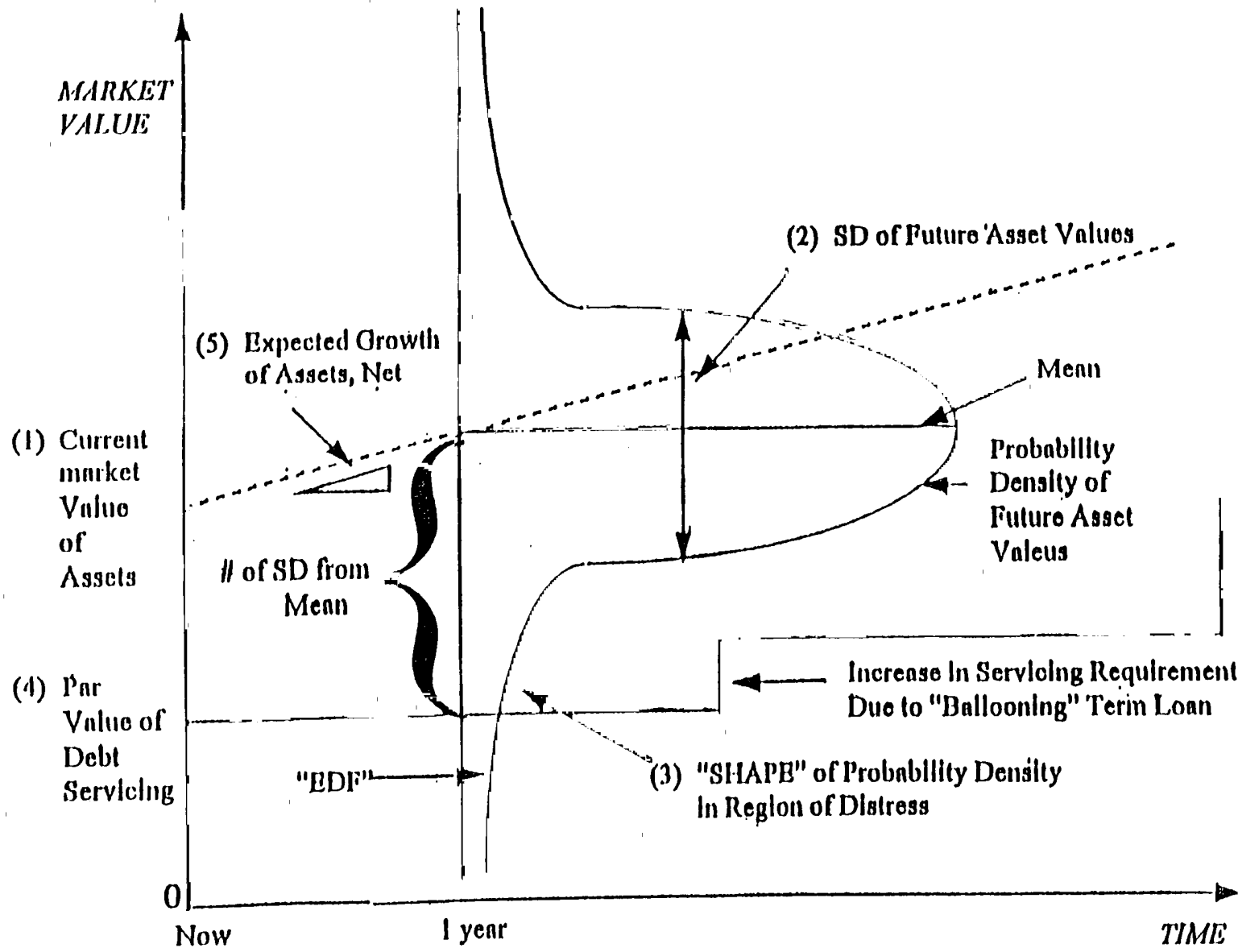
- KMV Assumes that All Short Term Debt and 50% of Long Term Liabilities Are Used to Calculate the Default Point (Was 25% of LTD).
- When MV Assets < Payable Liabilities then Firm Defaults. Firm Cannot Sell Off Assets or Raise Additional Capital Because All Existing Assets are Fully Encumbered.

KMV Strengths

- Can be applied to any publicly-traded company
- Responsive to changing conditions, (EDF updated quarterly)
- Based on stock market data which is timely and contains a forward looking view
- Strong theoretical underpinnings (versus ad-hoc models)

KMV Weaknesses

- Difficult to diagnose a theoretical EDF (what is the distribution of asset return outcomes)
- Problems in applying model to private companies and thinly-traded companies
- Results sensitive to stock *market* movements (does the stock-market over-react to news?)
- Ad-hoc definition of anticipated liabilities (i.e.. 50% of long-term debt)



KMV'S Expected Default Frequency (EDF)

Based on empirical observation of the Historical Frequency of the Number of Firms that Defaulted With Asset Values (Equity + Debt) Exceeding Face Value of Debt Service By a Certain Number of Standard (Std.) Deviations at one year prior to default.

For Example:

Current Market Value of Assets	=	\$ 910
Expected One Year Growth in Assets	=	10%
Expected One Year Asset Value	=	\$1,000
Standard Deviation	=	\$ 150
Par Value of Debt Service in One Year	=	\$ 700

Therefore:

# Std. Deviations from Debt Service	=	2
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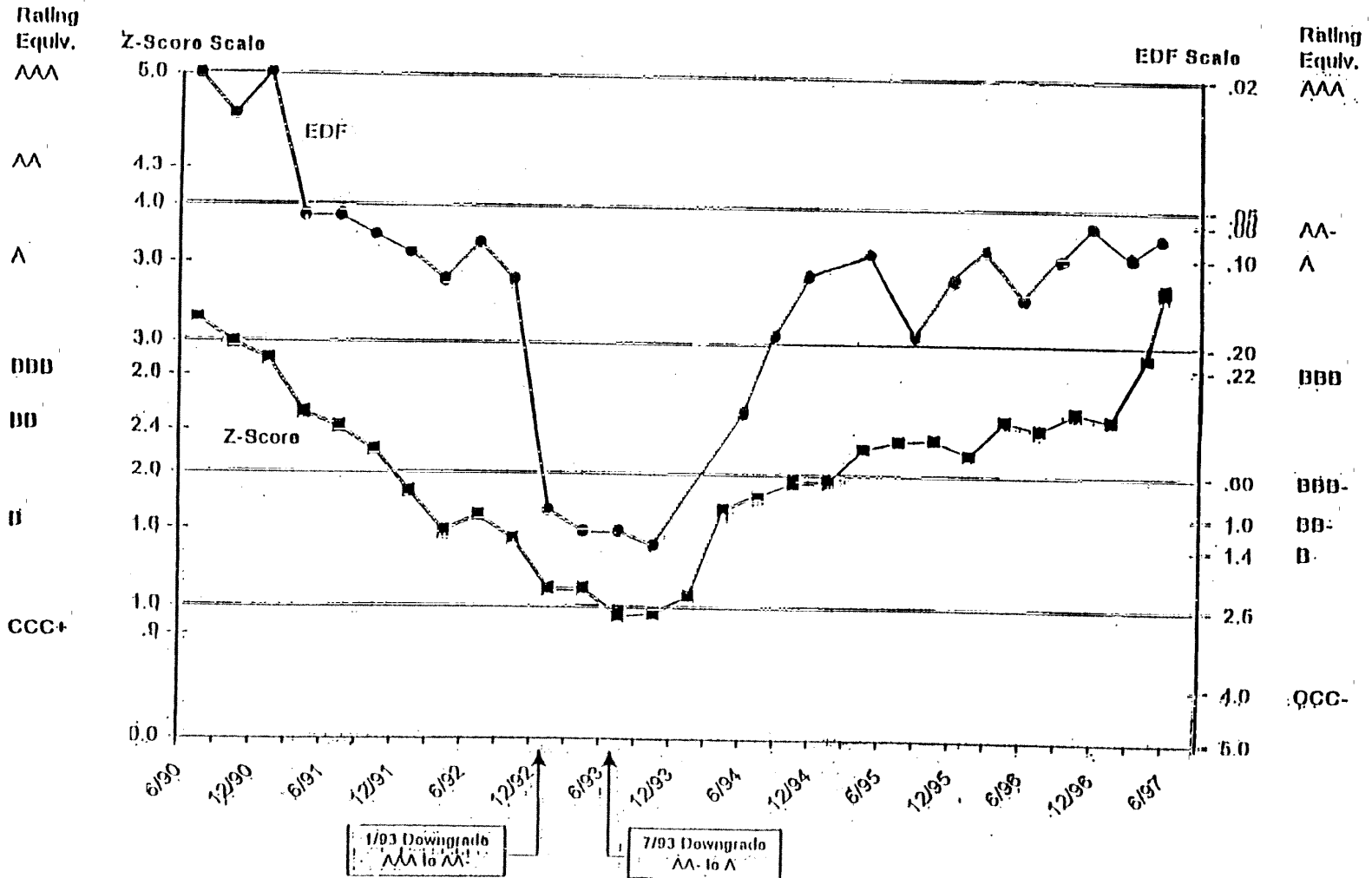
Expected Default Frequency (EDF)

$$\text{EDF} = \frac{\text{Number of Firms that Defaulted With Asset Values 2 Std. Deviations from Debt Service}}{\text{Total Population of Firms With 2 Std. Deviations from Debt Service}}$$

$$\text{e.g..} = \frac{50 \text{ Defaults}}{1,000 \text{ Population}} = .05 = \text{EDF}$$

Comparing Z-Score and KMV-EDF Bond Rating Equivalents

IBM Corporation



BondScore (from “Credit Sights) Credit Score Model

- BondScore calculates credit risks on a weekly basis for all U.S. non-financial corporations with total assets in excess of \$250 millions and publicly traded equity (approx. 2,200 issuers). The model’s output is a one year default probability estimate called Credit Risk Estimate or CRE.
- BondScore Credit Risk Estimates (CRE) are used in two capacities: to measure **trend** in credit risk migration; and to measure divergence from the rating agencies. BondScore helps to predict credit risk migration, spread movements and rating agency actions through its estimation of one year default probabilities.
- The BondScore model was created using 25 years of data on financial ratios, equity prices on defaults on over 2,000 issuers.
- A non linear logistic regression-based “hybrid” model, BondScore uses Altman-type financial ratios in addition to Merton-type equity inputs to predict defaults. Each of the model’s inputs were found to be significant predictors of default.

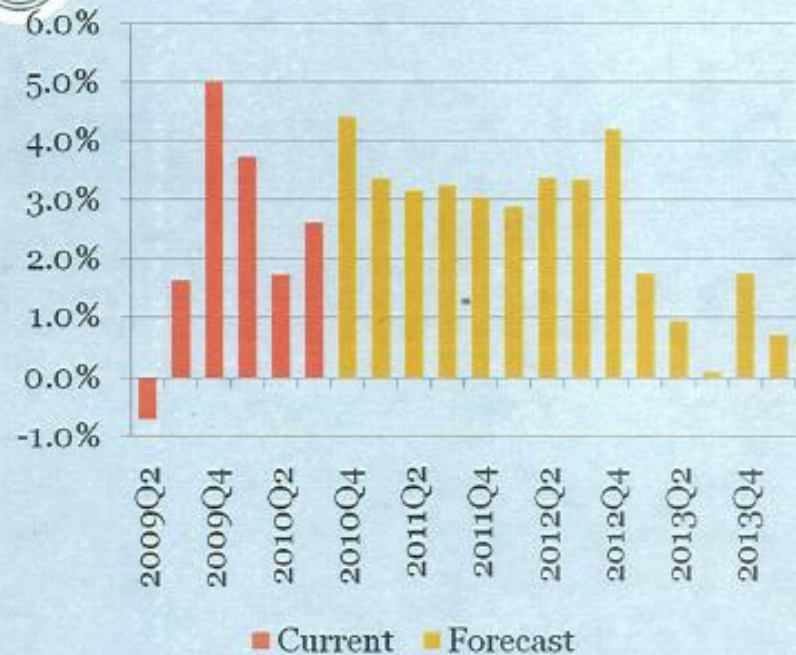
BondScore Model Inputs

- **EBITDA margin** (EBITDA/Sales)
- **Asset turnover** (Sales/Assets)
- **Leverage** (debt including capitalized leases/equity market capitalization plus book value of debt)
- **Size** (log relative assets to all other BondScore issuers)
- **Liquidity** (Quick Ratio)
- **Volatility of stock returns** (standard deviation of error in beta equation; measures idiosyncratic volatility of issuer vs. pure volatility)
- **Volatility of cash flow** (standard deviation of EBITDA/Assets over past ten years)

The Forecast

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Q4 2010	Contribution to Annual Growth	
	Baseline	Scenario 1
Consumption	3.1%	3.1%
Non-Durables	0.8%	0.8%
Durables	1.8%	1.8%
Services	0.6%	0.6%
Investment	-0.2%	-0.2%
Residential	0.2%	0.2%
Non-Residential	0.5%	0.5%
Structures	0.2%	0.2%
Equipment & Software	0.4%	0.4%
Change in Inventories	-0.9%	-0.9%
Government	-0.4%	-0.4%
Federal	-0.3%	-0.3%
State & Local	-0.1%	-0.1%
Net Exports	2.2%	2.9%
Exports	0.8%	0.8%
Imports	1.4%	2.1%
GDP	4.7%	5.1%



Strong: Exports, Business Investment
Average: Consumers
Weak: Construction, Government