The Use of Credit Scoring Models and the Importance of a Credit Culture

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Evolution of 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

Evolution of 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*)

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

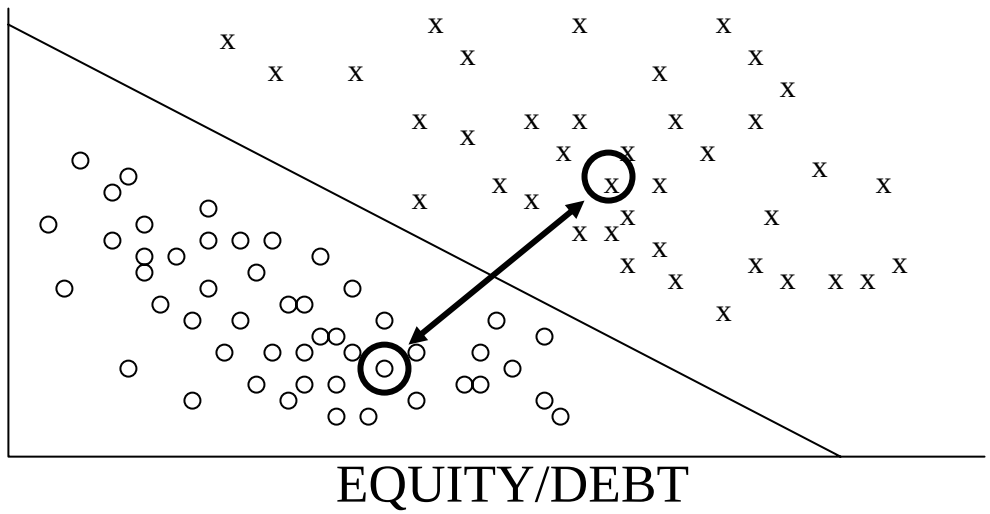
$Z = a_1x_1 + a_2x_2 + a_3x_3 + \ldots\ldots + a_nx_n$

Z = Discriminant Score (Z Score)

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

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

Example



"Z" Score Component Definitions

Variable	Definition	Weighting Factor
X_1	$\frac{\text{Working Capital}}{\text{Total Assets}}$	1.2
X_2	$\frac{\text{Retained Earnings}}{\text{Total Assets}}$	1.4
X_3	$\frac{\text{EBIT}}{\text{Total Assets}}$	3.3
X_4	$\frac{\text{Market Value of Equity}}{\text{Book Value of Total Liabilities}}$	0.6
X_5	$\frac{\text{Sales}}{\text{Total Assets}}$	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

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

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

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

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

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

Zones of Discrimination:
Original Z - Score Model

$Z > 2.99$ - “Safe” Zone

$1.8 < Z < 2.99$ - “Grey” Zone

$Z < 1.80$ - “Distress” Zone

Average Z-Score by S&P Bond Rating
S&P 500: 1992 - 2001

	1996-2001			1995		1994		1993		1992	
Rating	# Firms	Average Z Score	SD	Average Z Score	SD	Average Z Score	SD	Average Z Score	SD	Average Z Score	SD
AAA	66	6.20	3.06	5.02	1.60	4.38	1.38	4.51	1.50	5.26	2.19
AA	194	4.73	2.36	4.30	1.91	4.05	1.83	4.03	1.89	4.23	2.09
A	519	3.74	2.29	3.61	2.26	3.47	2.01	3.61	2.18	3.92	3.26
BBB	530	2.81	1.48	2.78	1.49	2.70	1.58	2.84	1.74	2.60	1.54
BB	538	2.38	1.85	2.45	1.62	2.28	1.69	2.19	1.63	2.10	1.54
B	390	1.80	1.91	1.67	1.23	1.88	1.52	1.96	1.72	1.96	2.33
CCC+CC	9	0.33	1.16								

Estimating Probability of Default and Probability of Loss Given Defaults

- Credit scores on new issues to estimate
- Bond ratings equivalents on new issues and then,
- Utilize mortality rates to estimate annual and cumulative defaults

Marginal and Cumulative Mortality Rate Equation

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

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	Year 1 Call	Year 1 SF	Year 2 Default	Year 2 Call	Year 2 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

	Year 1	Year 2
Marginal Mortality Rate	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[a]
1971-2003

		Years after Issuance									
		1	2	3	4	5	6	7	8	9	10
AAA	Marginal	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
	Cumulative	0.00%	0.00%	0.00%	0.00%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%
AA	Marginal	0.00%	0.00%	0.33%	0.17%	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%
	Cumulative	0.00%	0.00%	0.33%	0.50%	0.50%	0.50%	0.50%	0.50%	0.53%	0.55%
A	Marginal	0.01%	0.11%	0.02%	0.09%	0.05%	0.10%	0.06%	0.21%	0.11%	0.06%
	Cumulative	0.01%	0.12%	0.14%	0.23%	0.28%	0.38%	0.44%	0.65%	0.75%	0.82%
BBB	Marginal	0.40%	3.45%	1.58%	1.45%	0.98%	0.56%	0.28%	0.25%	0.16%	0.42%
	Cumulative	0.40%	3.84%	5.38%	6.73%	7.64%	8.16%	8.98%	9.11%	9.25%	9.63%
BB	Marginal	1.22%	2.52%	4.44%	2.05%	2.55%	1.10%	1.65%	0.88%	1.72%	3.70%
	Cumulative	1.22%	3.77%	7.98%	9.87%	12.17%	13.14%	14.57%	15.15%	16.61%	19.69%
B	Marginal	3.06%	6.92%	7.48%	8.58%	6.08%	4.18%	3.74%	2.31%	2.00%	0.88%
	Cumulative	3.06%	9.77%	16.52%	23.69%	28.32%	31.32%	33.89%	35.41%	36.70%	37.26%
CCC	Marginal	8.18%	15.57%	19.15%	12.18%	4.26%	10.25%	5.65%	3.15%	0.00%	4.28%
	Cumulative	8.18%	22.48%	37.32%	44.96%	47.30%	52.70%	55.37%	56.78%	56.78%	58.63%

(a) Rated by S&P at Issuance
Based on 1,719 issues
Source: Standard & Poor's (New York) and Author's Compilation

Mortality Losses by Original Rating

All Rated Corporate Bonds[a]
1971-2003

		Years after Issuance									
		1	2	3	4	5	6	7	8	9	10
AAA	Marginal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Cumulative	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
AA	Marginal	0.00%	0.00%	0.06%	0.06%	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%
	Cumulative	0.00%	0.00%	0.06%	0.12%	0.12%	0.12%	0.12%	0.12%	0.15%	0.17%
A	Marginal	0.00%	0.04%	0.01%	0.04%	0.02%	0.06%	0.02%	0.04%	0.08%	0.00%
	Cumulative	0.00%	0.04%	0.05%	0.09%	0.11%	0.17%	0.19%	0.23%	0.31%	0.31%
BBB	Marginal	0.28%	2.54%	1.15%	0.94%	0.65%	0.37%	0.47%	0.15%	0.10%	0.29%
	Cumulative	0.28%	2.81%	3.93%	4.83%	5.45%	5.80%	6.24%	6.38%	6.48%	6.75%
BB	Marginal	0.73%	1.51%	3.24%	1.46%	1.40%	0.75%	0.99%	0.28%	0.94%	1.18%
	Cumulative	0.73%	2.23%	5.40%	6.78%	8.08%	8.78%	9.68%	9.93%	10.78%	11.83%
B	Marginal	2.13%	5.05%	5.60%	6.00%	4.56%	2.51%	2.74%	1.64%	1.10%	0.67%
	Cumulative	2.13%	7.07%	12.38%	17.54%	21.30%	23.38%	25.00%	26.23%	27.04%	27.53%
CCC	Marginal	5.48%	11.68%	15.37%	9.72%	3.20%	8.21%	4.80%	2.52%	0.00%	3.22%
	Cumulative	5.48%	16.52%	29.35%	36.22%	38.26%	43.37%	46.05%	47.41%	47.41%	49.10%

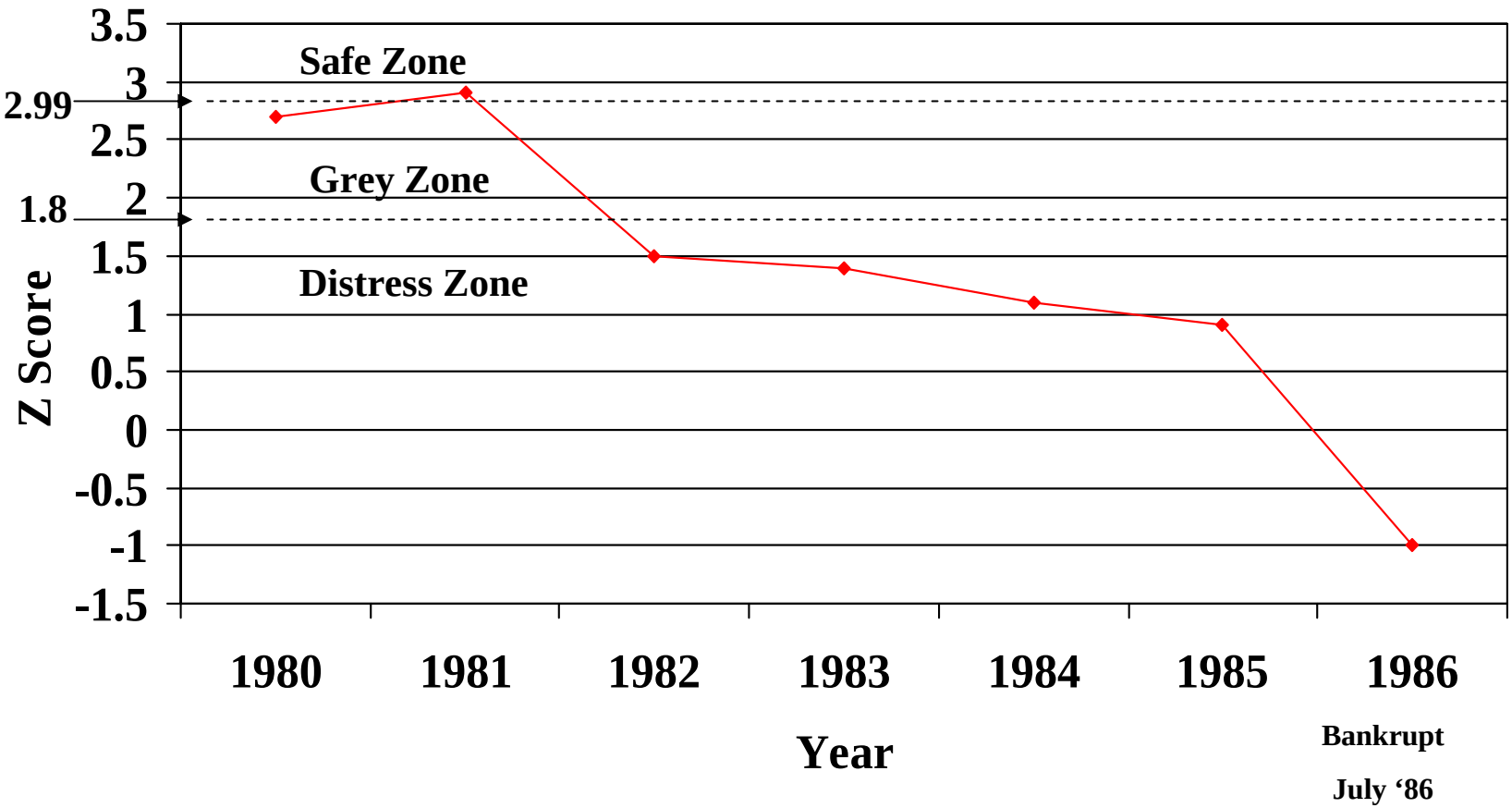
(a) Rated by S&P at Issuance
Based on 1,535issues
Source: Standard & Poor's (New York) and Author's Compilation

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

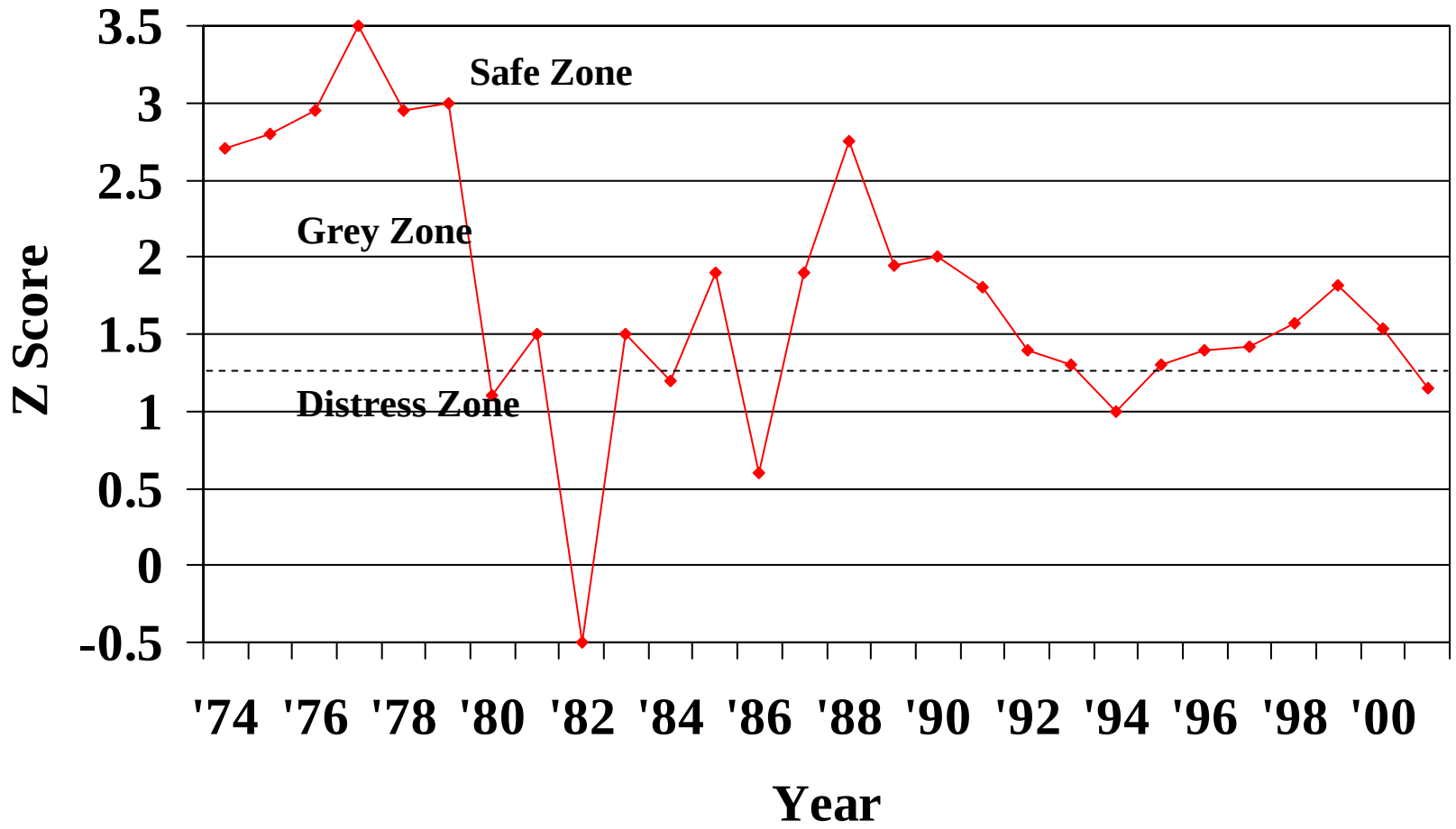
Year Prior To Failure	Original Sample (33)	Holdout Sample (25)	1969-1975 Predictive Sample (86)	1976-1995 Predictive Sample (110)	1997-1999 Predictive Sample (120)
1	94% (88%)	96% (72%)	82% (75%)	85% (78%)	94% (84%)
2	72%	80%	68%	75%	74%
3	48%	-	-	-	-
4	29%	-	-	-	-
5	36%	-	-	-	-

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

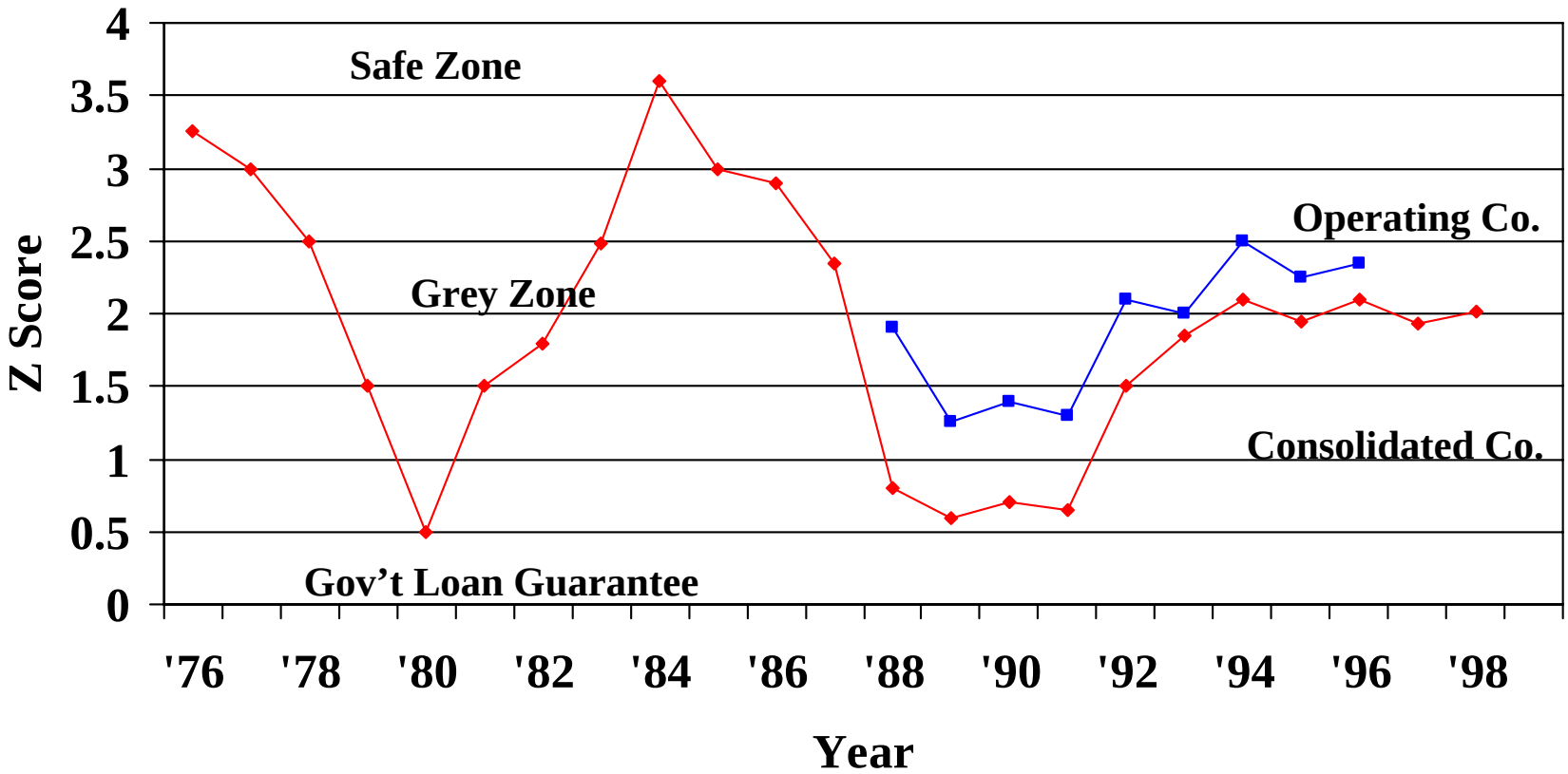
Z Score Trend - LTV Corp.



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

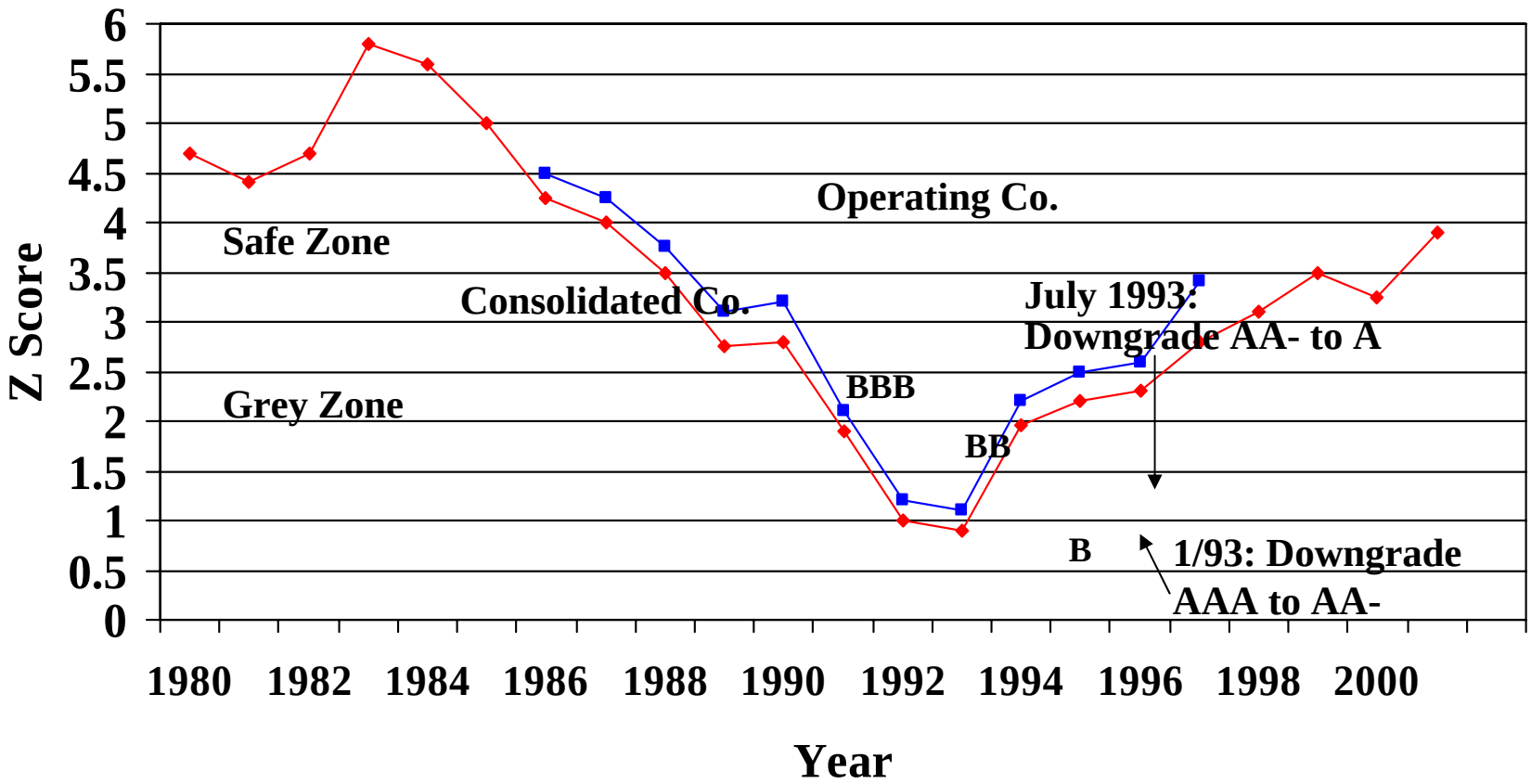


Chrysler Corporation
Z Score (1976 – 3Q 1998*)

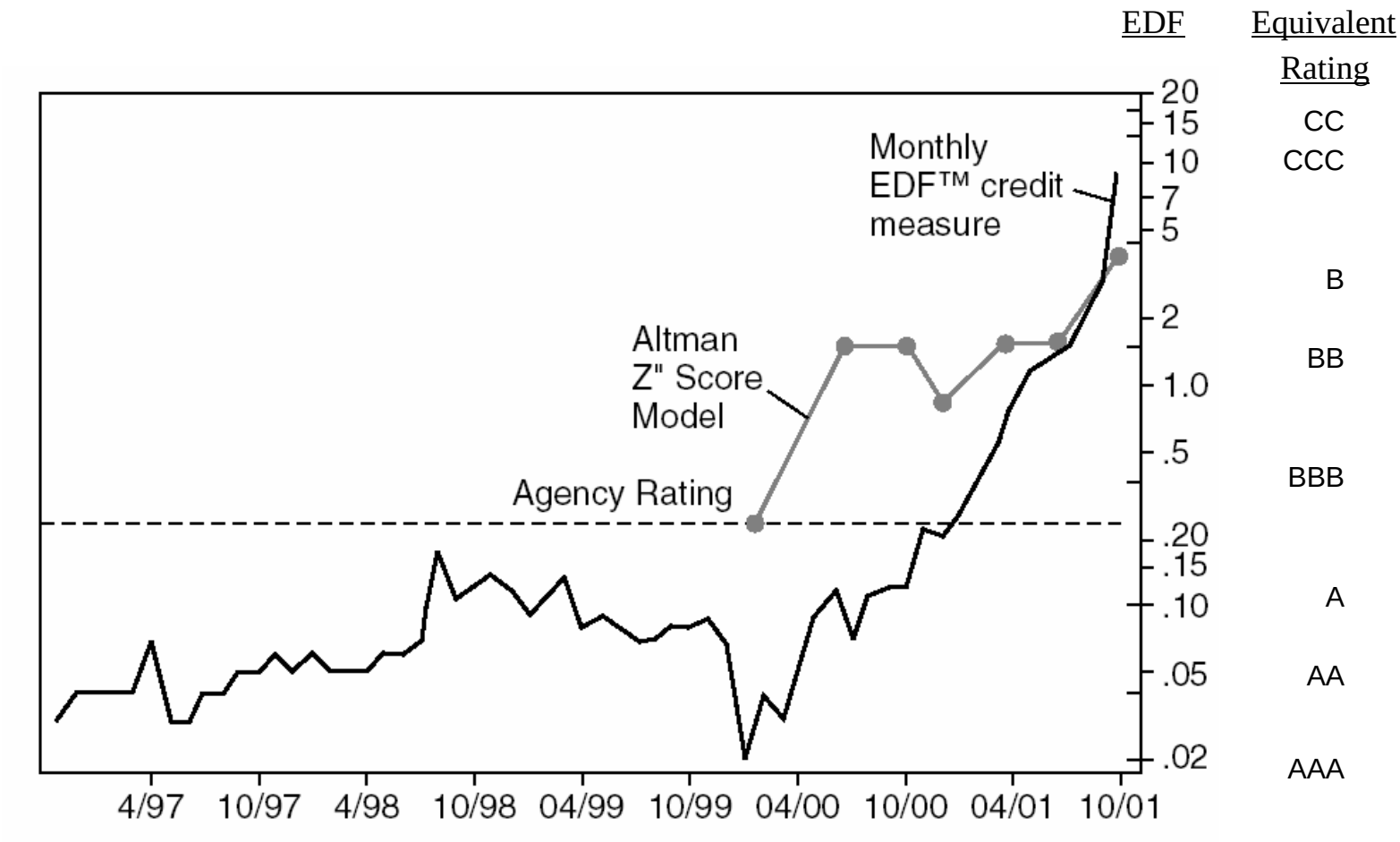


*Third quarter figures for 1998 are annualized

IBM Corporation
Z Score (1980 – 2001)

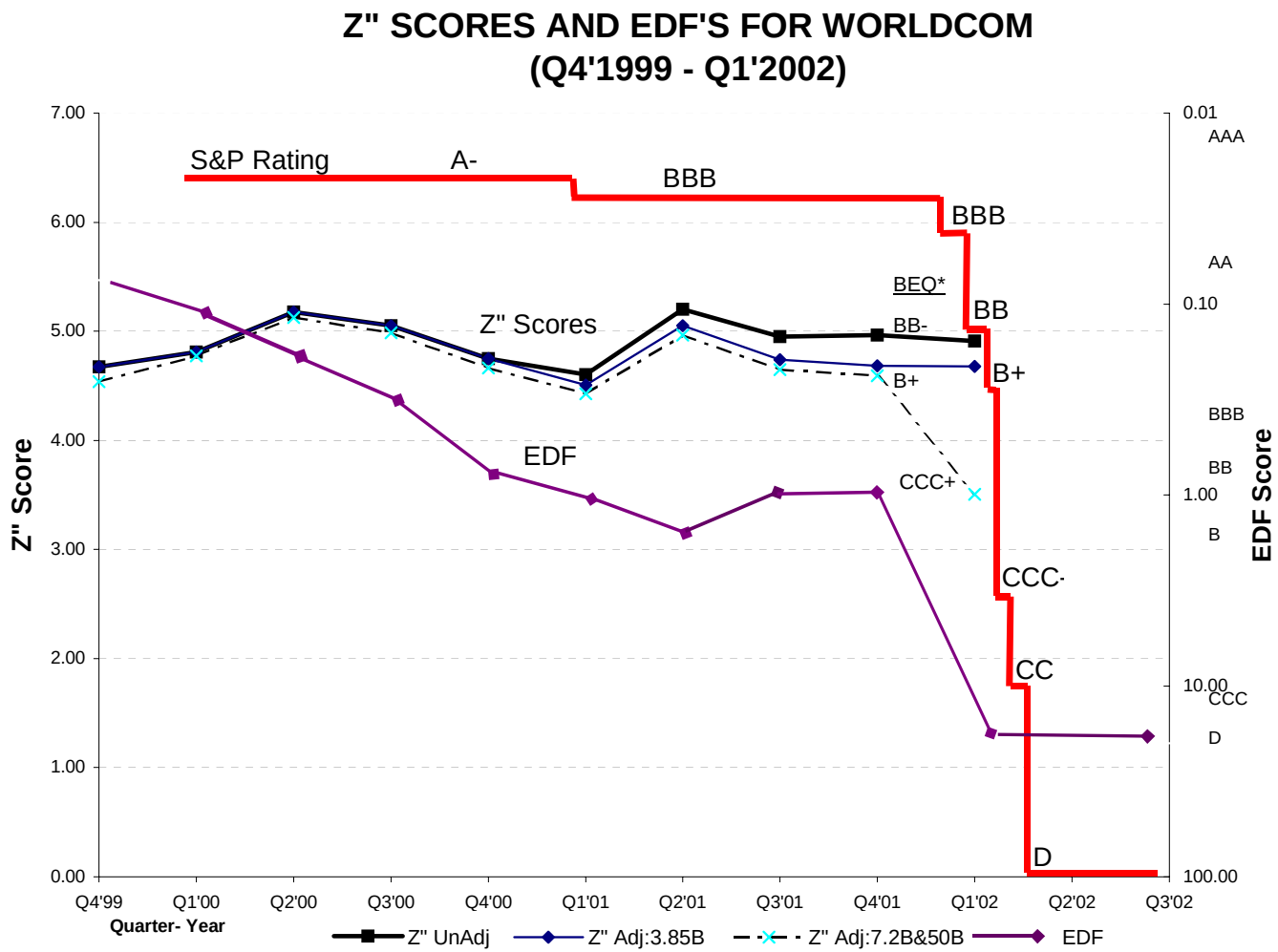


Enron Credit Risk Measures



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

Worldcom Credit Risk Measures



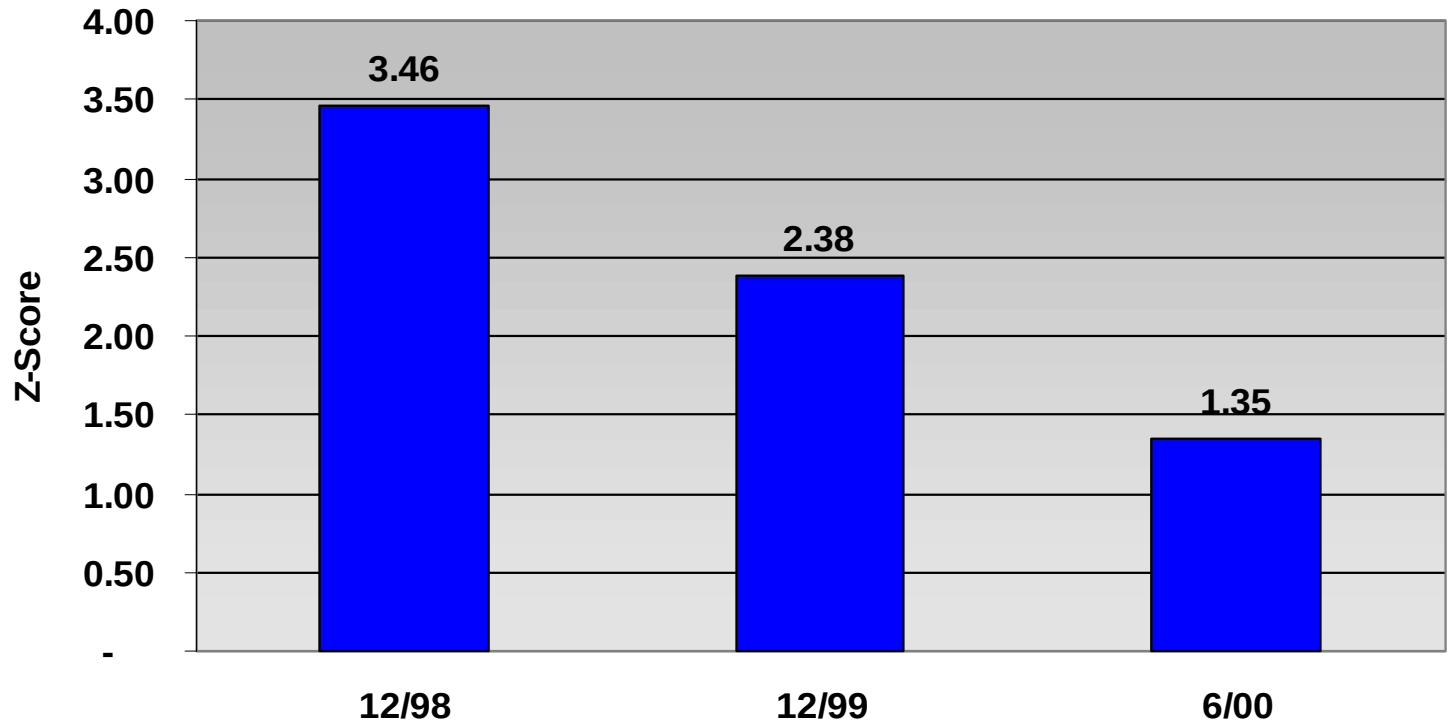
Sources: Compilation by the author (E. Altman, NYU Stern), the KMV (Moody's) Website and Standard & Poor's Corporation.

Key Industrial Financial Ratios U.S. Industrial Long-term Debt

Three Year (1998-2000) Medians	AAA	AA	A	BBB	BB	B	CCC
EBIT interest coverage (x)	21.4	10.1	6.1	3.7	2.1	0.8	0.1
EBITDA interest coverage (x)	26.5	12.9	9.1	5.8	3.4	1.8	1.3
Funds from operations/total debt (%)	128.8	55.4	43.2	30.8	18.8	7.8	1.6
Free operating cash flow/total debt (%)	84.2	25.5	15.0	8.5	2.6	-3.2	-12.9
Pretax return on capital (%)	34.9	21.7	19.4	13.6	11.6	6.6	1.0
Operating income/sales (%)	27.0	22.1	18.6	15.4	15.9	11.9	11.9
Long-term debt/capital (%)	13.3	28.2	33.9	42.5	57.2	69.7	68.8
Total debt/capitalization (%)	22.9	37.7	42.5	48.2	62.6	74.8	87.7
Companies	8	29	136	218	273	281	22

Standard & Poor's, Corporate Ratings Criteria, Ratings and ratios.

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

Z' Score
Private Firm Model

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

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

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

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

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

$$X_5 = \frac{\text{Sales}}{\text{Total Assets}}$$

$Z' > 2.90$ - "Safe" Zone

$1.23 < Z' < 2.90$ - "Grey" Zone

$Z' < 1.23$ - "Distress" Zone

Z'' Score Model for Manufacturers, Non-Manufacturer Industrials, & Emerging Market Credits

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

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

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

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

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

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

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

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

AN EMERGING MARKET CORPORATE MODEL

US Bond Rating Equivalent Based on Adjusted Z" Score Model

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

US Equivalent Rating	Average EM Score	Sample Size
AAA	8.15	8
AA+	7.6	-
AA	7.3	18
AA-	7	15
A+	6.85	24
A	6.65	42
A-	6.4	38
BBB+	6.25	38
BBB	5.85	59
BBB-	5.65	52
BB+	5.25	34
BB	4.95	25
BB-	4.75	65
B+	4.5	78
B	4.15	115
B-	3.75	95
CCC+	3.2	23
CCC	2.5	10
CCC-	1.75	6
D	0	14

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.

- ± - 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.

Z-Score Models and Bond Rating Equivalent

Selected Auto and Telecom Companies

	Date	Z-Score	Equivalent Rating	Z"-Score	Equivalent Rating	Revised Rating	S&P Rating
GM	31/12/03	0.84	CCC+	5.23	BB	BBB-	BBB
Ford	31/12/03	0.43	CCC	2.33	CCC	B	BBB-
Fiat	31/12/03	1.07	CCC+	4.64	B+	BB+	BB-
Daimler	31/12/03	1.15	CCC+	5.41	BB+	BBB	BBB
Telefonica	31/12/03	1.58	B-	4.16	B	BB	A
Deutsche Telecom	31/12/03	0.53	CCC	2.27	CCC	B	BBB+
Telecom Italia	31/12/03	1.19	CCC+	4.64	B+	BB+	BBB+
France Telecom	31/12/03	0.69	CCC	2.36	CCC	B	BBB+

Z-Score Models and Bond Rating Equivalent

General Motors Co.

	Z-Score	Equivalent Rating	Z''-Score	Equivalent Rating	Revised Rating
Dec 2003	0.84	CCC+	5.23	BB	BBB-
Dec 2002	0.79	CCC	4.89	BB-	BBB-
Dec 2001	0.75	CCC	4.08	B-	BB-
Dec 2000	0.81	CCC	3.73	CCC+	B+

Z-Score Models and Bond Rating Equivalent

Ford Motors Co.

	Z-Score	Equivalent Rating	Z"-Score	Equivalent Rating	Revised Rating
Dec 2003	0.43	CCC	2.33	CCC	B
Dec 2002	0.44	CCC	2.44	CCC	B
Dec 2001	0.36	CCC	1.87	CCC-	B-
Dec 2000	0.53	CCC	1.93	CCC-	B-

Z-Score Models and Bond Rating Equivalent

Fiat Auto S.p.A.

	Z-Score	Equivalent Rating	Z''-Score	Equivalent Rating	Revised Rating
Dec 2003	1.07	CCC+	4.64	B+	BB+
Dec 2002	0.84	CCC+	4.50	B	BB
Dec 2001	0.87	CCC+	4.32	B	BB
Dec 2000	0.92	CCC+	4.09	B-	BB-

Z-Score Models and Bond Rating Equivalent

Daimler-Chrysler

	Z-Score	Equivalent Rating	Z"-Score	Equivalent Rating	Revised Rating
Dec 2003	1.38	B-	5.41	BB+	BBB
Dec 2002	1.15	CCC+	3.93	B-	BB-
Dec 2001	1.07	CCC+	3.55	CCC+	B+
Dec 2000	1.46	B-	5.08	BB	BBB-

Z-Score Models and Bond Rating Equivalent

Telefonica

	Z-Score	Equivalent Rating	Z"-Score	Equivalent Rating	Revised Rating
Dec 2003	1.58	B-	4.16	B	BB
Dec 2002	1.02	CCC+	3.60	CCC+	B
Dec 2001	1.32	B-	3.98	B-	B+
Dec 2000	1.27	CCC+	3.91	B-	B+

Z-Score Models and Bond Rating Equivalent

Deutsche Telecom

	Z-Score	Equivalent Rating	Z''-Score	Equivalent Rating	Revised Rating
Dec 2003	0.53	CCC	2.27	CCC	B
Dec 2002	0.29	CCC-	2.01	CCC	B
Dec 2001	0.67	CCC	3.21	CCC+	B
Dec 2000	1.04	CCC+	3.34	CCC+	B

Z-Score Models and Bond Rating Equivalent

Telecom Italia

	Z-Score	Equivalent Rating	Z"-Score	Equivalent Rating	Revised Rating
Dec 2003	1.19	CCC+	4.64	B+	BB+
Dec 2002	0.71	CCC	4.23	B	BB
Dec 2001	0.64	CCC	4.10	B-	B+
Dec 2000	0.58	CCC	3.72	CCC+	B+

Z-Score Models and Bond Rating Equivalent

France Telecom

	Z-Score	Equivalent Rating	Z"-Score	Equivalent Rating	Revised Rating
Dec 2003	0.69	CCC	2.36	CCC	B
Dec 2002	(0.19)	D	0.40	CCC-	B-
Dec 2001	0.42	CCC	2.71	CCC	B
Dec 2000	0.70	CCC	1.93	CCC-	B-

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

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

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	5.65	5.85	BBB-	
	7.60	8.15	AA+	5.25	5.65	BB+	
	7.30	7.60	AA	4.95	5.25	BB	**Grey zone**
	7.00	7.30	AA-	4.75	4.95	BB-	
	6.85	7.00	A+	4.50	4.75	B+	
	6.65	6.85	A	4.15	4.50	B	
	6.40	6.65	A-	3.75	4.15	B-	
	6.25	6.40	BBB+	3.20	3.75	CCC+	**Distress zone**
	5.85	6.25	BBB	2.50	3.20	CCC	
				1.75	2.50	CCC-	
				< 1.75	1.75	D	

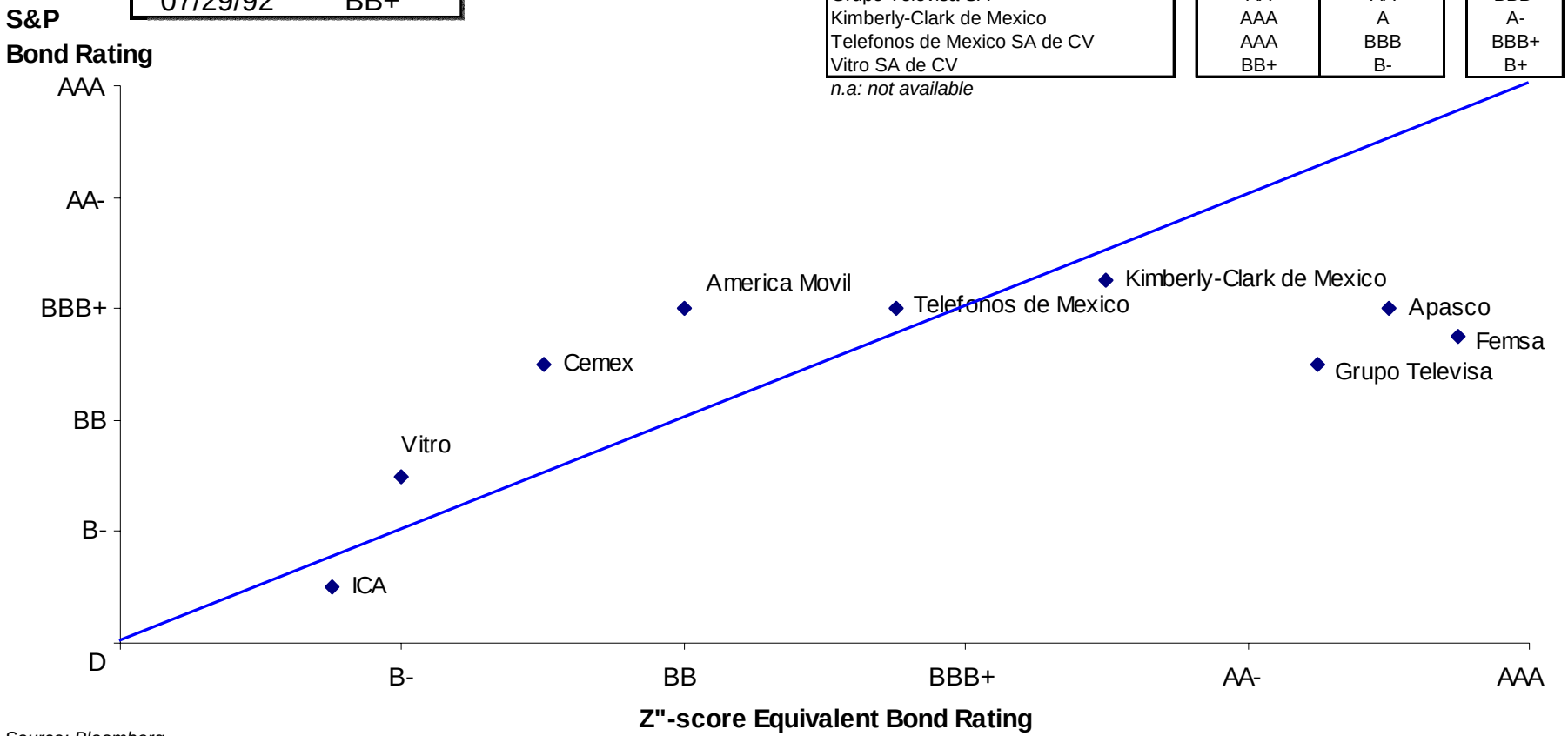
Z”-score Distressed models and S&P Ratings

(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+

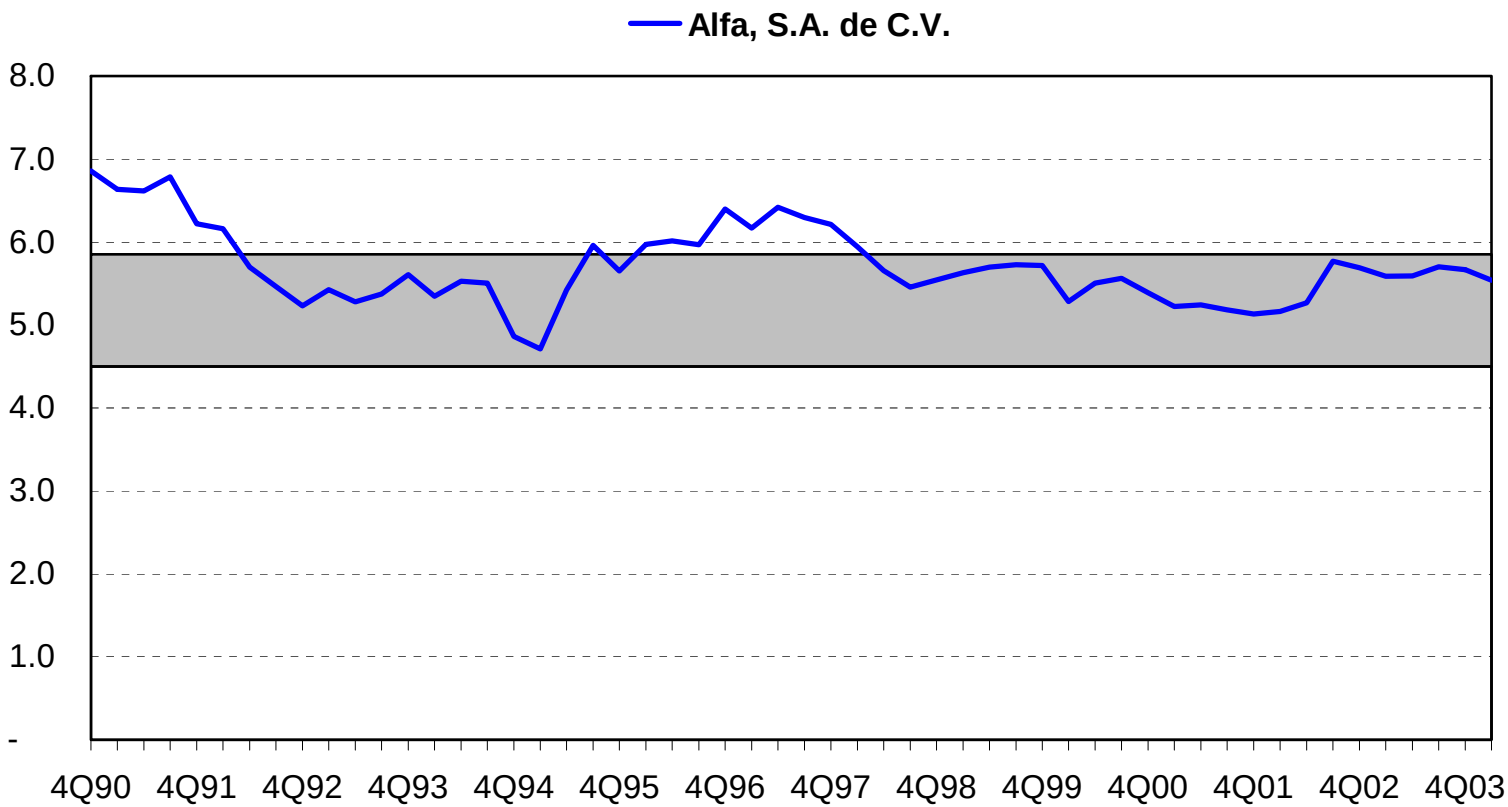
	Z"-Score Rating		S&P Rating
	Dec 94	Dec 02	Dec 02
America Movil SA de CV	*n.a.*	BB	BBB+
Apasco SA de CV	AAA	AA+	BBB+
Cemex SA de CV	BBB-	B+	BBB-
Coca-Cola Femsa SA de CV	A-	AAA	BBB
Empresas ICA Sociedad Controladora	BBB	CCC+	CCC
Grupo Televisa SA	AA	AA	BBB-
Kimberly-Clark de Mexico	AAA	A	A-
Telefonos de Mexico SA de CV	AAA	BBB	BBB+
Vitro SA de CV	BB+	B-	B+

n.a: not available



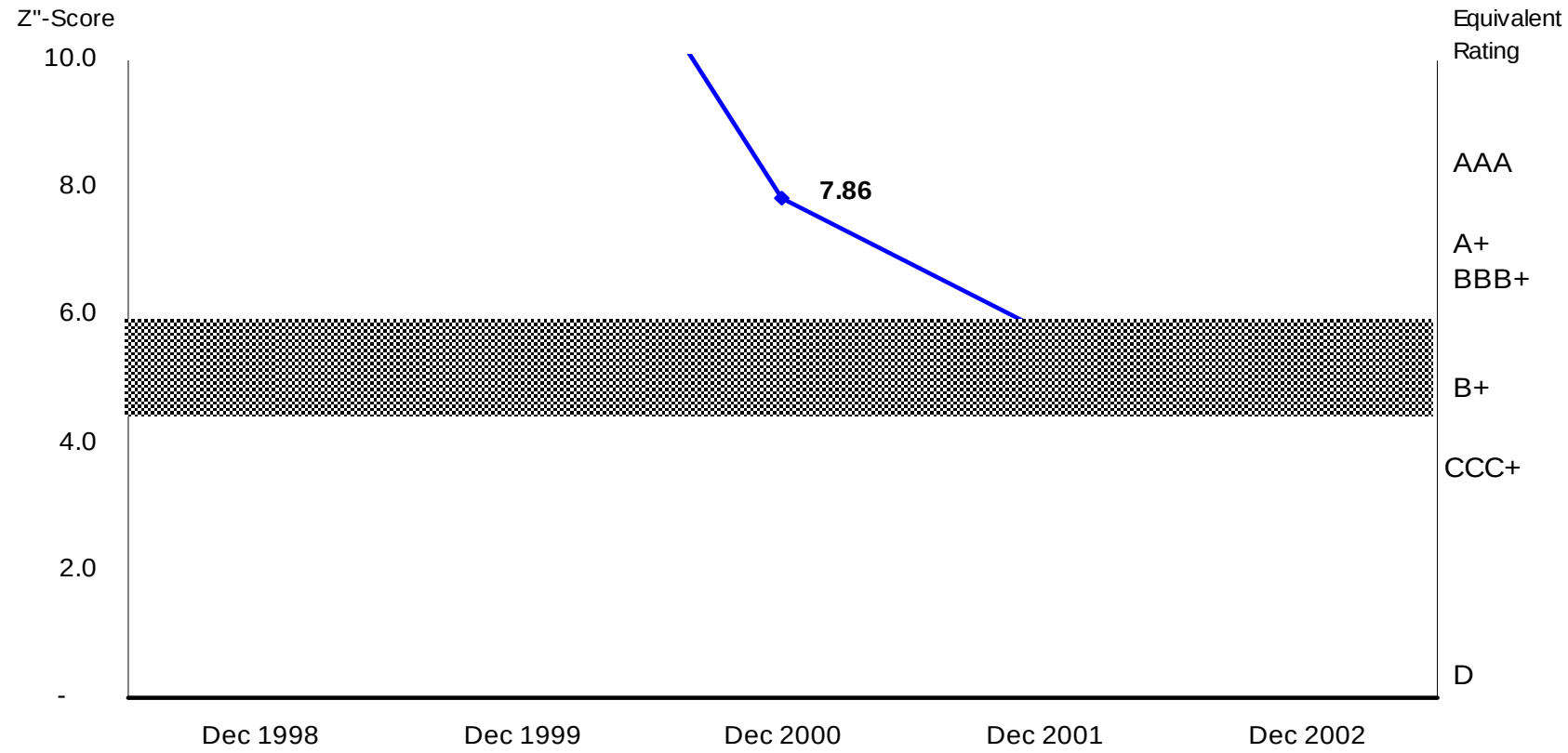
Source: Bloomberg

Alfa, S.A. de C.V.


Alfa, S.A. de C.V.
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
-
4Q90
4Q91
4Q92
4Q93
4Q94
4Q95
4Q96
4Q97
4Q98
4Q99
4Q00
4Q01
4Q02
4Q03

America Movil SA de CV

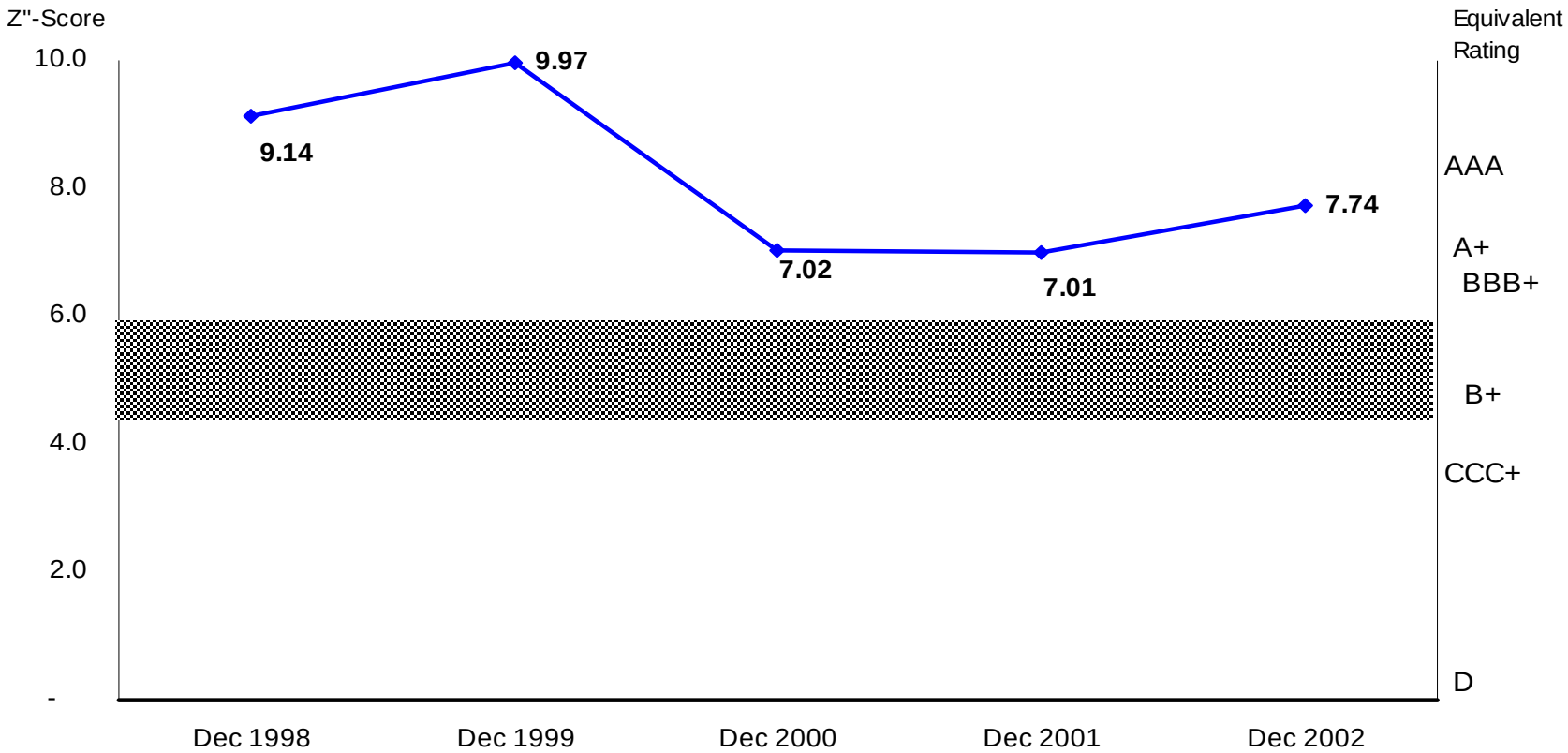
(provides wireless communications services in Mexico)



Source: Bloomberg

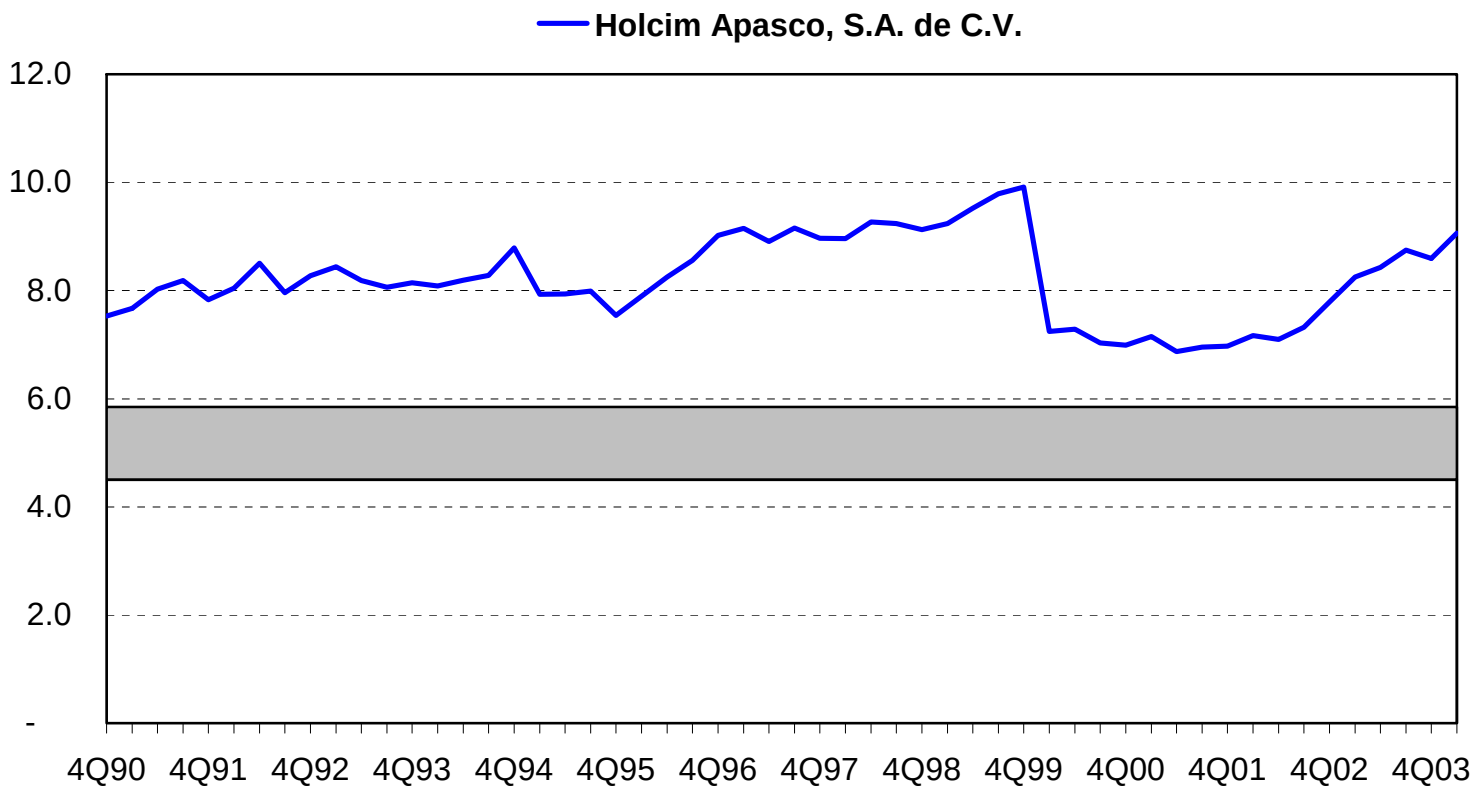
Apasco SA de CV

(production and marketing of cement)



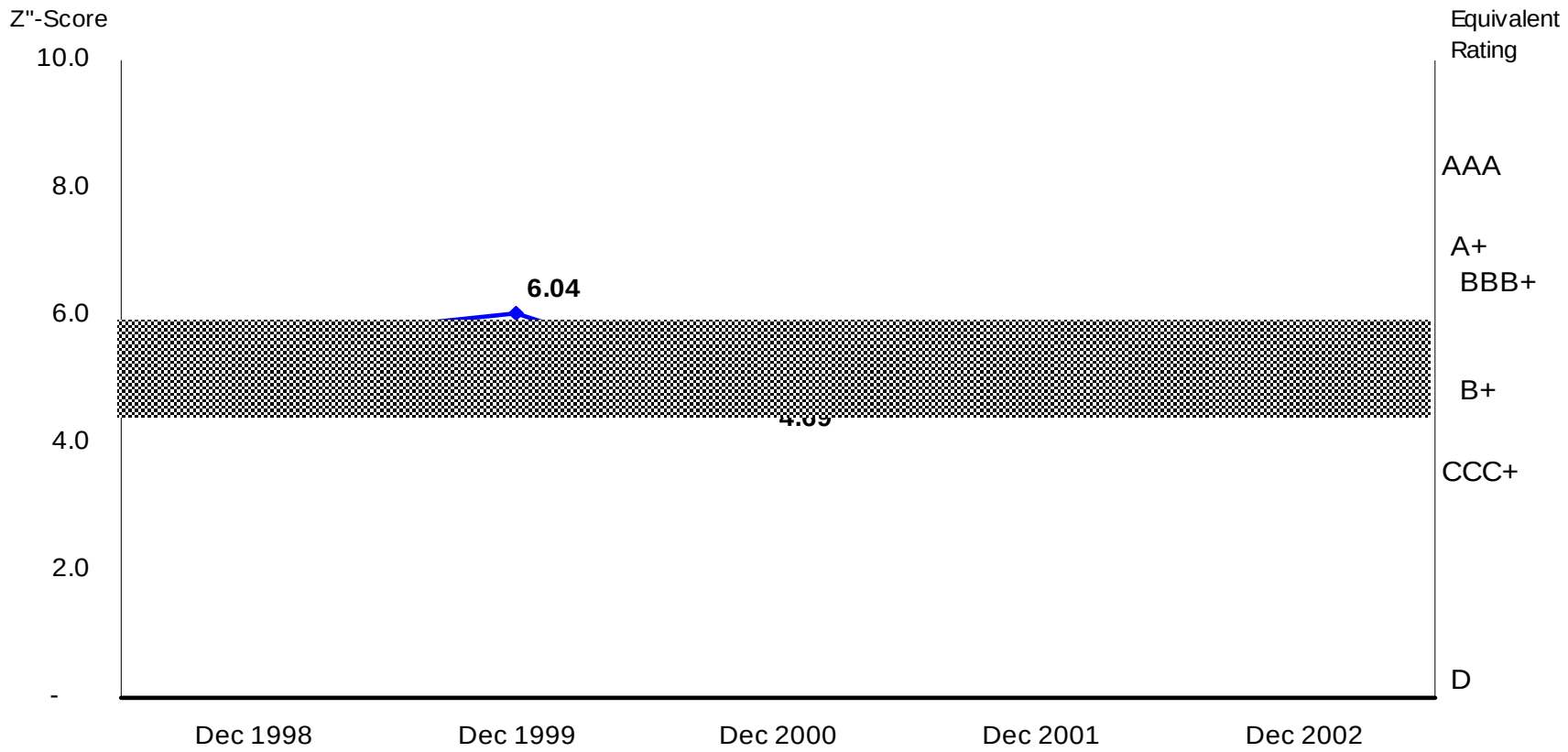
Source: Bloomberg

Holcim Apasco, S.A. de C.V.



Cemex SA de CV

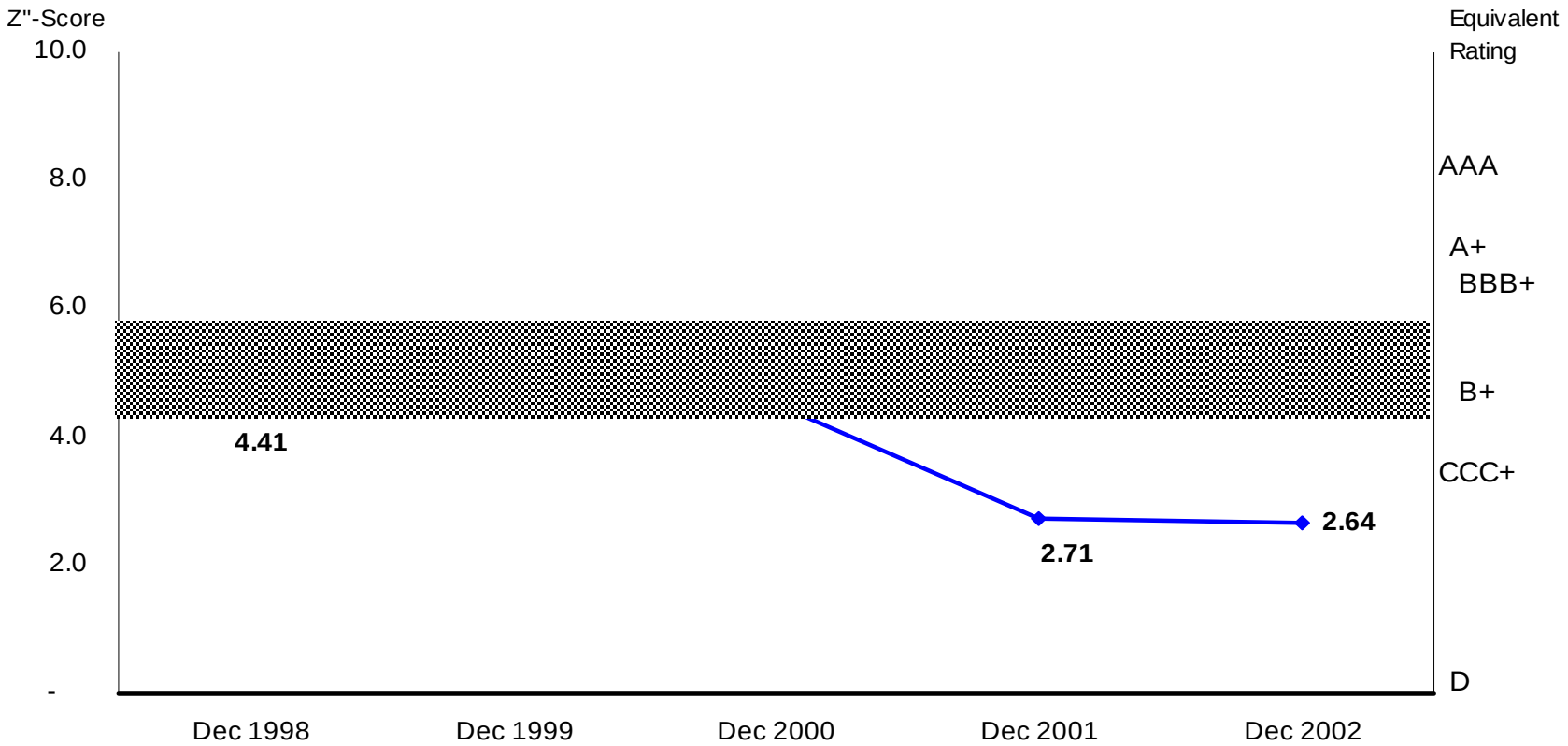
(production, distribution, marketing, and sale of cement)



Source: Bloomberg

Cintra SA de CV

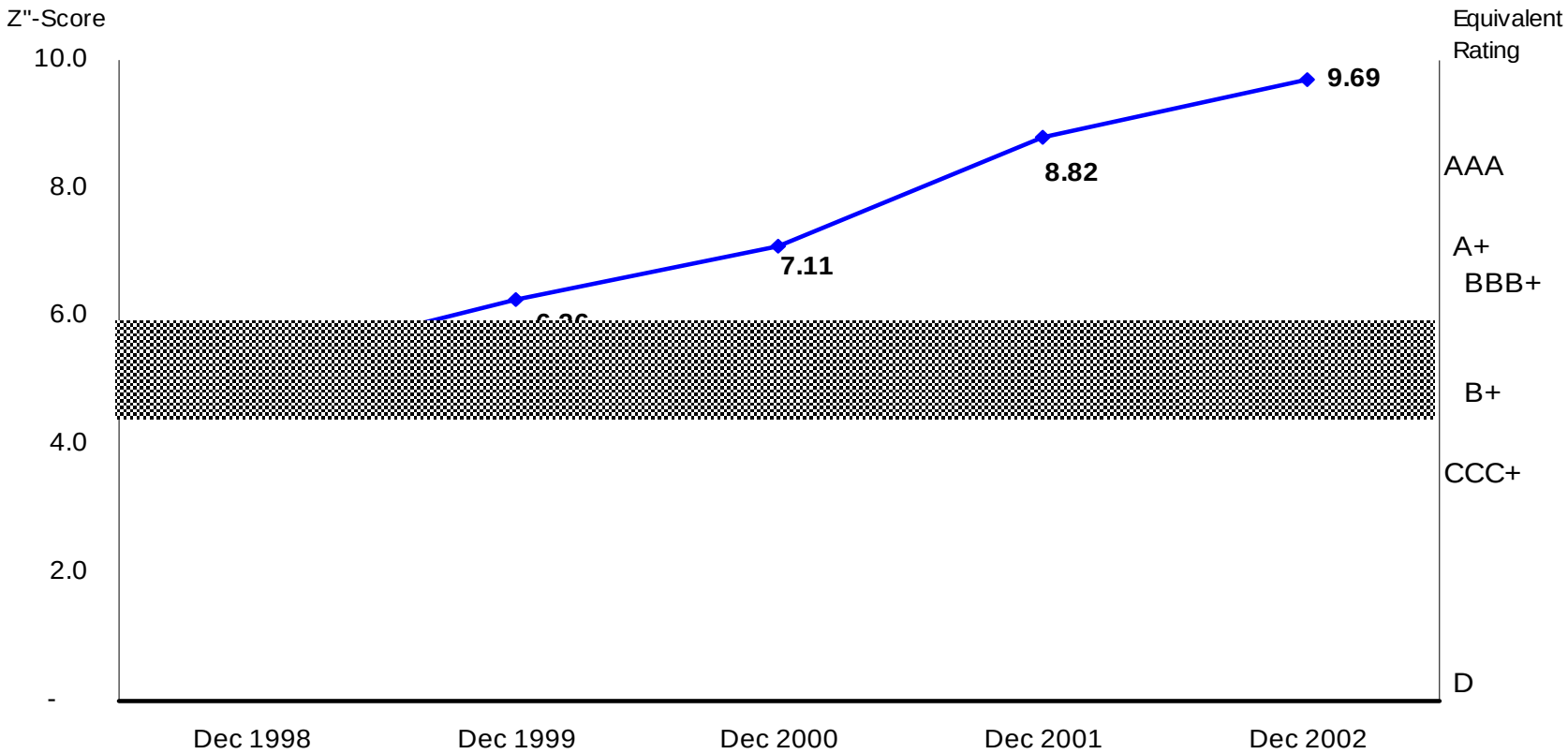
(AeroMéxico, Mexicana, Aerocaribe, Aerolitoral,…)



Source: Bloomberg

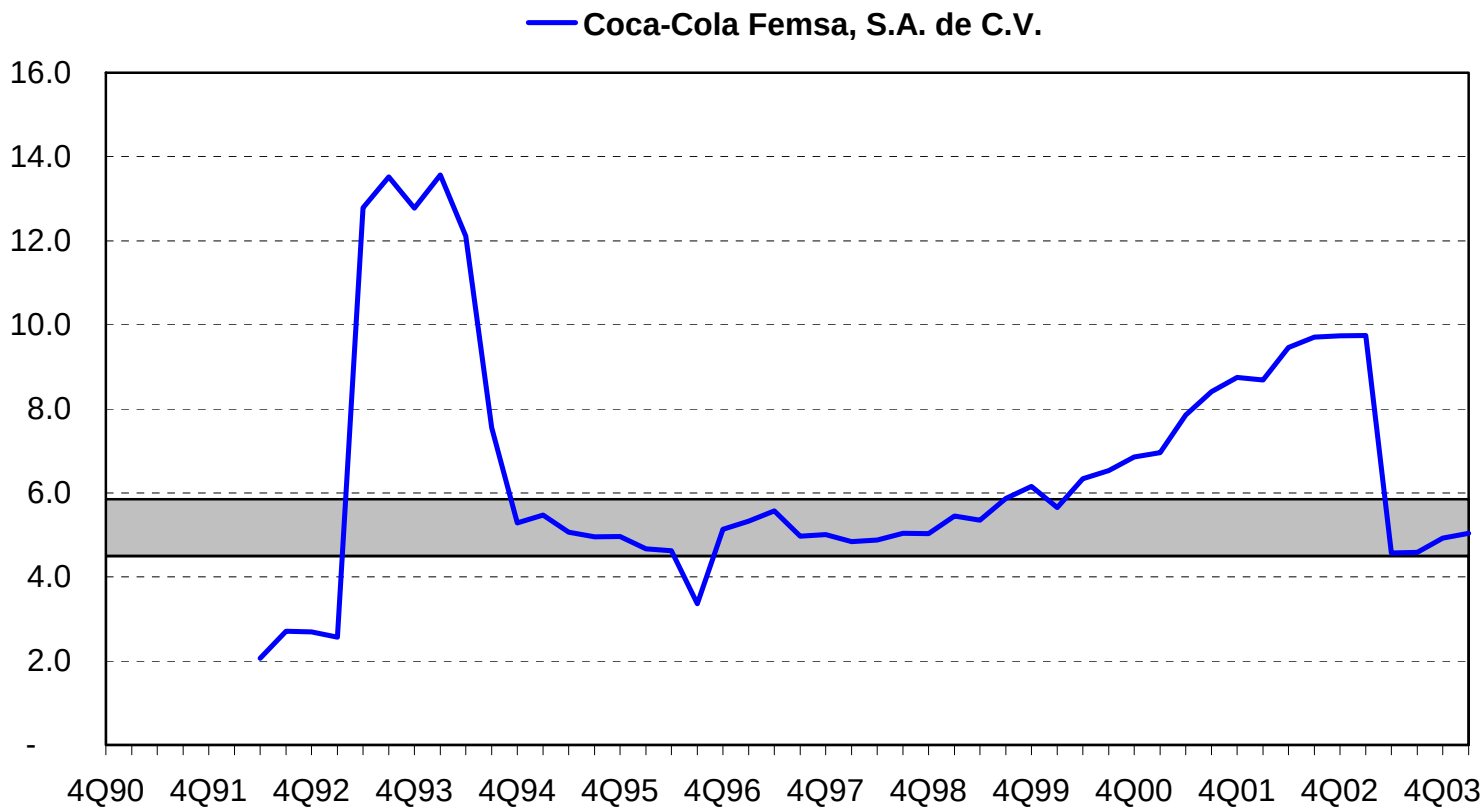
Coca-Cola Femsa SA de CV

(production, distribution, and marketing of certain Coca-Cola trademark beverages)

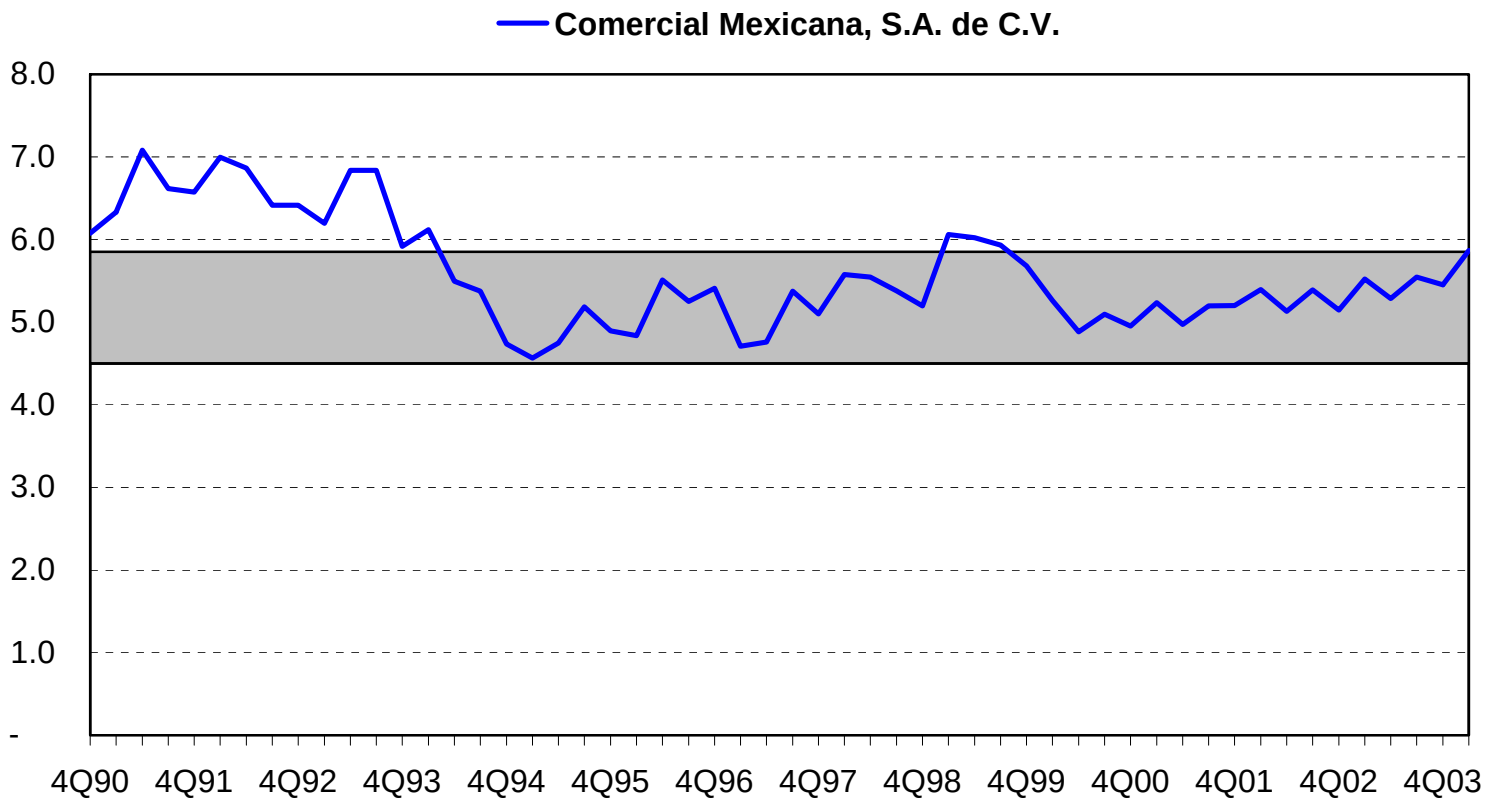


Source: Bloomberg

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

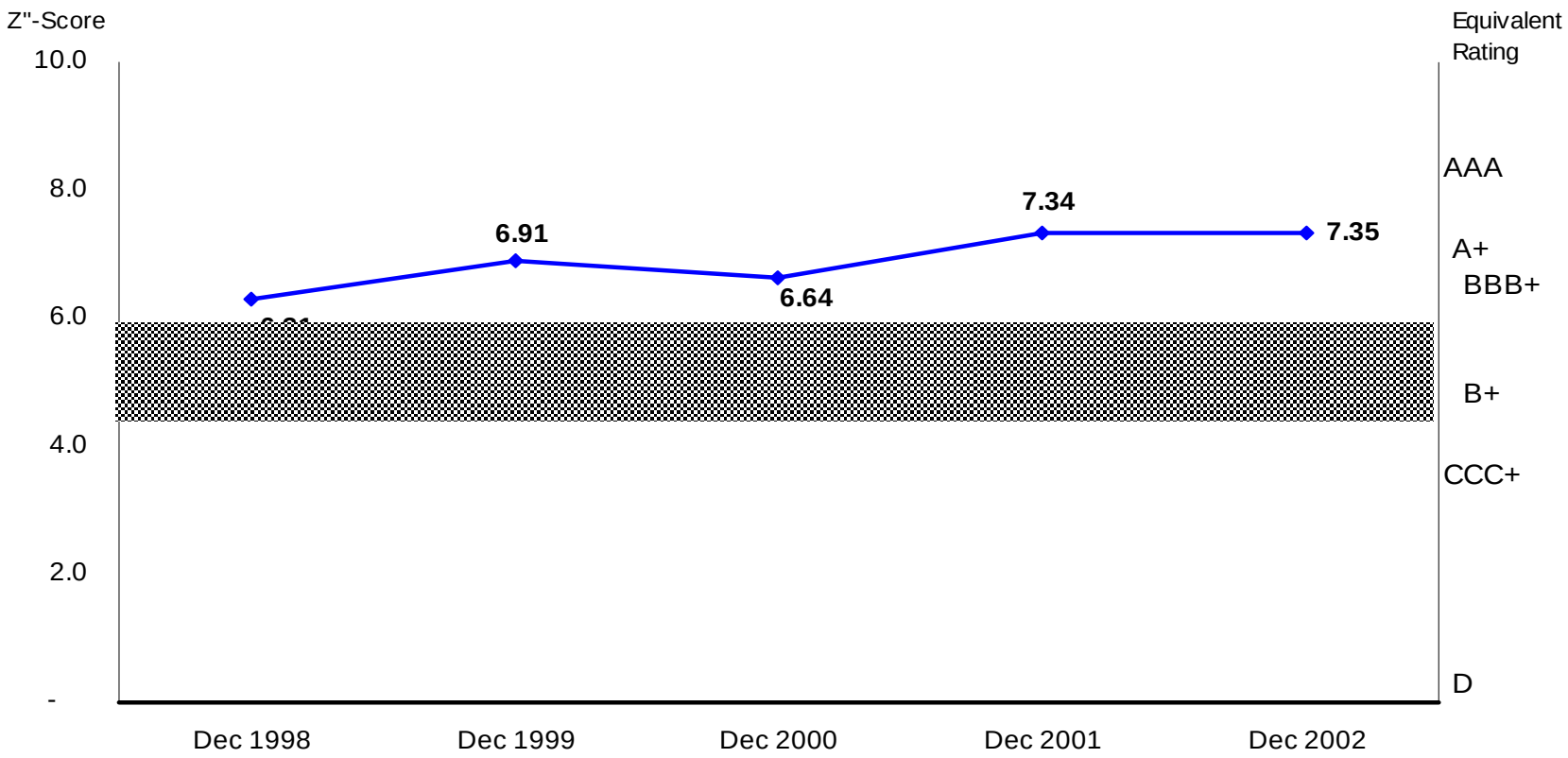


Comercial Mexicana, S.A. de C.V.



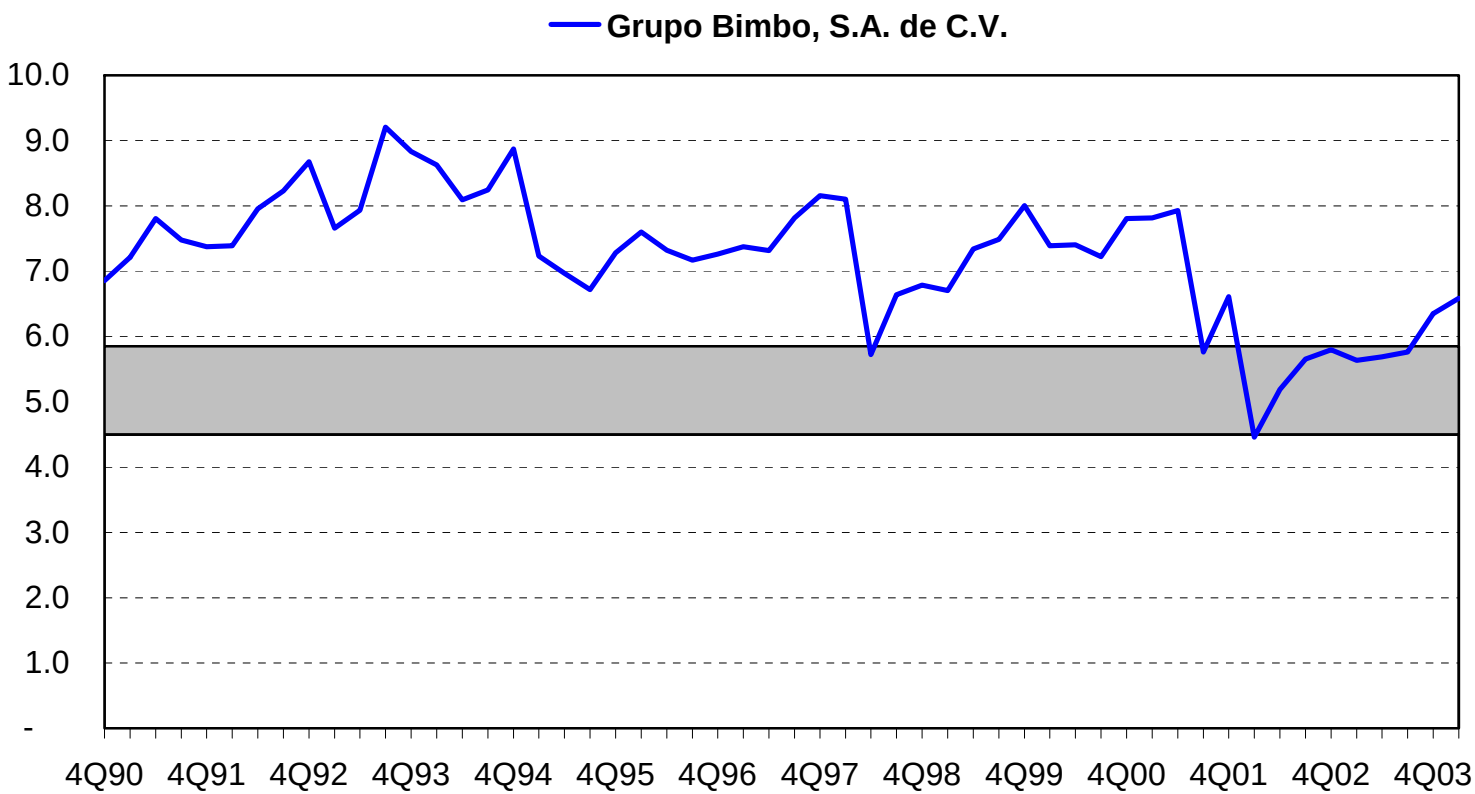
Fomento Economico Mexicano SA de CV

(brews beer and bottles soft drinks)



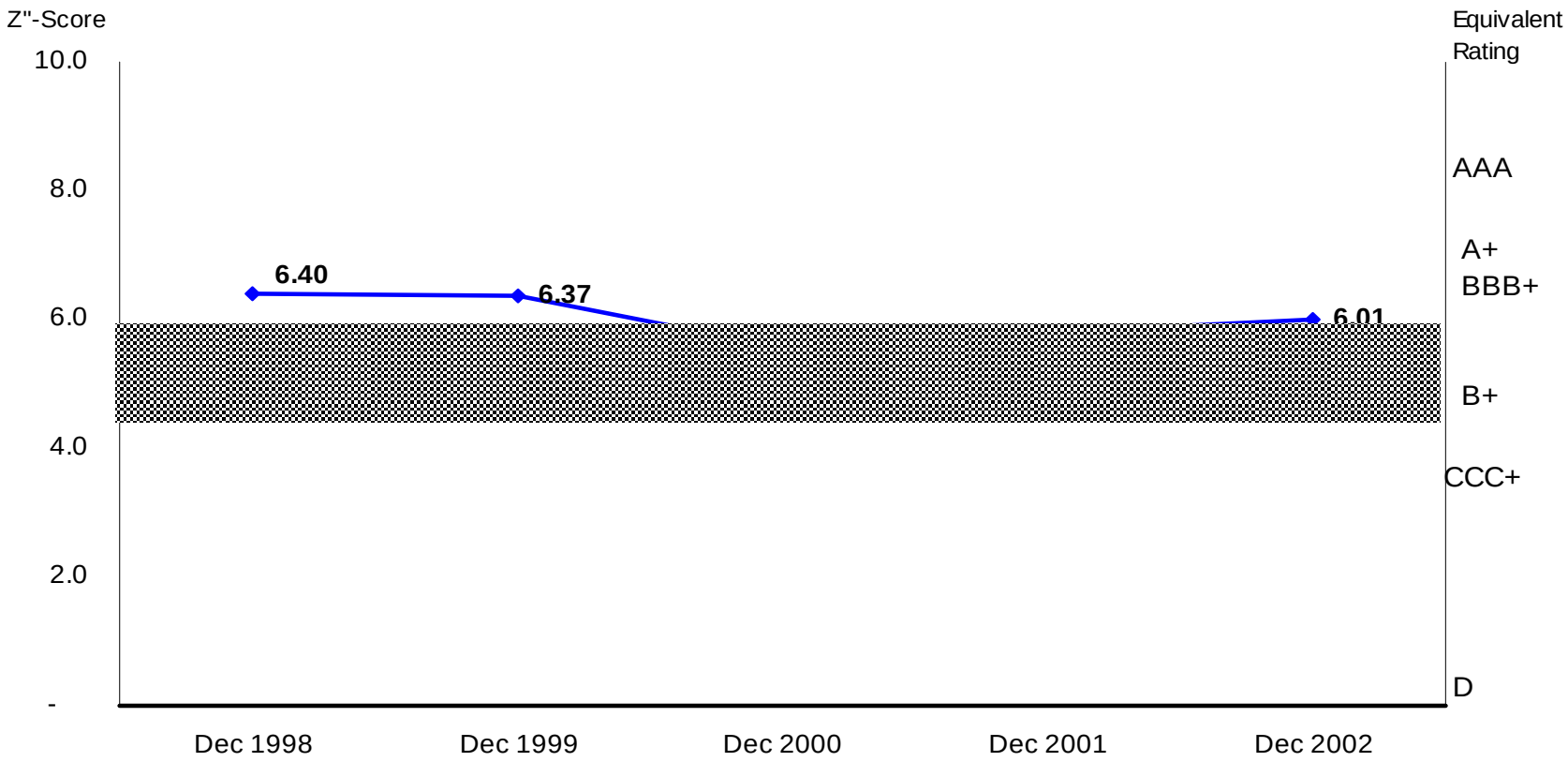
Source: Bloomberg

Grupo Bimbo, S.A. de C.V.



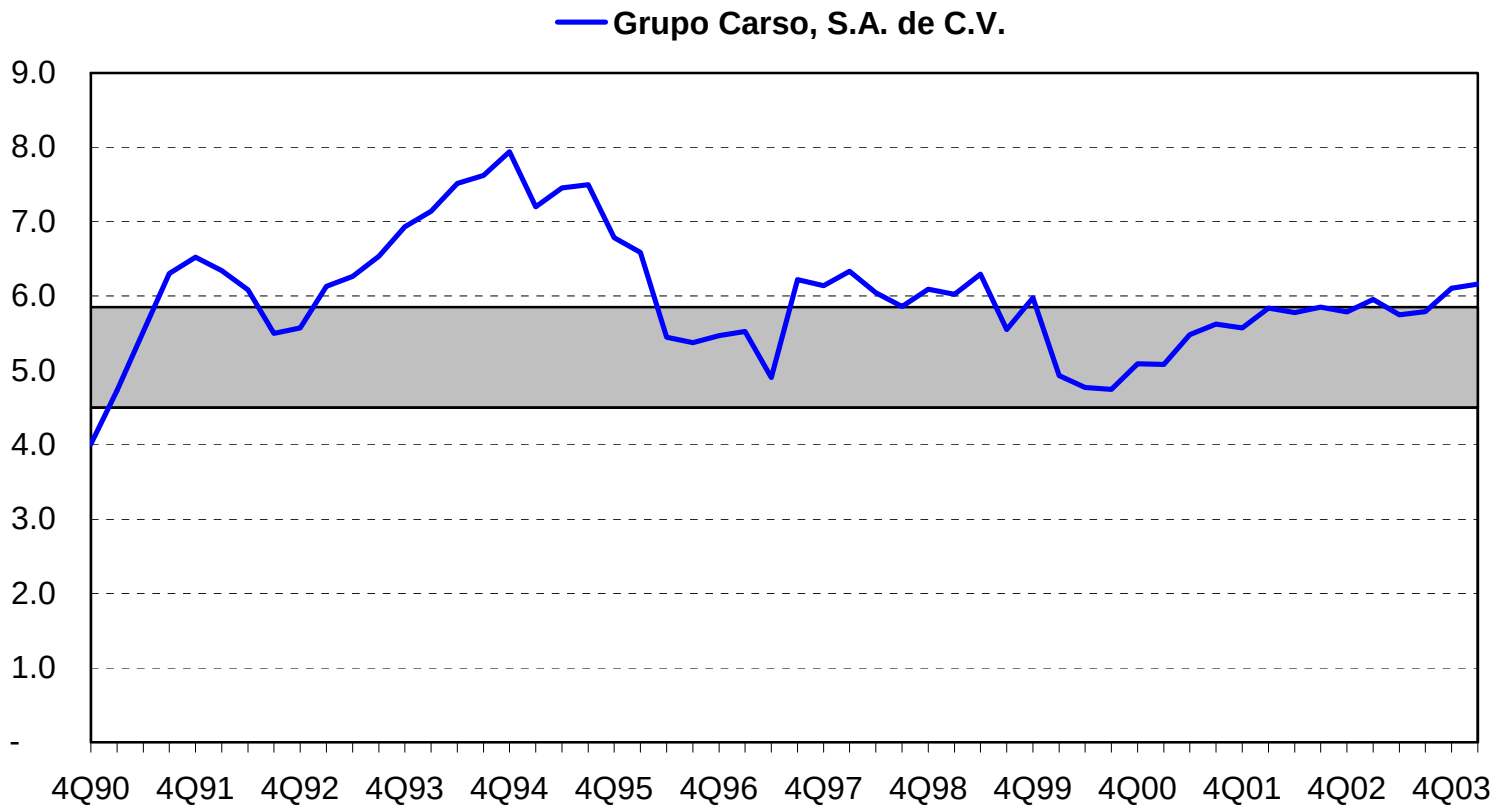
Grupo Carso SA de CV

(holding company in diverse industries (e.g. tobacco; mining, hospitality, retail, music stores,…))

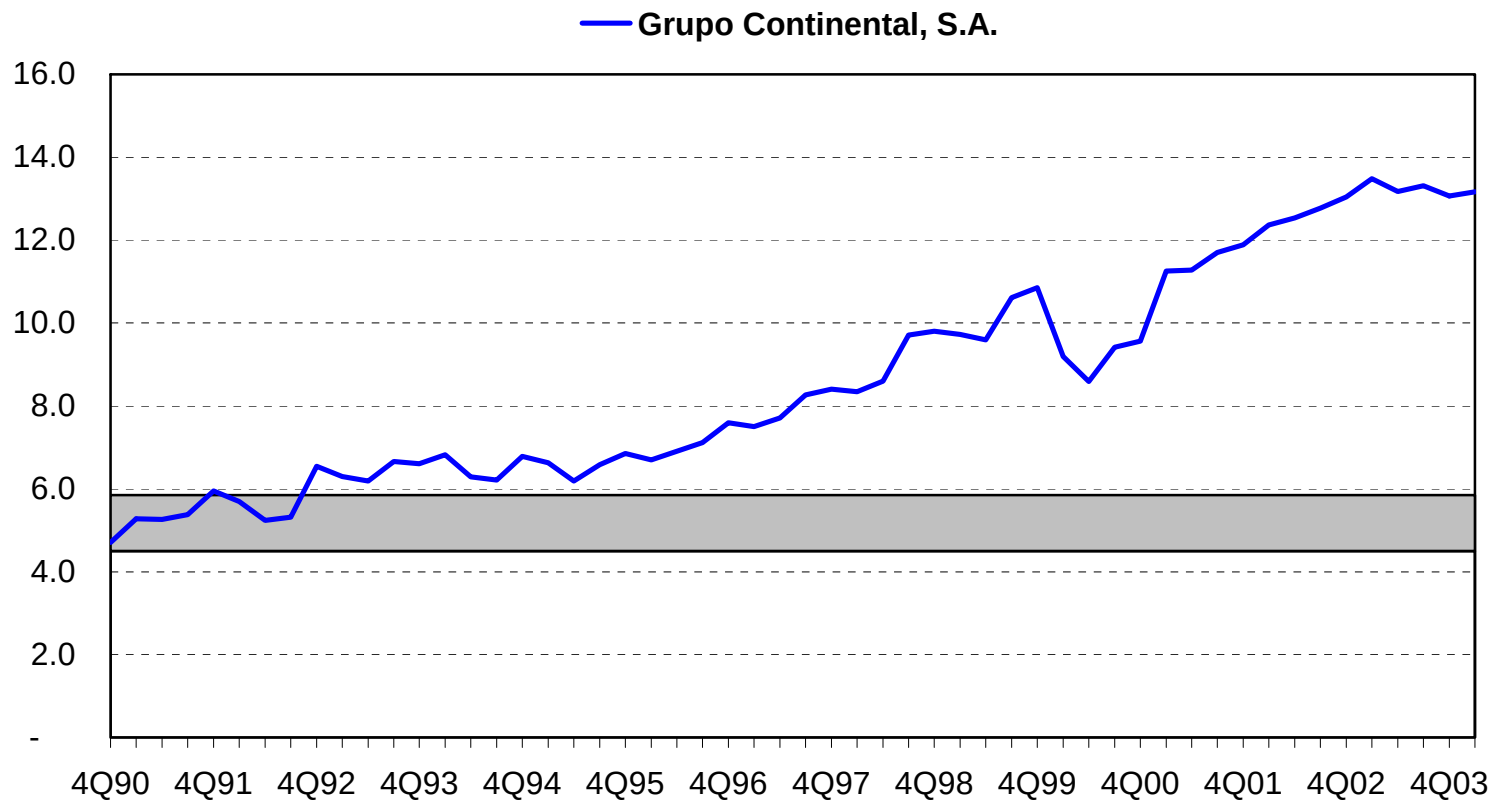


Source: Bloomberg

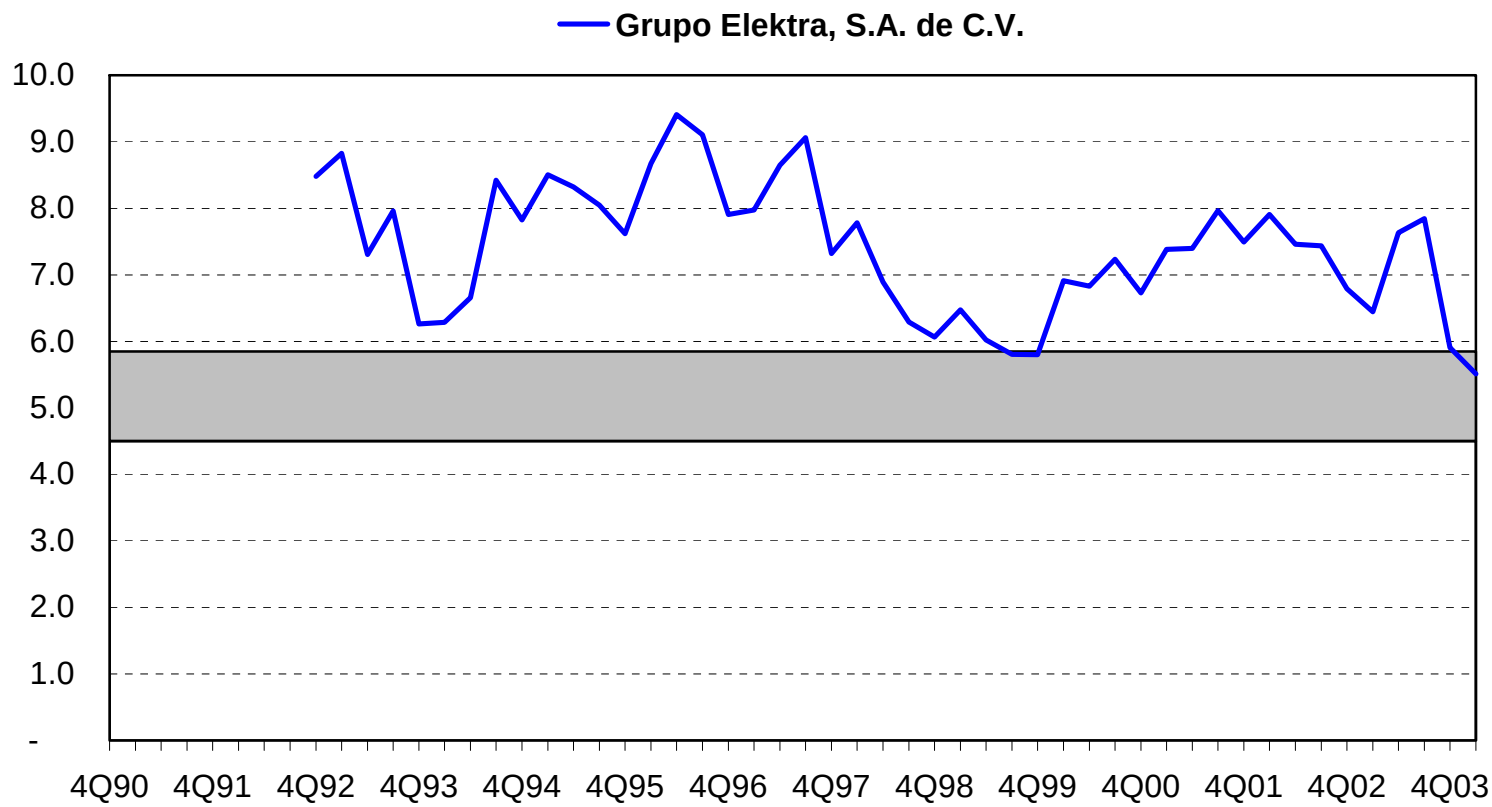
Grupo Carso, S.A. de C.V.



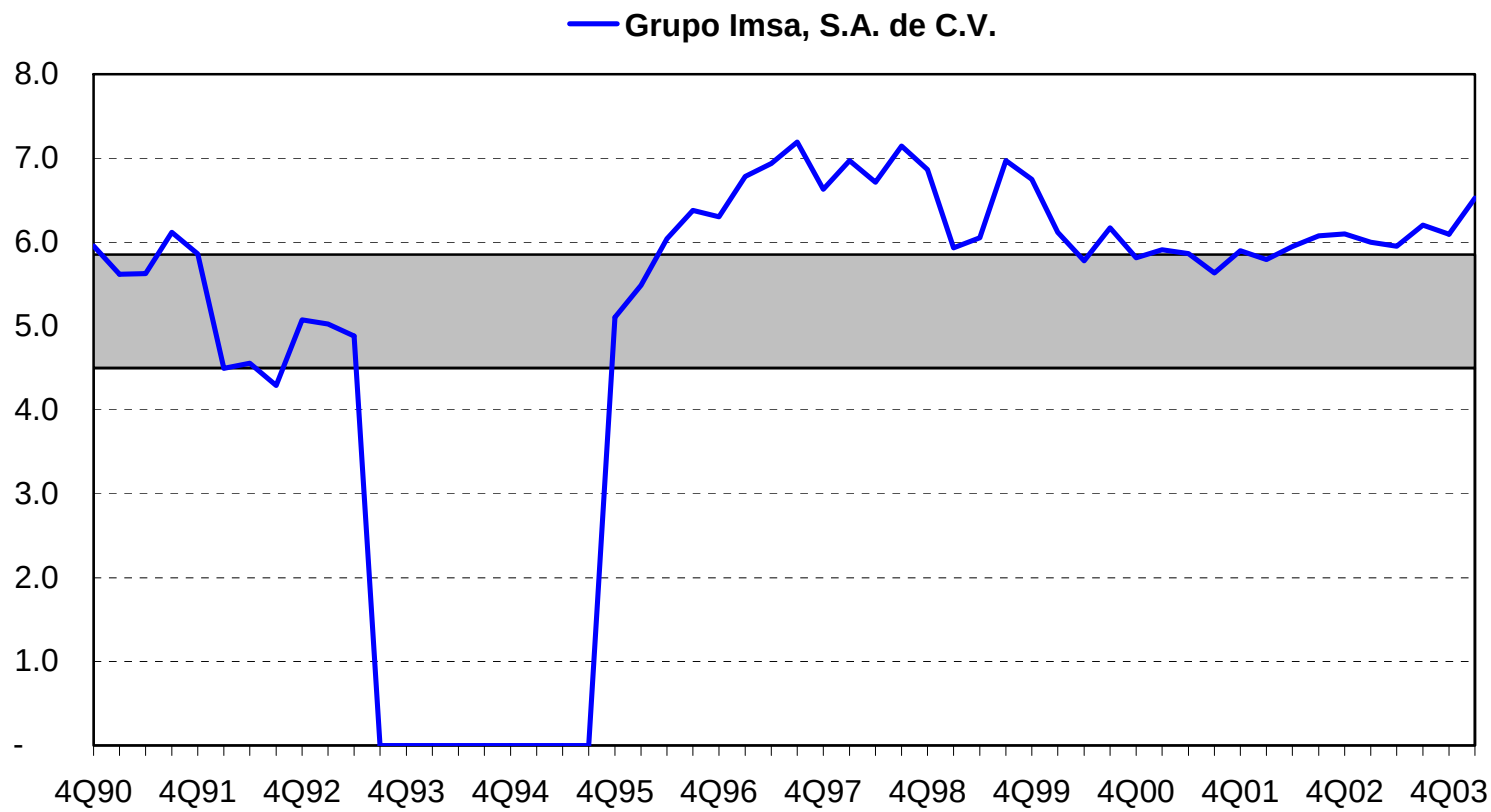
Grupo Continental, S.A.



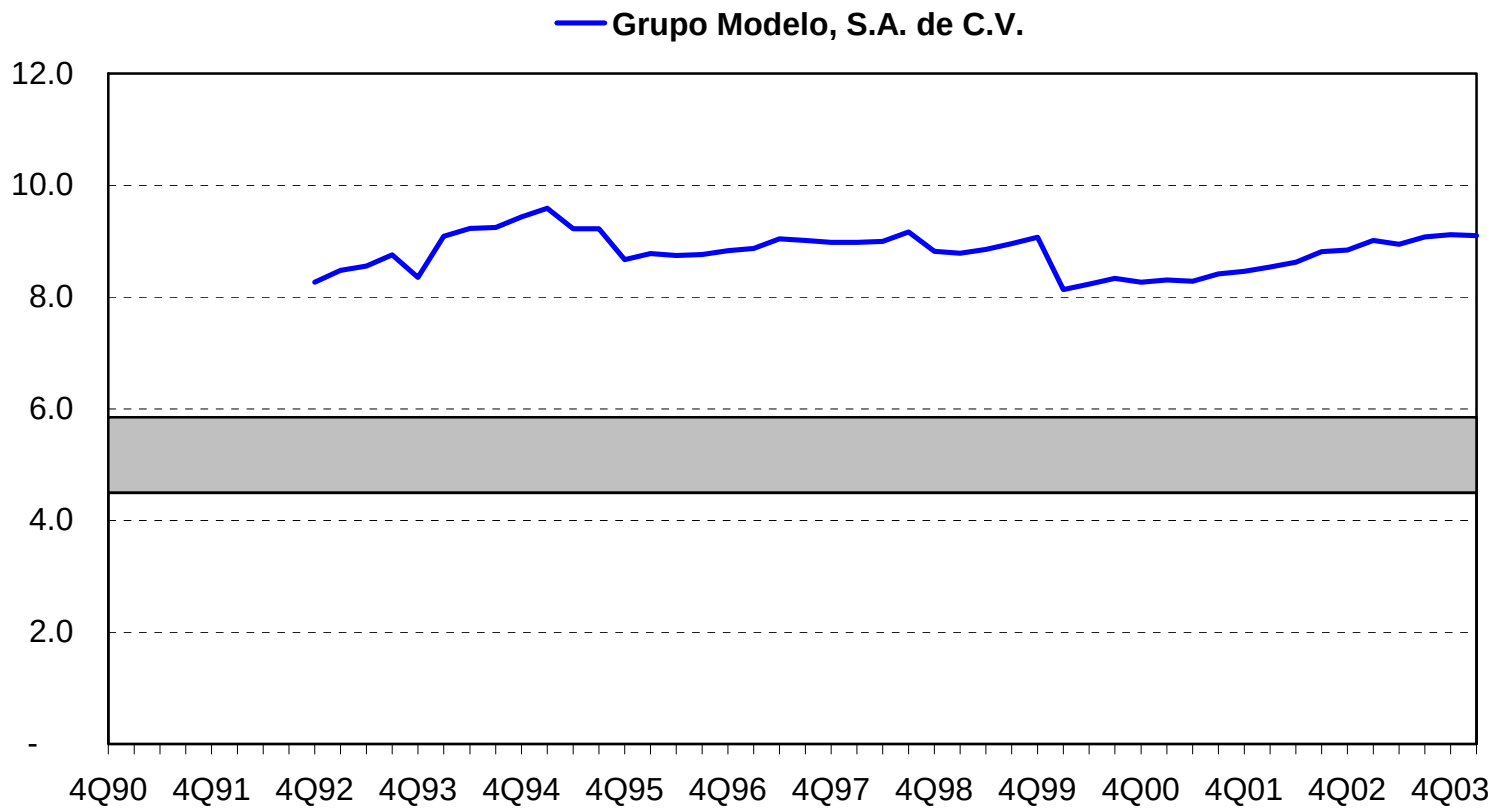
Grupo Elektra, S.A. de C.V.



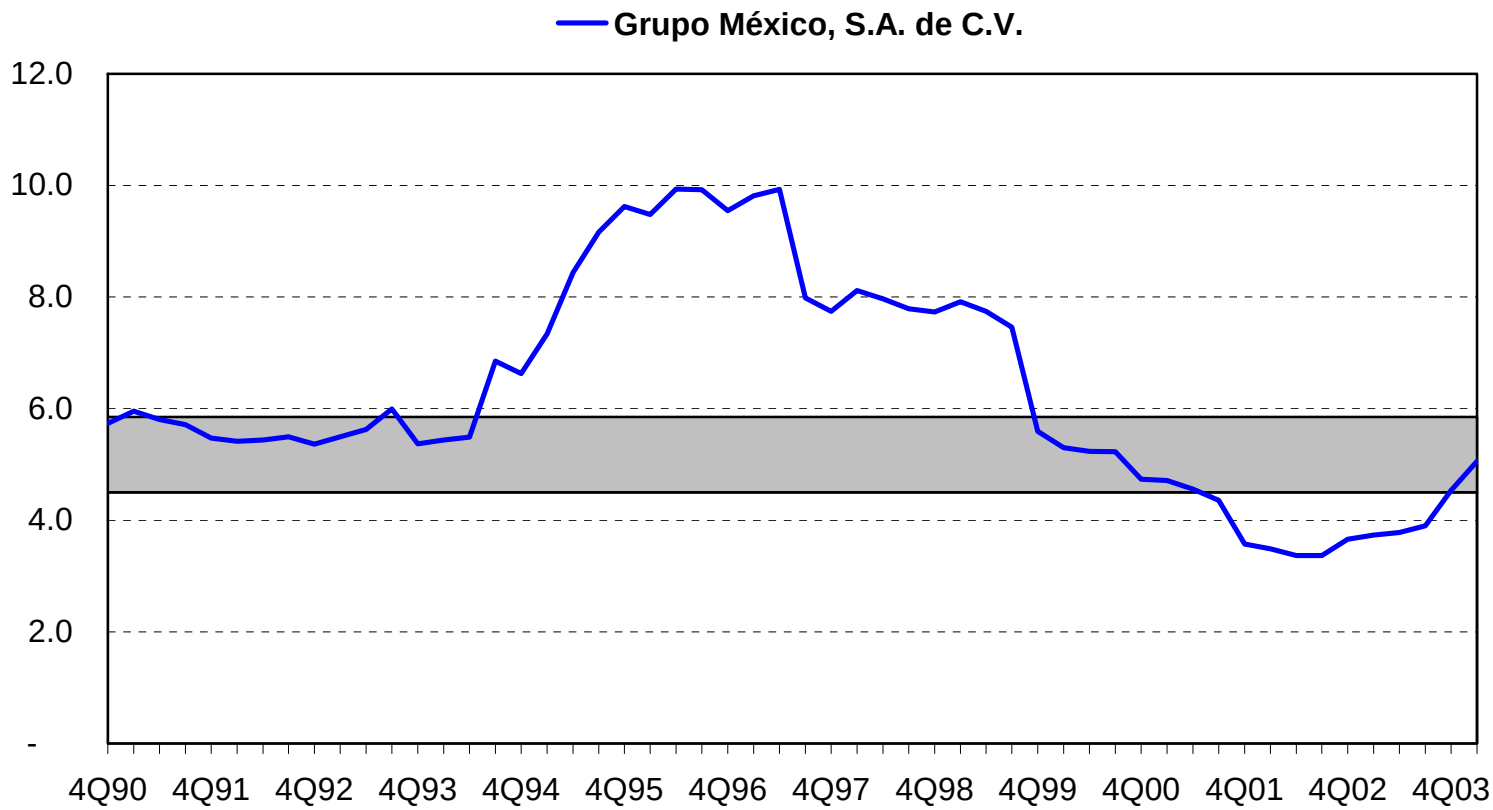
Grupo Imsa, S.A. de C.V.



Grupo Modelo, S.A. de C.V.

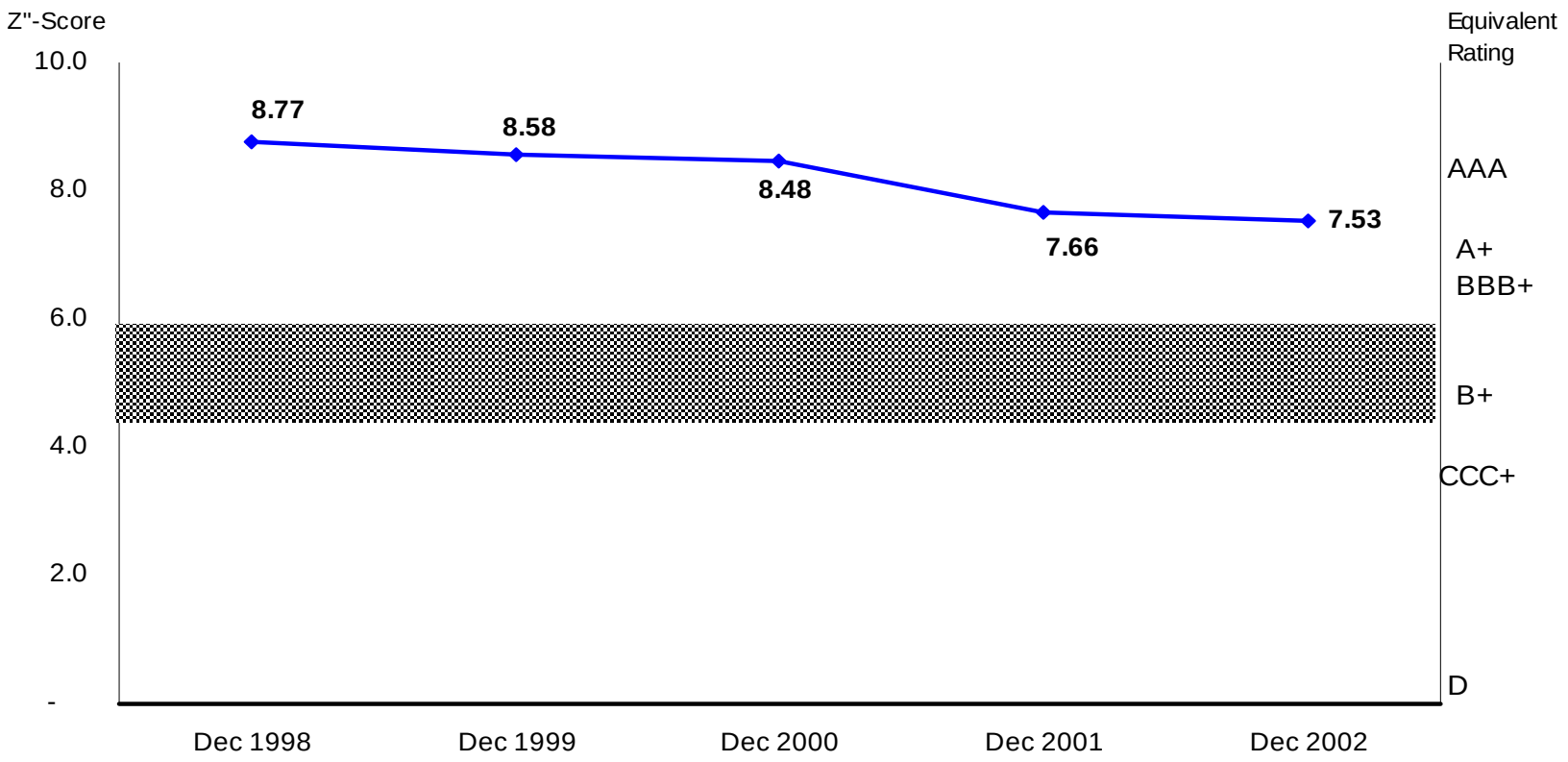


Grupo México, S.A. de C.V.



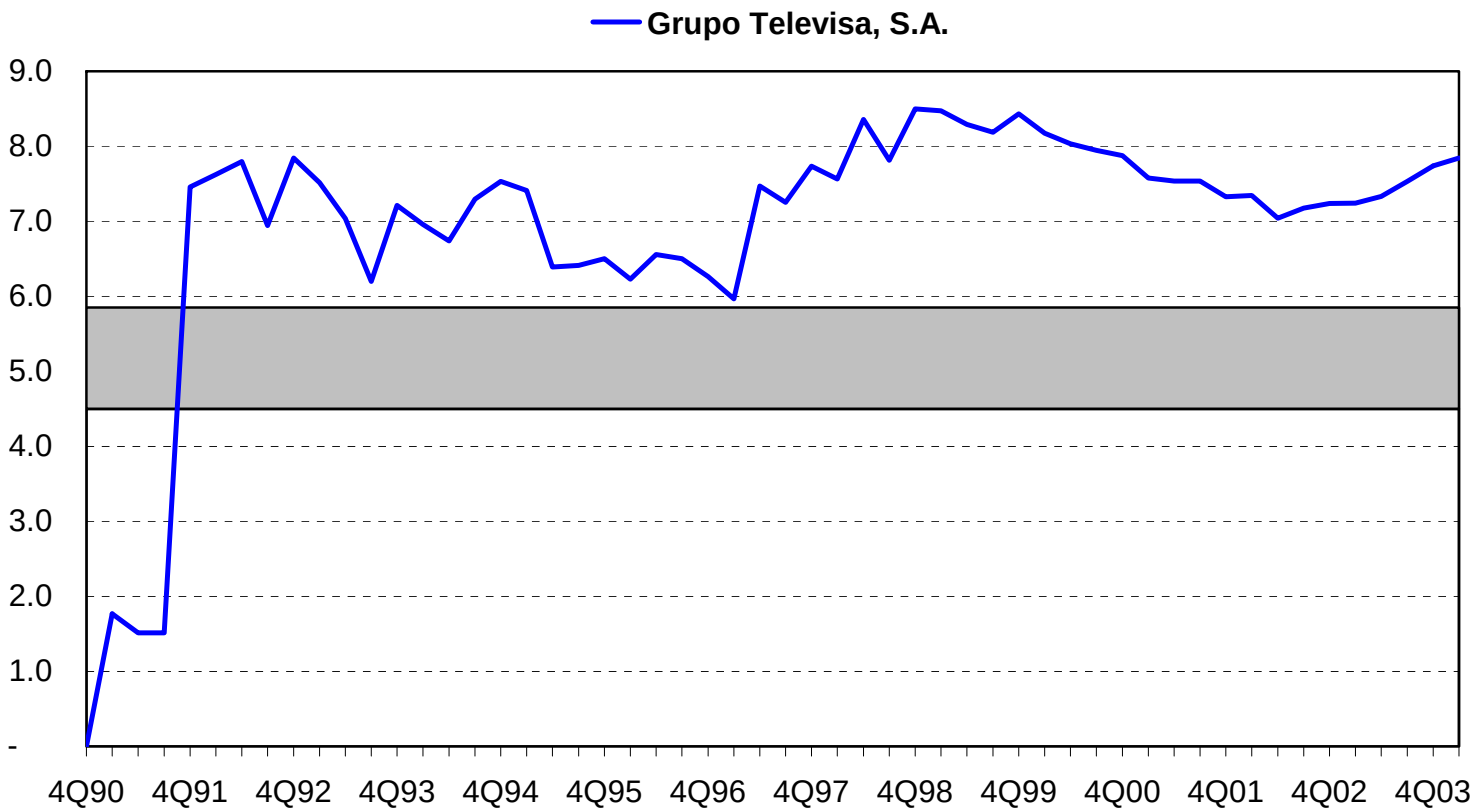
Grupo Televisa SA

(television broadcasting)



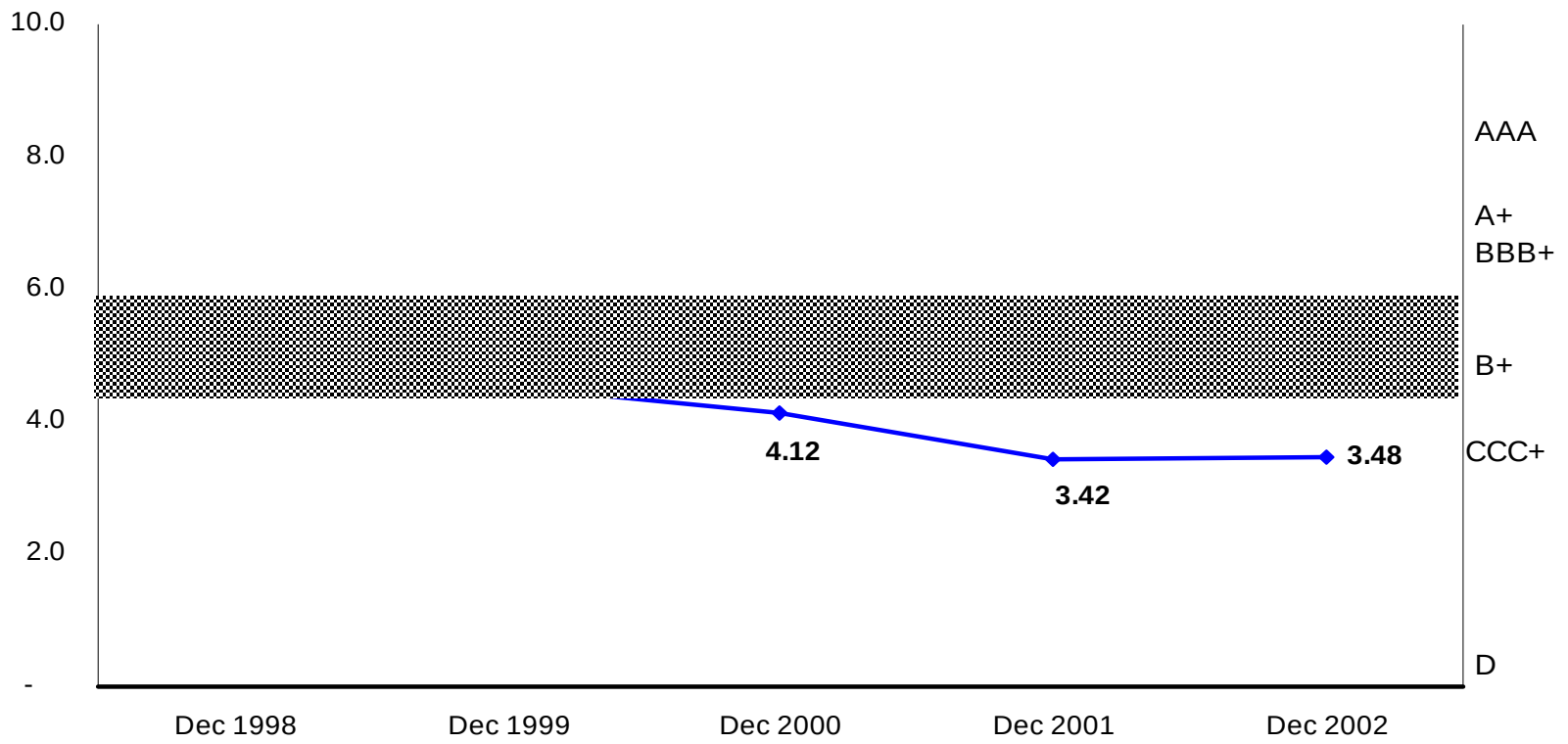
Source: Bloomberg

Grupo Televisa, S.A.



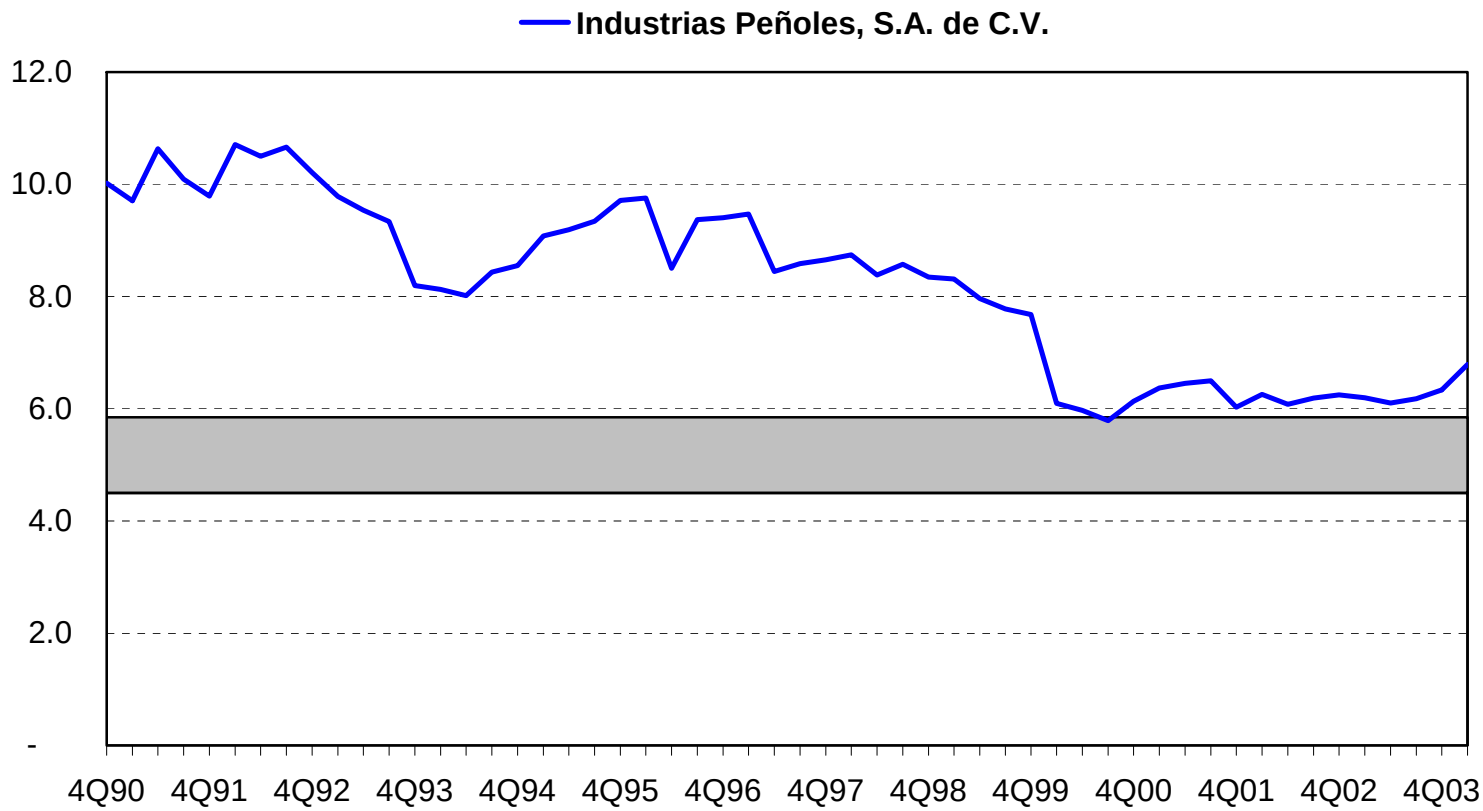
Empresas ICA Sociedad Controladora SA

(construction company)



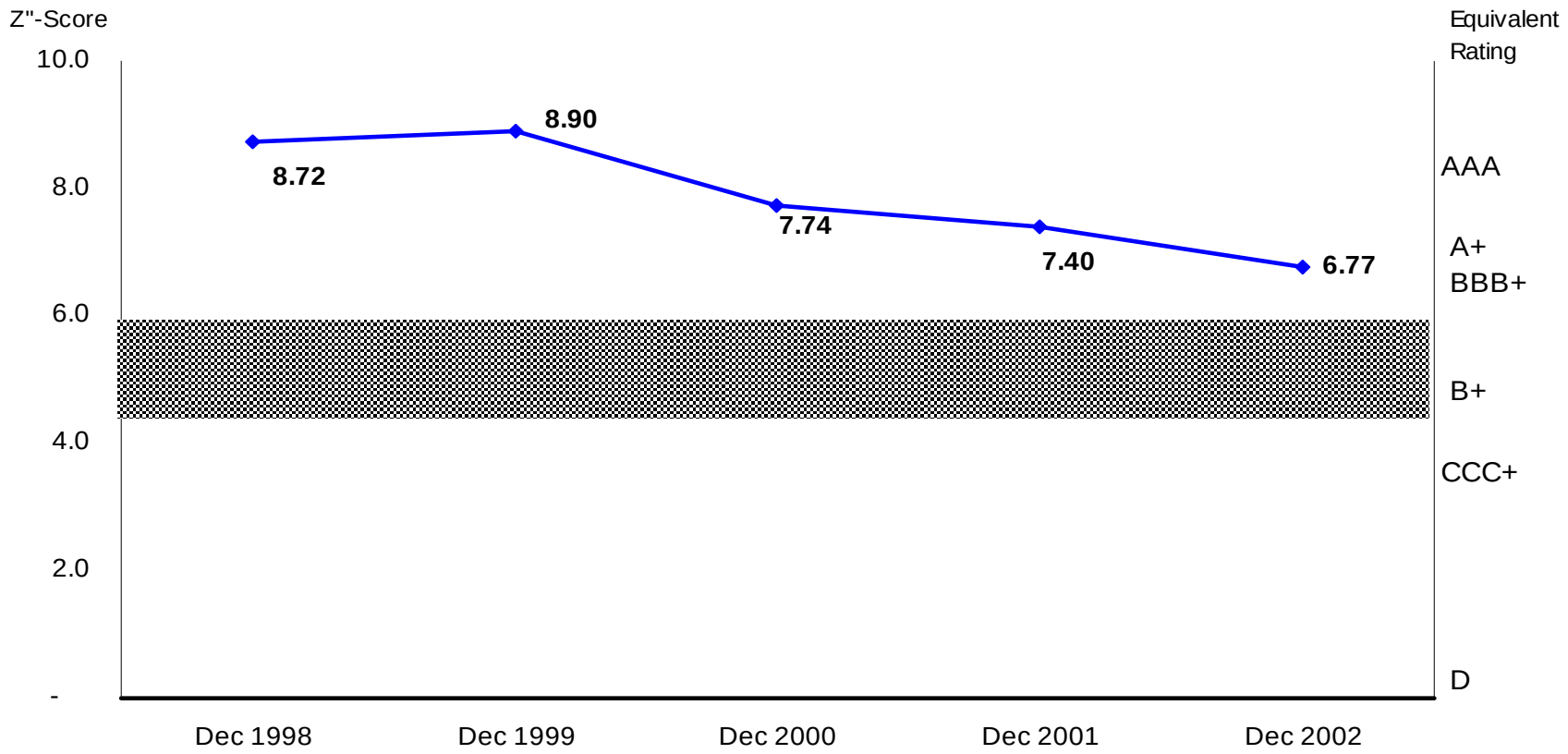
Source: Bloomberg

Industrias Peñoles, S.A. de C.V.



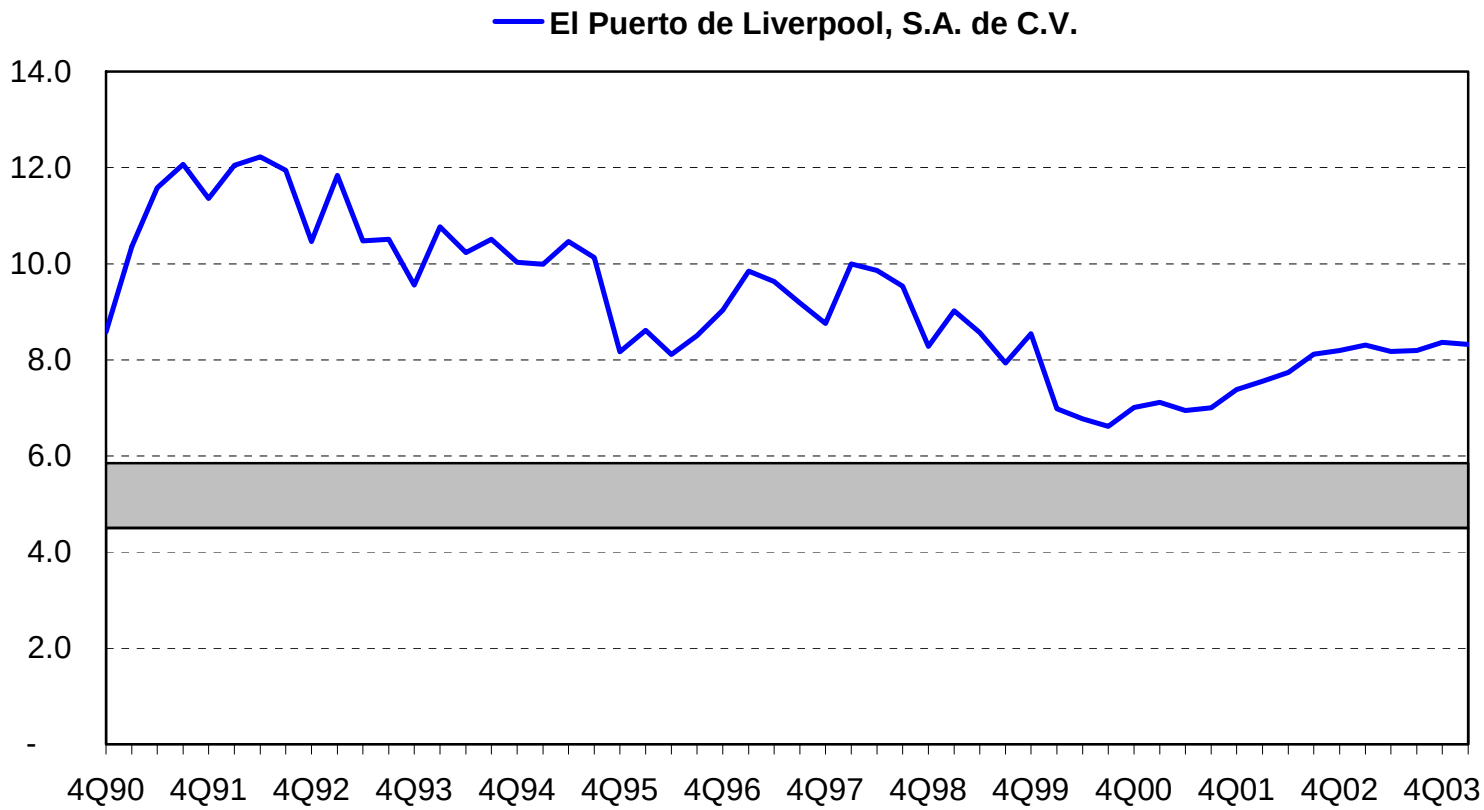
Kimberly-Clark de Mexico SA de CV

(manufacture and sale of consumer and industrial paper products)

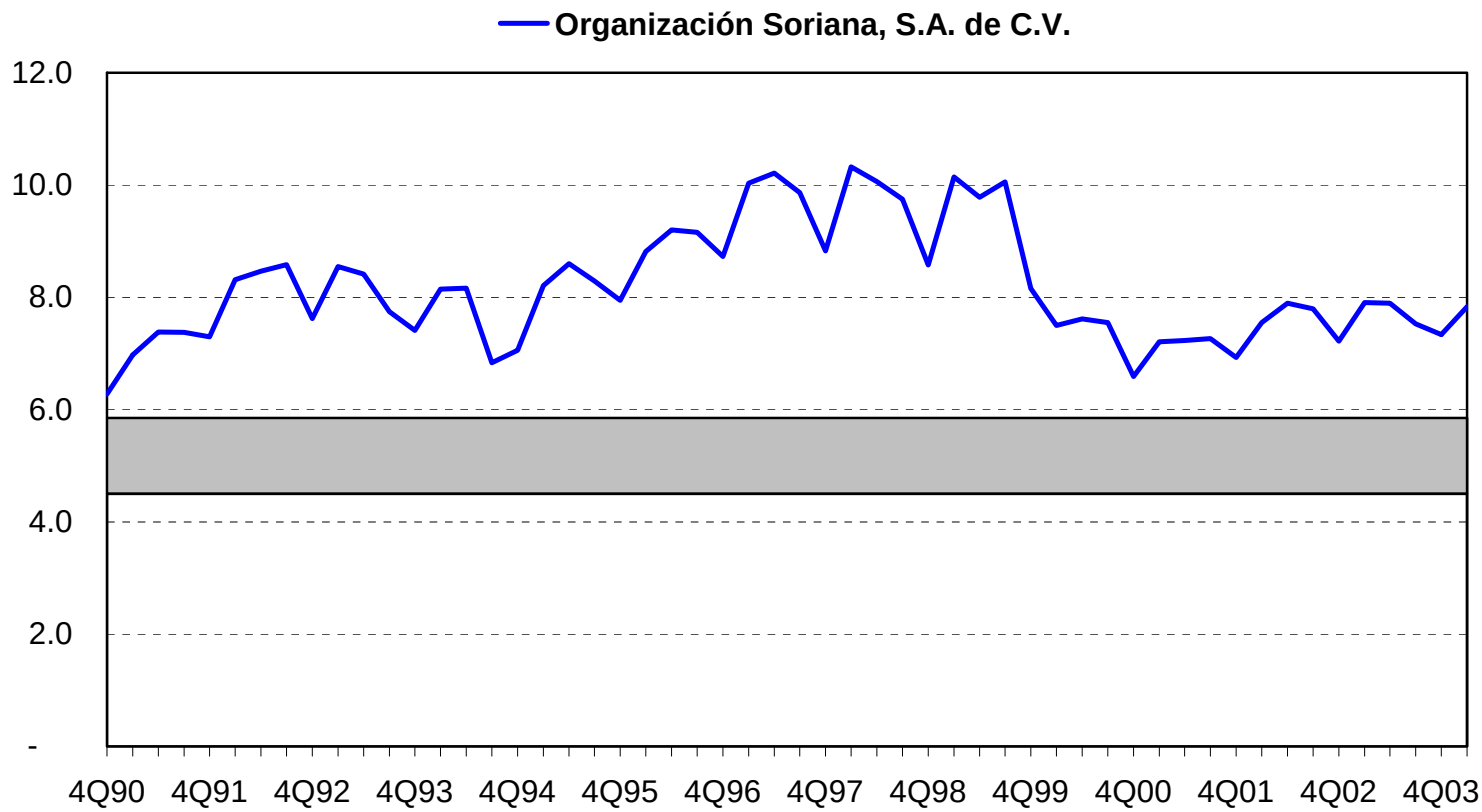


Source: Bloomberg

El Puerto de Liverpool, S.A. de C.V.

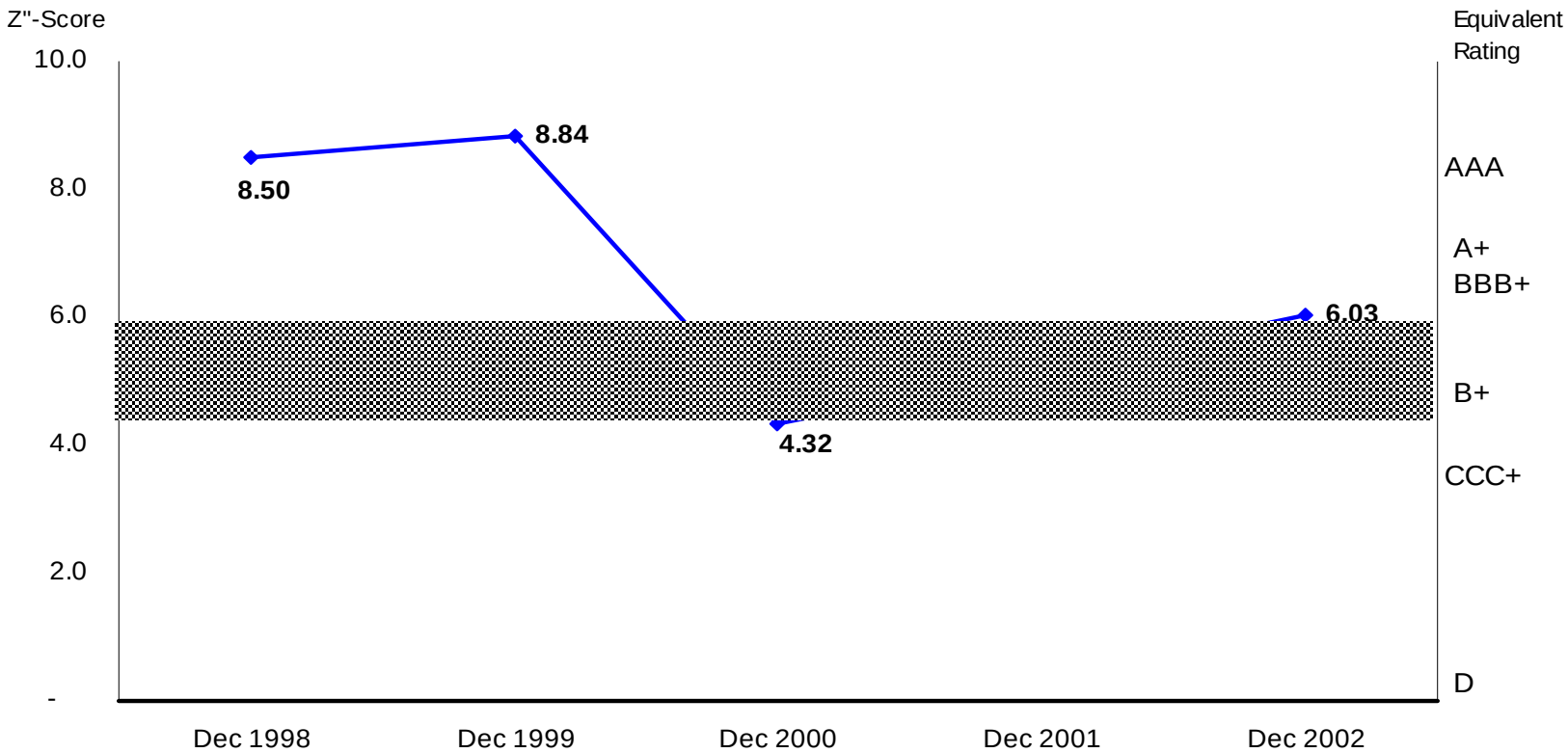


Organización Soriana, S.A. de C.V.



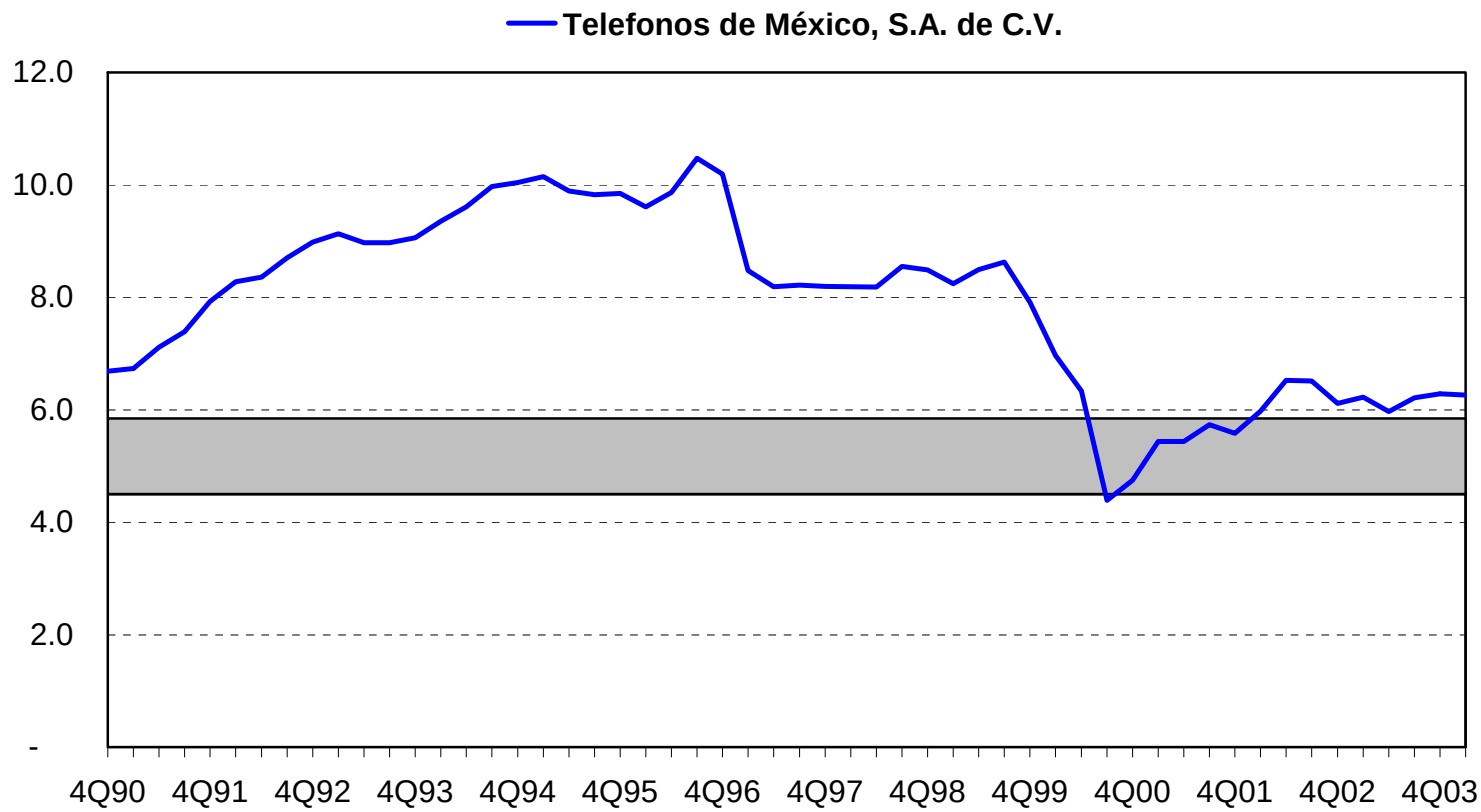
Telefonos de Mexico SA de CV

(provide telecommunications services (TELMEX))

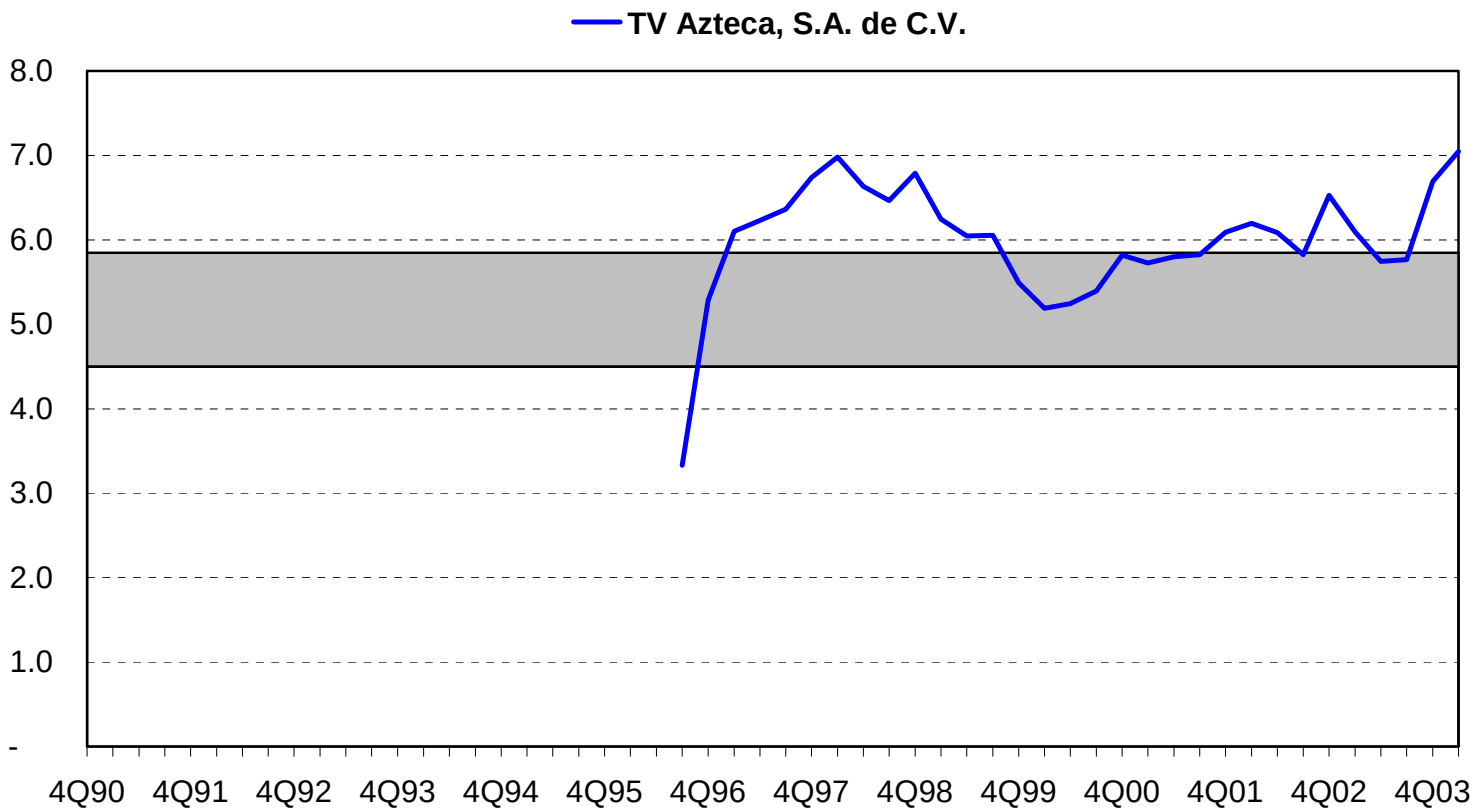


Source: Bloomberg

Telefonos de México, S.A. de C.V.

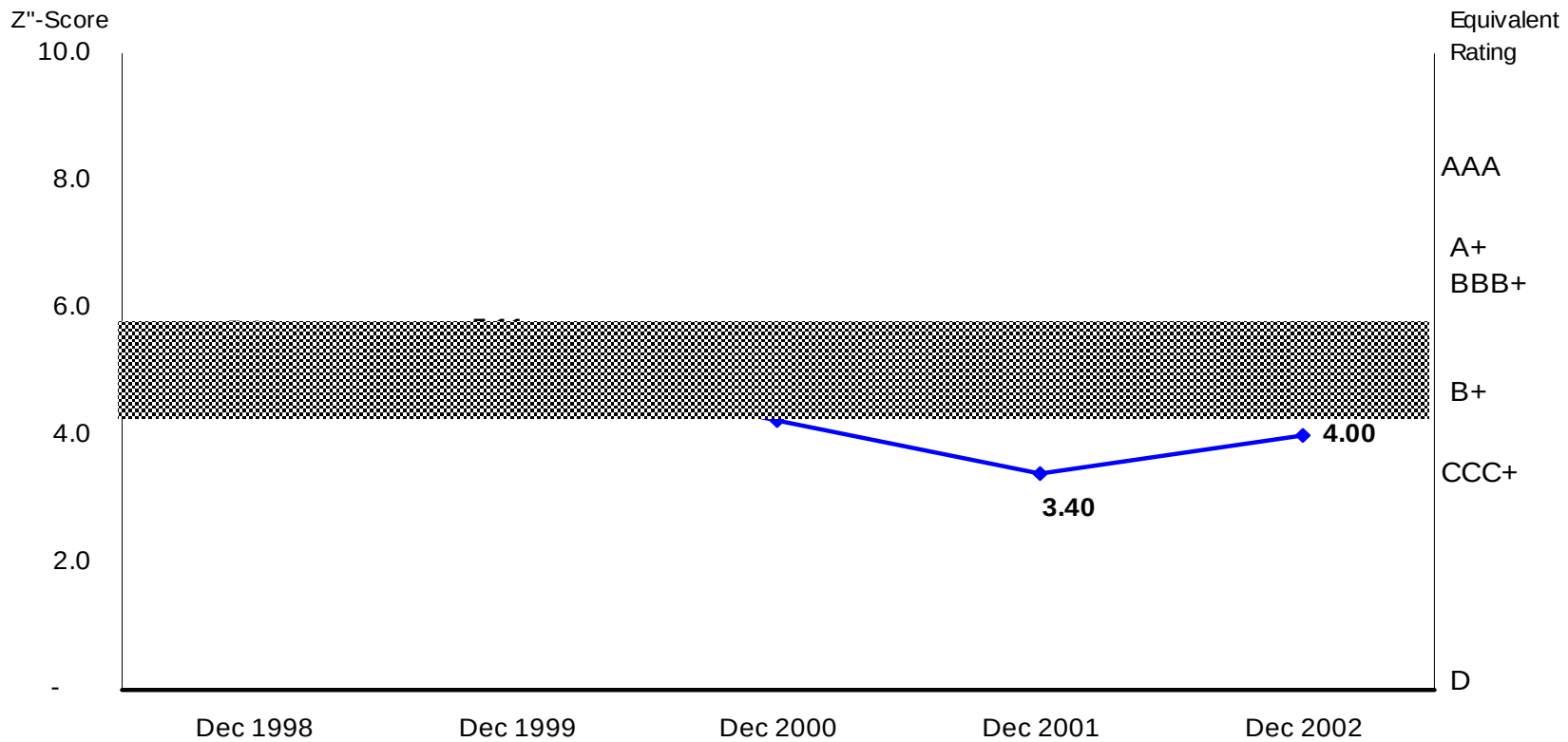


TV Azteca, S.A. de C.V.



Vitro SA de CV

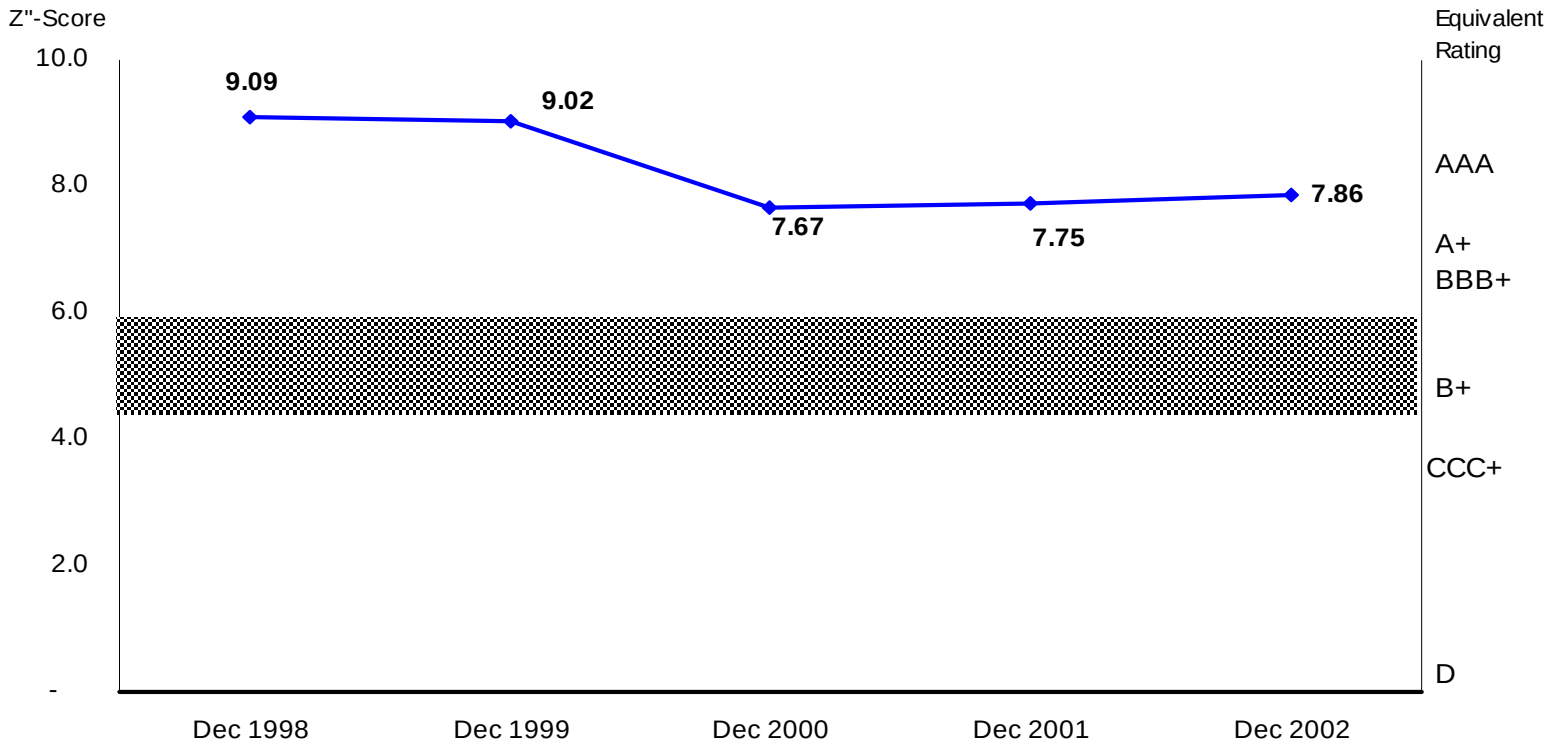
(manufacture and marketing of glass and plastic containers)



Source: Bloomberg

Wal-Mart de Mexico SA de CV

(retail)



Source: Bloomberg

KMV & HIBRYID SCORING MODELS

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).

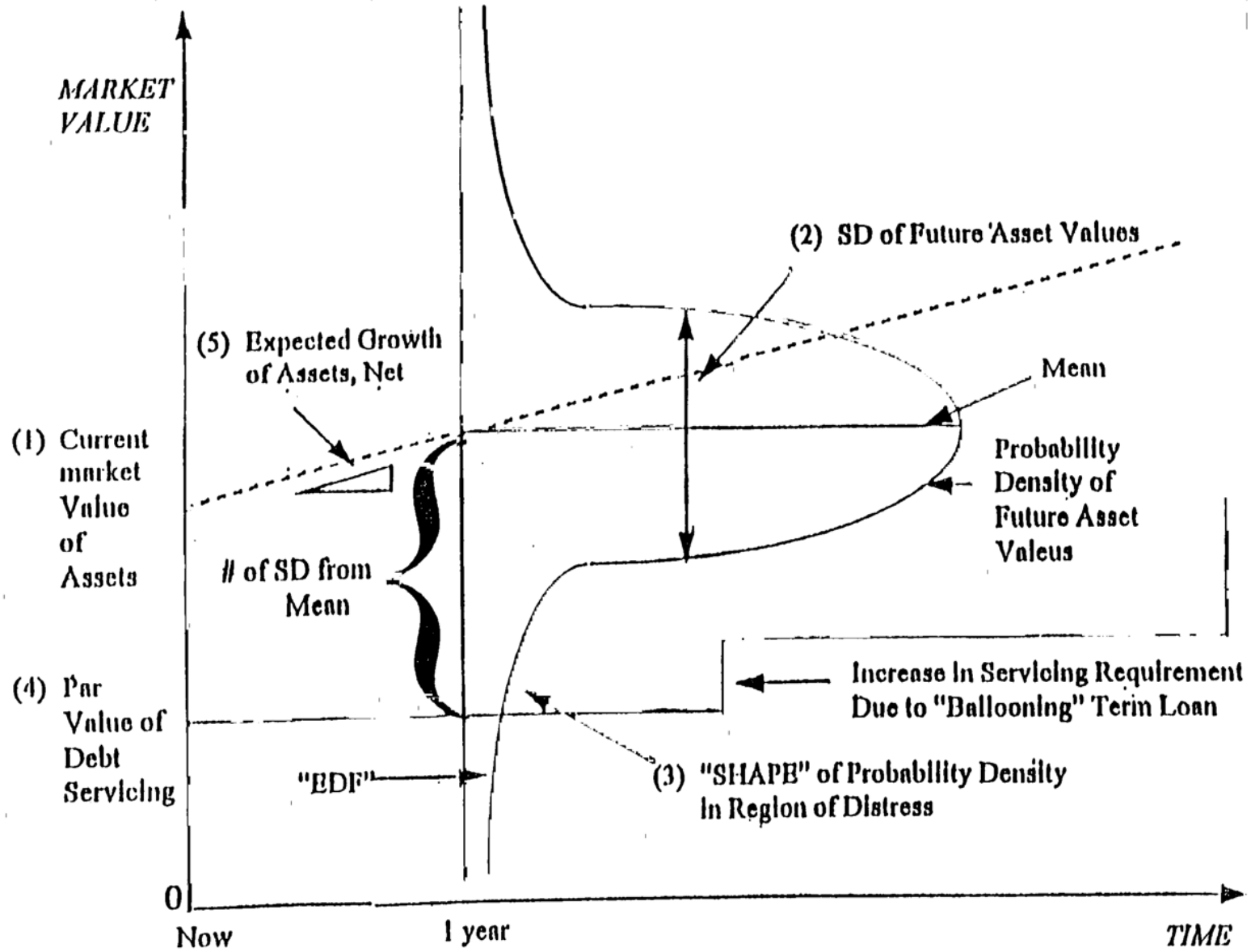
- When MV Assets < Payable Liabilities then Firm Defaults. Firm Cannot Sell Off Assets or Raise Additional Capital Because All Existing Assets are Fully Encumbered.

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)


MARKET VALUE
(2) SD of Future Asset Values
(5) Expected Growth of Assets, Net
Mean
(1) Current market Value of Assets
Probability Density of Future Asset Values
# of SD from Mean
Increase in Servicing Requirement Due to "Ballooning" Term Loan
(4) Par Value of Debt Servicing
"EDF"
(3) "SHAPE" of Probability Density in Region of Distress
0
Now
1 year
TIME

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

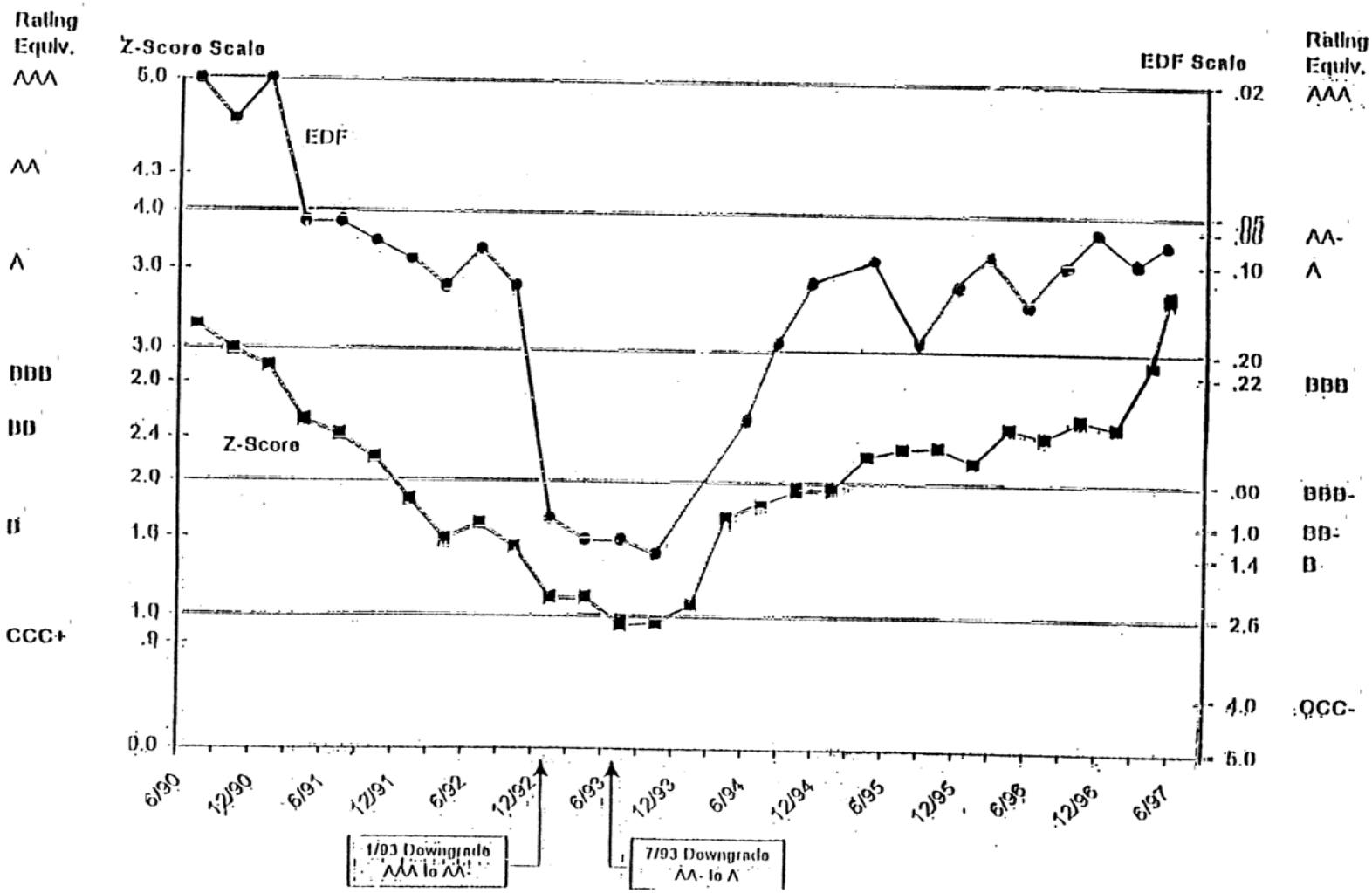
Expected Default Frequency (EDF)

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

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

Comparing Z-Score and KMV-EDF Bond Rating Equivalents

IBM Corporation



Diversification Based on Stock-Market Correlations (KMV)

- Uses Contingent Claims Approach based on the level and volatility of common stock prices to assess the value of the equity and its potential distribution. Compare that distribution of equity values plus the level of debt (total assets) to the anticipated debt level in the future in order to attain the probability of default (assets < liabilities). Losses based on expected recoveries.
- Assess the correlation of each loan's expected return based on correlations of stock prices and the unexpected losses from different combination of Loans.
- Observes the possible Sharpe Ratios (expected return spread / unexpected loss) on various combinations of loans with differential investments (weight) in each loan.
- Stipulates the official frontier portfolio.

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)

Argenti (A Score System)

Defects

In Management

Weight

8 - Chief Executive is an autocrat

4 - He is also the chairman

2 - Passive Board - an autocrat assures this

2 - Unbalanced Board - too many engineers or too many finance types

1 - Poor management depth

In Accountancy

3 - No budgets or budgetary controls

3 - No cash flow plans, or not updated

3 - No costing system. Cost and contribution of each product unknown

15 - Poor response to change, old fashioned product, obsolete factory, out-of-date marketing

Total Defects 42 Pass 10

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"