The Evolution & Applications of the Altman Z-Score Family of Models & Global Credit Markets Commentary

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Global Finance Conference
Hofstra University
New York
May 05, 2017

NYU STERN

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))

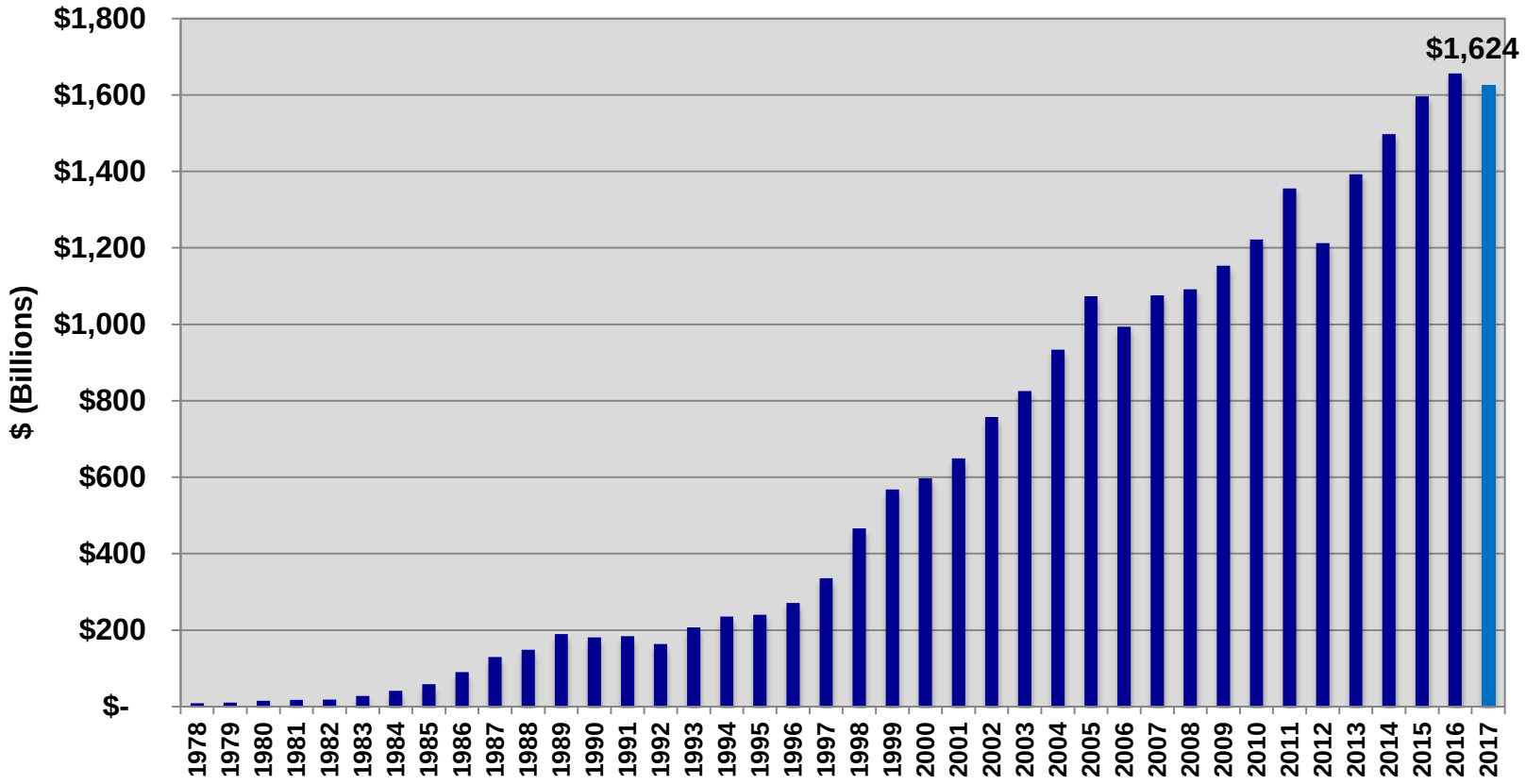
- Option/Contingent Claims Models
  - Risk of Ruin
  - KMV Credit Monitor Model
- Blended Ratio/Market Value Models
  - Moody's *Risk Cal*
  - Bond Score (*Credit Sights*)
  - Z-Score (*Market Value Model*)
- Z-Metrics (MSCI)
  - Blended and Macro Approach

Major Agencies Bond Rating Categories

Moody's		S&P/Fitch
Aaa		AAA
Aa1		AA+
Aa2		AA
Aa3		AA-
A1		A+
A2		A
A3		A-
Baa1		BBB+
Baa2	Investment	BBB
Baa3	Grade	BBB-
Ba1	High Yield	BB+
Ba2	("Junk")	BB
Ba3		BB-
B1		B+
B2		B
B3		B-
Caa1		CCC+
Caa		CCC
Caa3		CCC-
Ca		CC
		C
C		D

Size of the US High-Yield Bond Market

1978 – 2017 *(Mid-year US$ billions)*



Source: NYU Salomon Center estimates using Credit Suisse, S&P and Citi data.

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

Medians of Three- Year (2009-2011) Averages	AAA	AA	A	BBB	BB	B	CCC*
EBITDA margin (%)	27.9	27.6	20.4	19.7	17.6	16.6	
Return on Capital (%)	30.6	23.6	20.7	13.2	10.9	7.8	2.7
EBIT Interest Coverage(x)	33.4	14.2	11.6	5.9	3.0	1.3	0.4
EBITDA Interest Coverage (x)	38.1	19.6	15.3	8.2	4.8	2.3	1.1
Funds from Operations/Total Debt (%)	252.6	64.7	52.6	33.7	24.9	11.7	2.5
Free Operating Cash Flow/Total Debt (%)	208.2	51.3	35.7	19.0	11.1	3.9	(3.6)
Disc. Cash Flow/Debt (%)	142.8	32.0	26.1	13.9	8.8	3.1	
Total Debt/EBITDA (x)	0.4	1.2	1.5	2.3	3.2	5.5	8.6
Total Debt/Total Debt + Equity (%)	14.7	29.2	33.8	43.5	52.2	75.2	98.9
No. of Companies	4	14	93	227	260	287	

* 2005-2007

Source: Standard & Poor's, CreditStats: 2011 Industrial Comparative Ratio Analysis, Long-Term Debt – US (RatingsDirect, August 2012).

Key Industrial Financial Ratios
(Europe, Middle East & Africa Industrial Long-term Debt)

Medians of Three- Year (2008-2010) Averages	AA	A	BBB	BB	B
EBITDA margin (%)	24.9	16.6	15.5	17.6	16.3
Return on Capital (%)	20.0	15.3	11.2	9.3	6.7
EBIT Interest Coverage(x)	15.7	7.0	3.9	3.1	1.0
EBITDA Interest Coverage (x)	18.5	9.5	5.7	4.6	2.0
Funds from Operations/Total Debt (%)	83.4	45.7	32.3	22.7	10.5
Free Operating Cash Flow/Total Debt (%)	57.8	23.2	16.0	7.1	1.3
Disc. Cash Flow/Debt (%)	30.5	12.5	8.0	3.4	0.8
Total Debt/EBITDA (x)	0.9	1.6	2.6	3.2	5.8
Total Debt/Total Debt + Equity (%)	25.7	33.8	44.4	51.9	75.8
No. of Companies	8	55	104	58	55

Source: Standard & Poor's, CreditStats: 2010 Adjusted Key US & European Industrial and Utility Financial Ratios (RatingsDirect, August 2011).

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

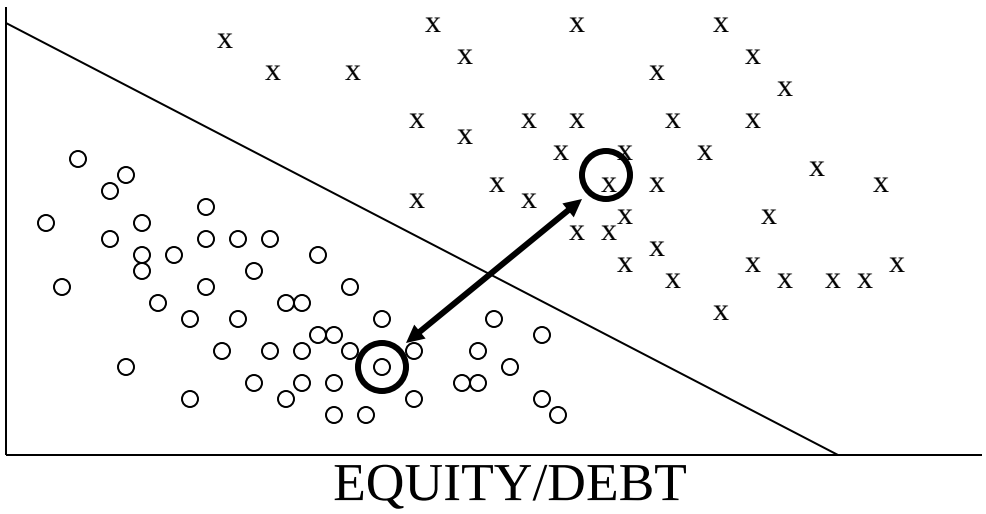
$Z = a_1x_1 + a_2x_2 + a_3x_3 + \ldots\ldots + a_nx_n$

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 and Weightings

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

Zones of Discrimination: Original Z - Score Model (1968)

Z > 2.99 - "Safe" Zone
1.8 < Z < 2.99 - "Grey" Zone
Z < 1.80 - "Distress" Zone

Time Series Impact On Corporate Z-Scores

- Credit Risk Migration
  - Greater Use of Leverage
  - Impact of HY Bond & LL Markets
  - Global Competition
  - More and Larger Bankruptcies

- Increased Type II Error

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 Cumulative Defaults)
- Utilizing mortality or cumulative default rates to estimate marginal and cumulative defaults
- Estimating Default Recoveries and Probability of Loss

or

Method #2

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

Median Z-Score by S&P Bond Rating for U.S. Manufacturing Firms: 1992 - 2013

Rating	2013 (No.)	2004-2010	1996-2001	1992-1995
AAA/AA	4.13 (15)	4.18	6.20*	4.80*
A	4.00 (64)	3.71	4.22	3.87
BBB	3.01 (131)	3.26	3.74	2.75
BB	2.69 (119)	2.48	2.81	2.25
B	1.66 (80)	1.74	1.80	1.87
CCC/CC	0.23 (3)	0.46	0.33	0.40
D	0.01 (33)	-0.04	-0.20	0.05

*AAA Only.

Sources: Compustat Database, mainly S&P 500 firms, compilation by NYU Salomon Center, Stern School of Business.

Marginal and Cumulative Mortality Rate Actuarial Approach

$$\mathbf{MMR_{(r,t)}} \quad \frac{\textit{total value of defaulting debt from rating (r) in year (t)}}{\textit{total value of the population at the start of the year (t)}}$$

$\overline{M}$MR = 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,

$$\boldsymbol{CMR}_{(r,t)} = 1 - \Pi\, SR_{(r,t)}\,,$$
$$t = 1 \rightarrow N$$
$$r = AAA \rightarrow CCC$$

here $CMR_{(r,t)}$ = Cumulative Mortality Rate of (r) in (t),

$SR_{(r,t)}$ = Survival Rate in $_{(r,t)}$, 1 - $MMR_{(r,t)}$

Mortality Rates by Original Rating

All Rated Corporate Bonds*
1971-2016

Years After Issuance

		1	2	3	4	5	6	7	8	9	10
AAA	Marginal	0.00%	0.00%	0.00%	0.00%	0.01%	0.02%	0.01%	0.00%	0.00%	0.00%
	Cumulative	0.00%	0.00%	0.00%	0.00%	0.01%	0.03%	0.04%	0.04%	0.04%	0.04%
AA	Marginal	0.00%	0.00%	0.20%	0.06%	0.02%	0.01%	0.01%	0.01%	0.02%	0.01%
	Cumulative	0.00%	0.00%	0.20%	0.26%	0.28%	0.29%	0.30%	0.31%	0.33%	0.34%
A	Marginal	0.01%	0.03%	0.11%	0.12%	0.09%	0.05%	0.02%	0.24%	0.07%	0.04%
	Cumulative	0.01%	0.04%	0.15%	0.27%	0.36%	0.41%	0.43%	0.67%	0.74%	0.78%
BBB	Marginal	0.32%	2.34%	1.24%	0.98%	0.49%	0.22%	0.25%	0.16%	0.17%	0.33%
	Cumulative	0.32%	2.65%	3.86%	4.80%	5.27%	5.48%	5.71%	5.86%	6.02%	6.33%
BB	Marginal	0.92%	2.04%	3.85%	1.95%	2.42%	1.56%	1.44%	1.10%	1.41%	3.11%
	Cumulative	0.92%	2.94%	6.68%	8.50%	10.71%	12.11%	13.37%	14.32%	15.53%	18.16%
B	Marginal	2.86%	7.67%	7.78%	7.75%	5.74%	4.46%	3.60%	2.05%	1.73%	0.75%
	Cumulative	2.86%	10.31%	17.29%	23.70%	28.08%	31.29%	33.76%	35.12%	36.24%	36.72%
CCC	Marginal	8.11%	12.40%	17.75%	16.25%	4.90%	11.62%	5.40%	4.75%	0.64%	4.26%
	Cumulative	8.11%	19.50%	33.79%	44.55%	47.27%	53.40%	55.91%	58.01%	58.28%	60.05%

*Rated by S&P at Issuance
Based on 3,280 issues

Source: Standard & Poor's (New York) and Author's Compilation

Mortality Losses by Original Rating

All Rated Corporate Bonds*
1971-2016

Years After Issuance

		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%	0.03%	0.02%	0.01%	0.01%	0.00%	0.01%	0.01%	0.01%
	Cumulative	0.00%	0.00%	0.03%	0.05%	0.06%	0.07%	0.07%	0.08%	0.09%	0.10%
A	Marginal	0.00%	0.01%	0.04%	0.05%	0.05%	0.04%	0.02%	0.02%	0.05%	0.03%
	Cumulative	0.00%	0.01%	0.05%	0.10%	0.15%	0.19%	0.21%	0.23%	0.28%	0.31%
BBB	Marginal	0.23%	1.53%	0.70%	0.58%	0.26%	0.16%	0.10%	0.09%	0.10%	0.18%
	Cumulative	0.23%	1.76%	2.44%	3.01%	3.26%	3.42%	3.51%	3.60%	3.70%	3.87%
BB	Marginal	0.55%	1.18%	2.30%	1.11%	1.38%	0.74%	0.78%	0.48%	0.73%	1.09%
	Cumulative	0.55%	1.72%	3.98%	5.05%	6.36%	7.05%	7.78%	8.22%	8.89%	9.88%
B	Marginal	1.92%	5.38%	5.32%	5.20%	3.79%	2.45%	2.34%	1.13%	0.91%	0.53%
	Cumulative	1.92%	7.20%	12.13%	16.70%	19.86%	21.82%	23.65%	24.52%	25.20%	25.60%
CCC	Marginal	5.37%	8.68%	12.49%	11.45%	3.42%	8.61%	2.32%	3.34%	0.40%	2.72%
	Cumulative	5.37%	13.58%	24.38%	33.04%	35.33%	40.89%	42.27%	44.19%	44.42%	45.93%

*Rated by S&P at Issuance
Based on 2,714 issues

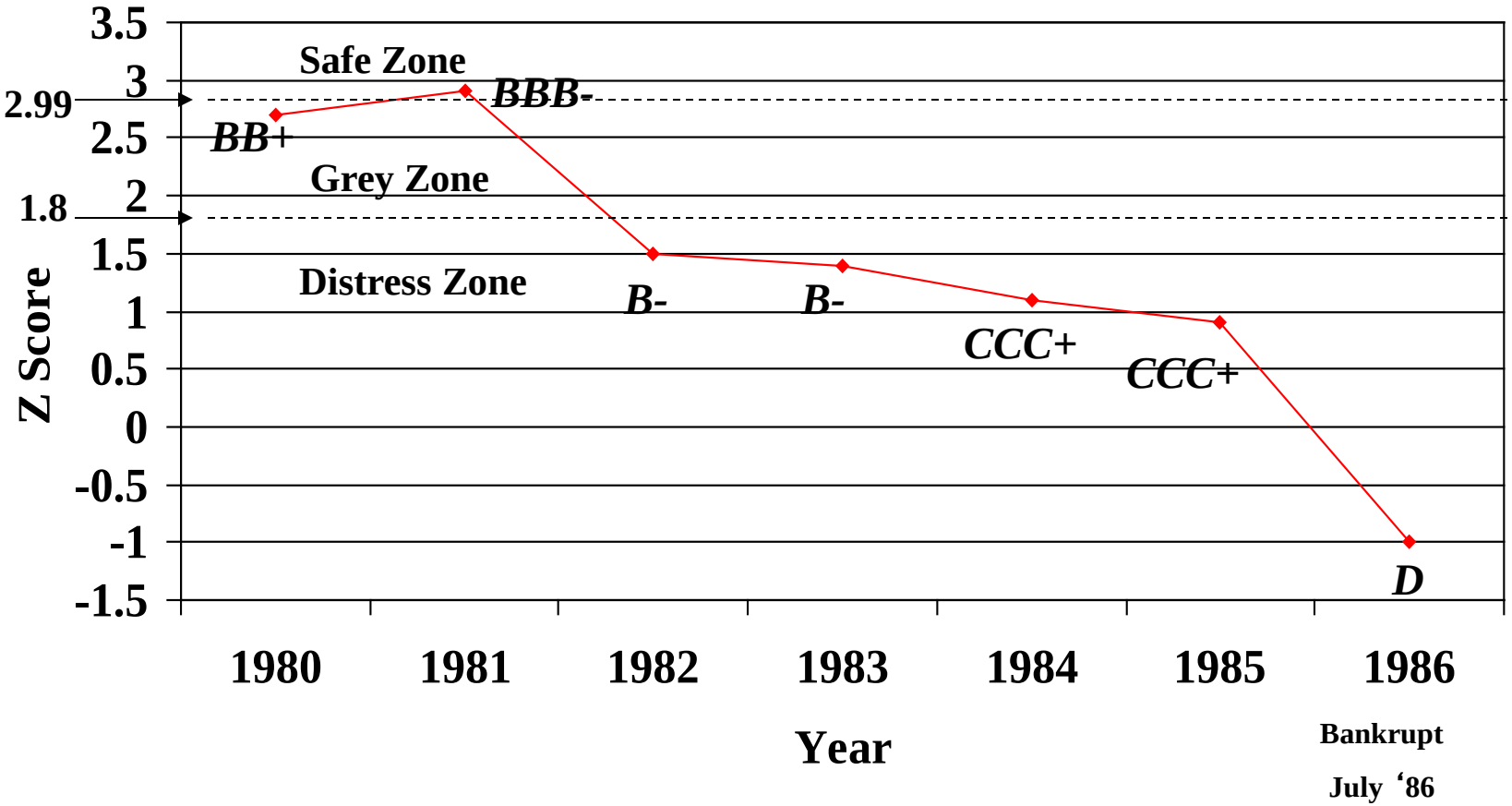
Source: Standard & Poor's (New York) and Author's Compilation

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

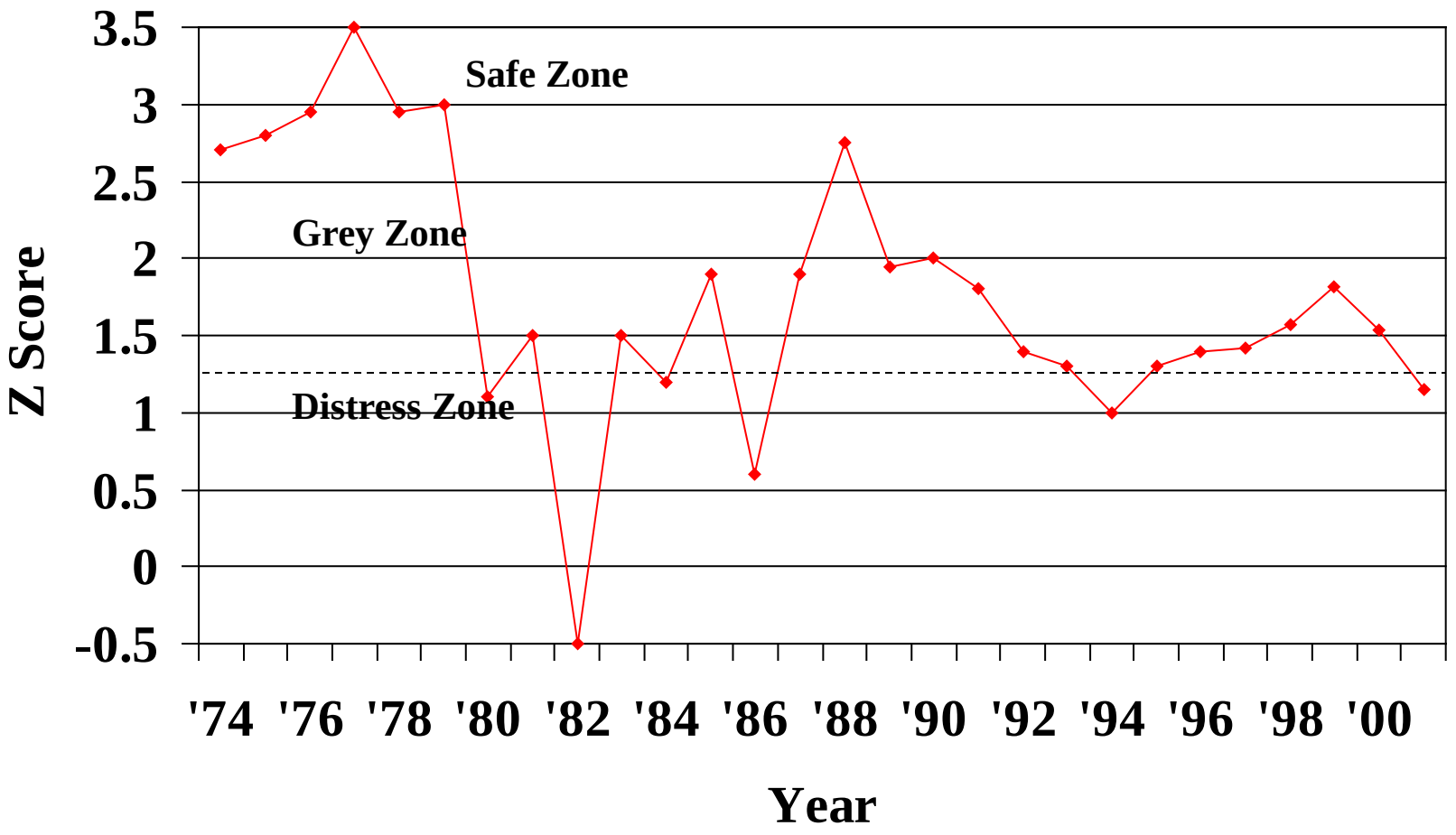
Year Prior To Failure	Original Sample (33)	Holdout Sample (25)	1969-1975 Predictive Sample (86)	1976-1995 Predictive Sample (110)	1997-1999 Predictive Sample (120)
1	94% (88%)	96% (72%)	82% (75%)	85% (78%)	94% (84%)
2	72%	80%	68%	75%	74%
3	48%	-	-	-	-
4	29%	-	-	-	-
5	36%	-	-	-	-

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

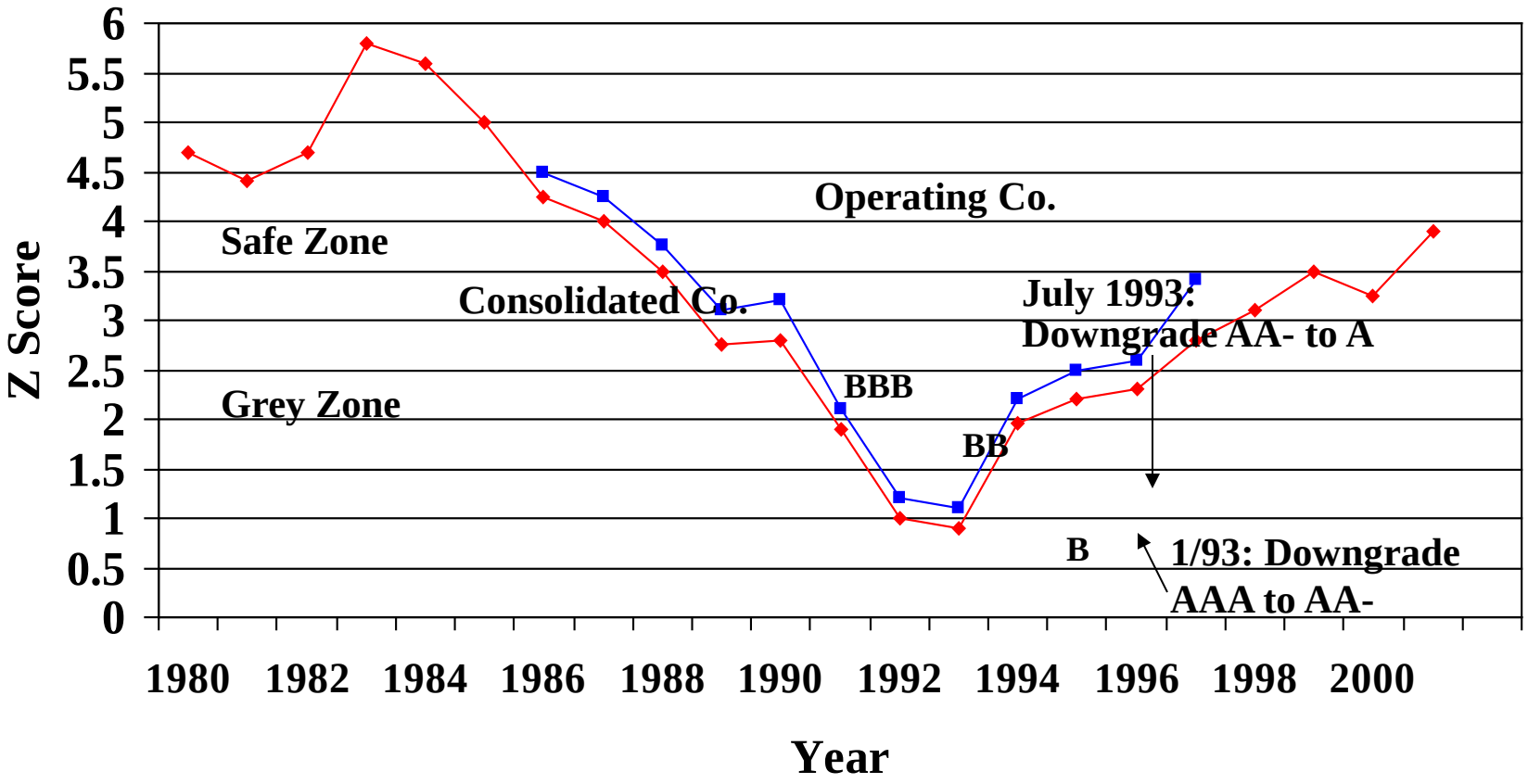
Z Score Trend - LTV Corp.



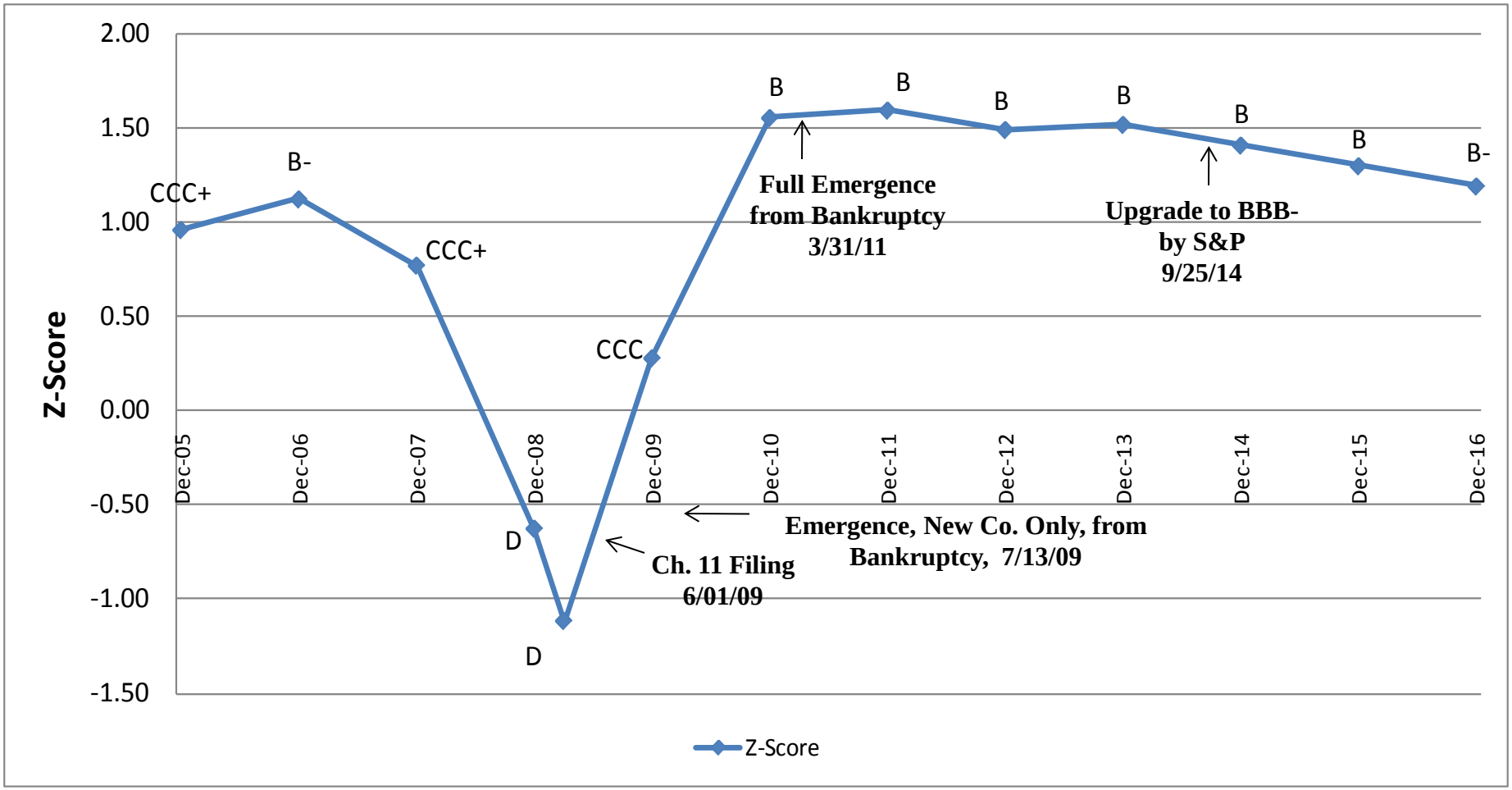
International Harvester (Navistar)
Z Score (1974 – 2001)



IBM Corporation
Z Score (1980 – 2001)



Z-Score Model Applied to GM (Consolidated Data): Bond Rating Equivalents and Scores from 2005 – 2016



Applying the Z Score Models to Recent Energy & Mining Company Bankruptcies

2015-2016

BREs	z				z''			
	t-1*		t-2**		t-1*		t-2**	
	#	%	#	%	#	%	#	%
A								
BBB+								
BBB								
BBB-								
BB+							1	2%
BB							0	0%
BB-							2	4%
B+							1	2%
B			1	4%	3	6%	11	23%
B-			1	4%	3	6%	6	13%
CCC+					1	2%	7	15%
CCC	4	17%	10	42%	2	4%	7	15%
CCC-					2	4%	9	19%
D	20	83%	12	50%	36	77%	3	6%
Total	**24**	**100%**	**24**	**100%**	**47**	**100%**	**47**	**100%**

* One or Two Quarters before Filing
** Five or Six Quarters before Filing

Source: CapIQ.

Additional Altman Z-Score Models:

Private Firm Model

Non-U.S., Emerging Markets Models for Non Financial Industrial Firms

e.g. Latin America, China, etc.

SME Models for the U.S. & Europe

e.g. Italian Minibonds

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

AN EMERGING MARKET CORPORATE MODEL

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

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

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

Z" > 5.85 - "Safe" Zone

4.35 < Z" < 5.85 - "Grey" Zone

Z" < 4.35 - "Distress" Zone

US Bond Rating Equivalents Based on Z”-Score Model

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

Rating	Median 1996 Z”-Score[a]	Median 2006 Z”-Score[a]	Median 2013 Z”-Score[a]
AAA/AA+	8.15 (8)	7.51 (14)	8.80 (15)
AA/AA-	7.16 (33)	7.78 (20)	8.40 (17)
A+	6.85 (24)	7.76 (26)	8.22 (23)
A	6.65 (42)	7.53 (61)	6.94 (48)
A-	6.40 (38)	7.10 (65)	6.12 (52)
BBB+	6.25 (38)	6.47 (74)	5.80 (70)
BBB	5.85 (59)	6.41 (99)	5.75 (127)
BBB-	5.65 (52)	6.36 (76)	5.70 (96)
BB+	5.25 (34)	6.25 (68)	5.65 (71)
BB	4.95 (25)	6.17 (114)	5.52 (100)
BB-	4.75 (65)	5.65 (173)	5.07 (121)
B+	4.50 (78)	5.05 (164)	4.81 (93)
B	4.15 (115)	4.29 (139)	4.03 (100)
B-	3.75 (95)	3.68 (62)	3.74 (37)
CCC+	3.20 (23)	2.98 (16)	2.84 (13)
CCC	2.50 (10)	2.20 (8)	2.57(3)
CCC-	1.75 (6)	1.62 (-)[b]	1.72 (-)[b]
CC/D	0 (14)	0.84 (120)	0.05 (94)[c]

[a]Sample Size in Parantheses. [b]Interpolated between CCC and CC/D. [c]Based on 94 Chapter 11 bankruptcy filings, 2010-2013.
Sources: Compustat, Company Filings and S&P.

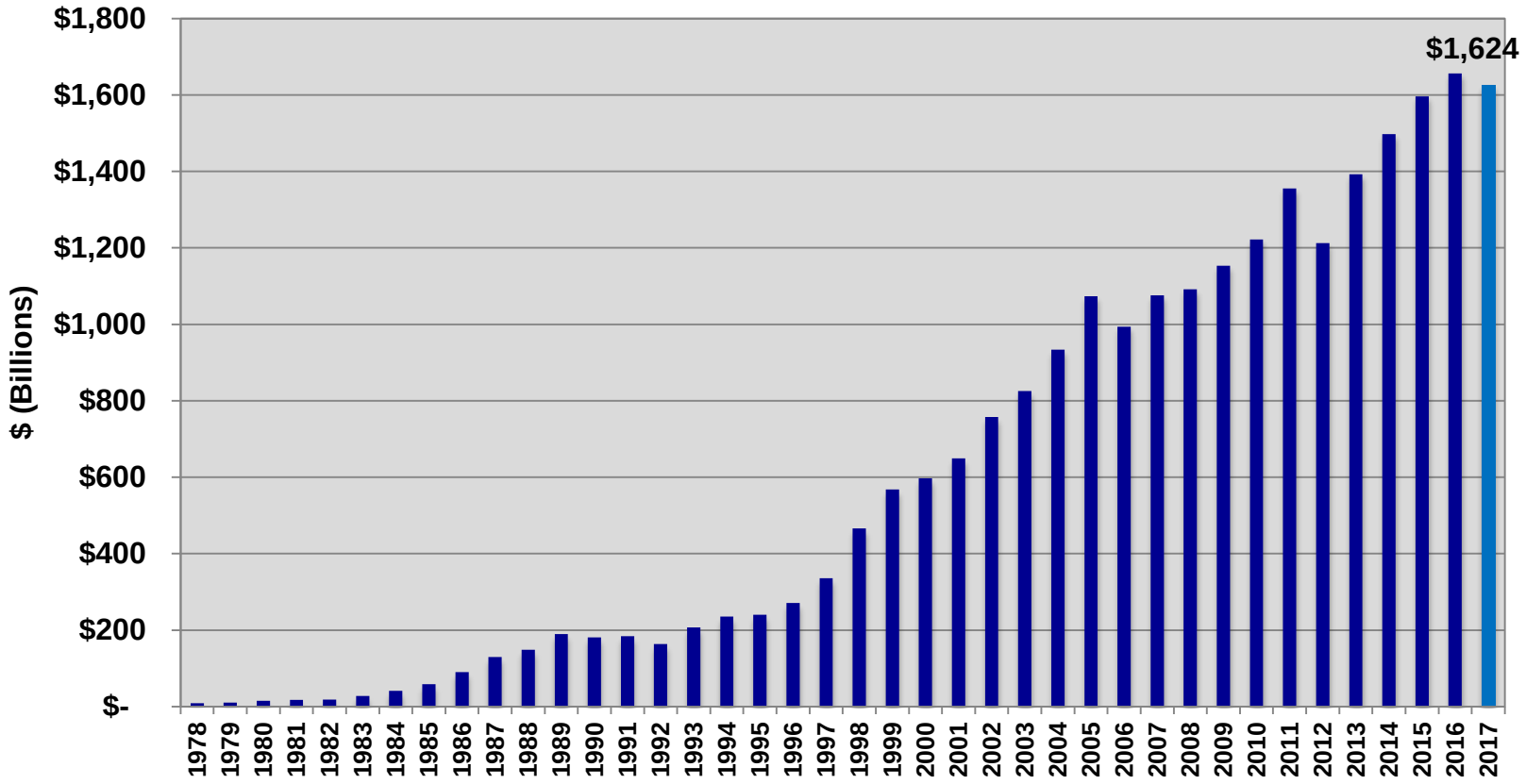
Current Conditions and Outlook in Global Credit Markets

Benign Credit Cycle? Is It Over?

- **Length of Benign Credit Cycles: Is the Current Cycle Over?**
- **Default Rates (yes), Default Forecast (no), Recovery Rates (yes), Yields (no) & Liquidity (no)**
- **Coincidence with Recessions: U.S. & European Scenarios**
- **Comparative Health of High-Yield Firms (2007 vs. 2012/2014/3Q16)**
- **LBO Statistics and Trends**
- **Possible Timing of the Bubble Burst (Short-term versus Longer-term)**

Size of the US High-Yield Bond Market

1978 – 2017 *(Mid-year US$ billions)*

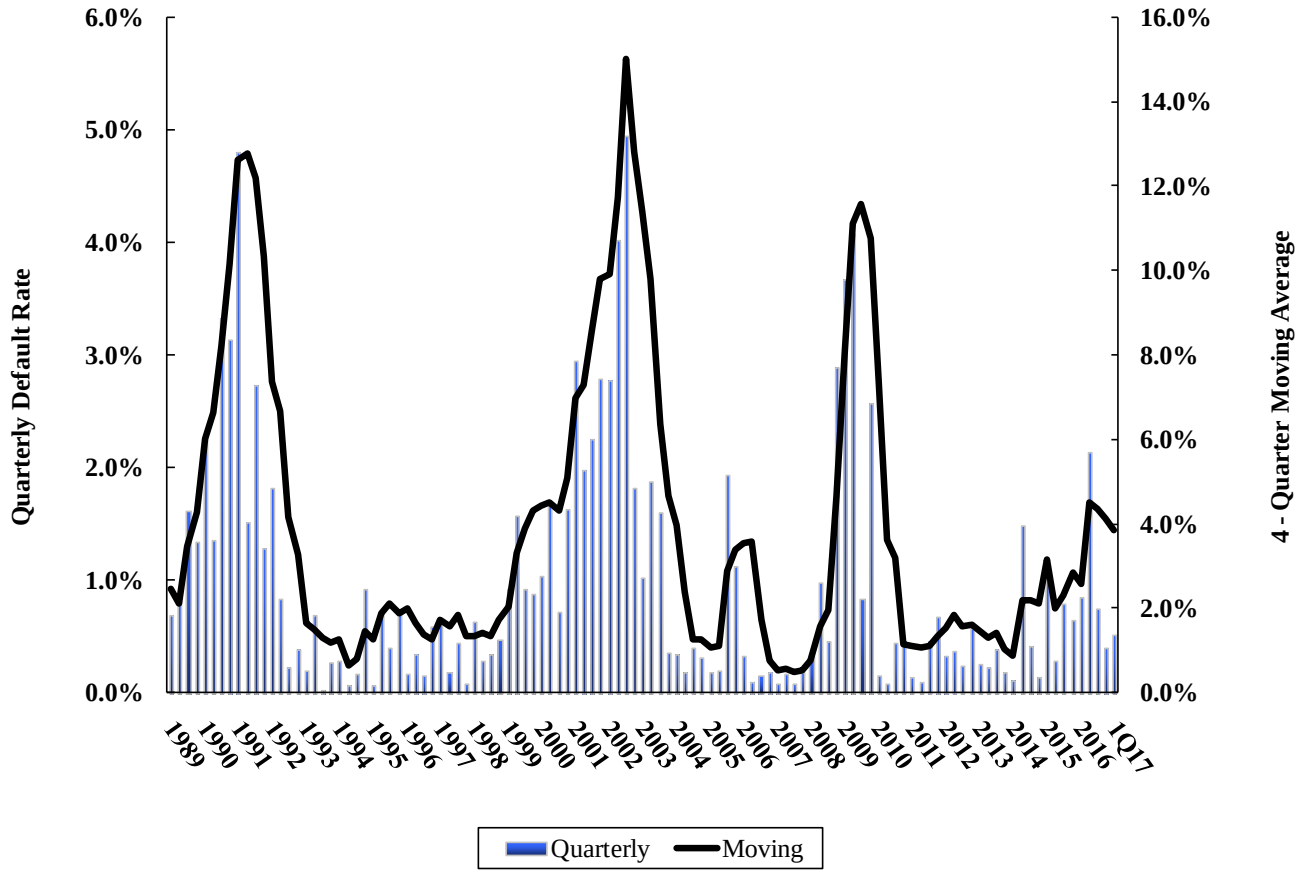


Source: NYU Salomon Center estimates using Credit Suisse, S&P and Citi data.

Default Rates on High-Yield Bonds

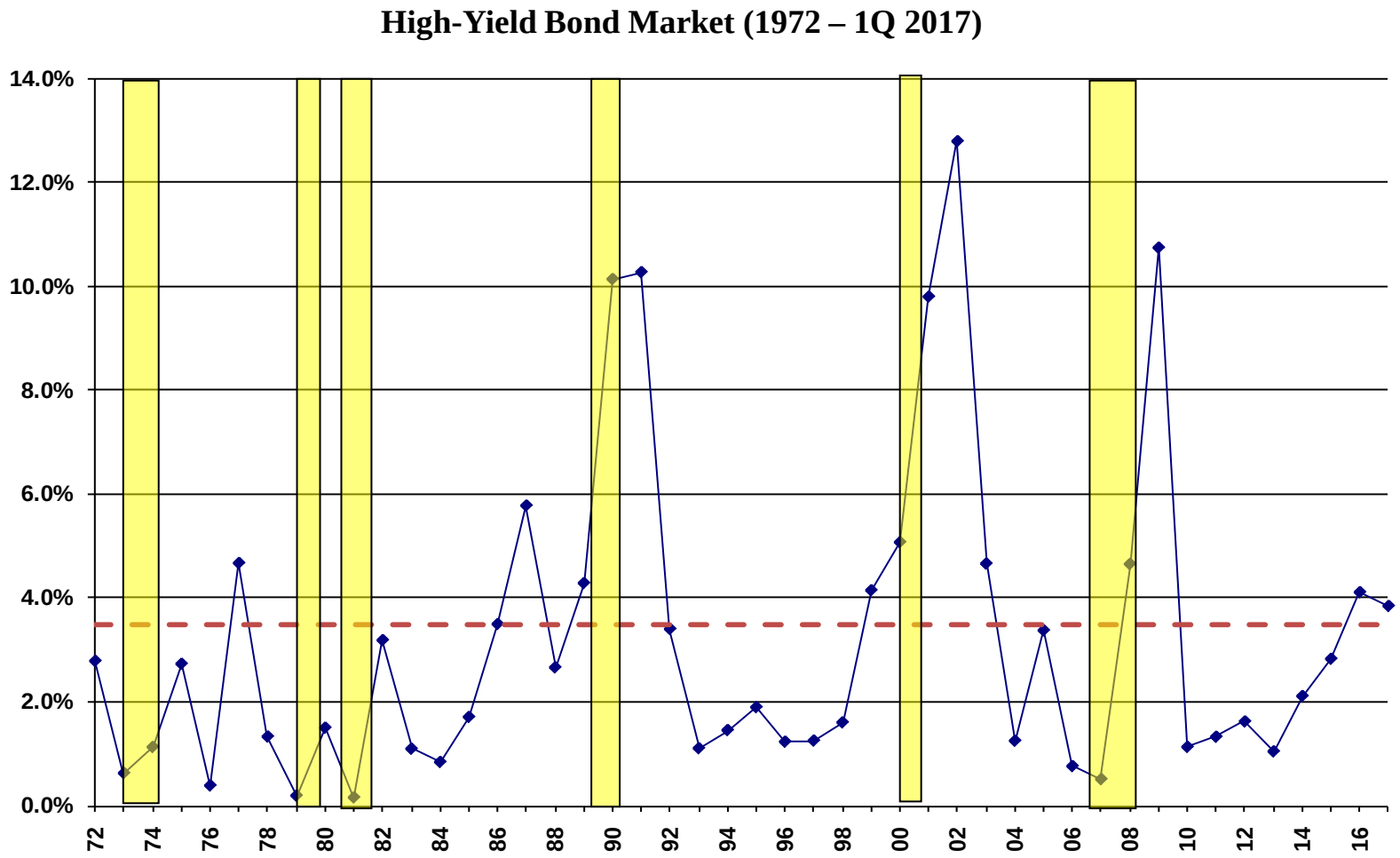
Quarterly Default Rate and Four-Quarter Moving Average

1989 – 1Q 2017



Source: Author's Compilations

Historical Default Rates and Recession Periods in the U.S.*



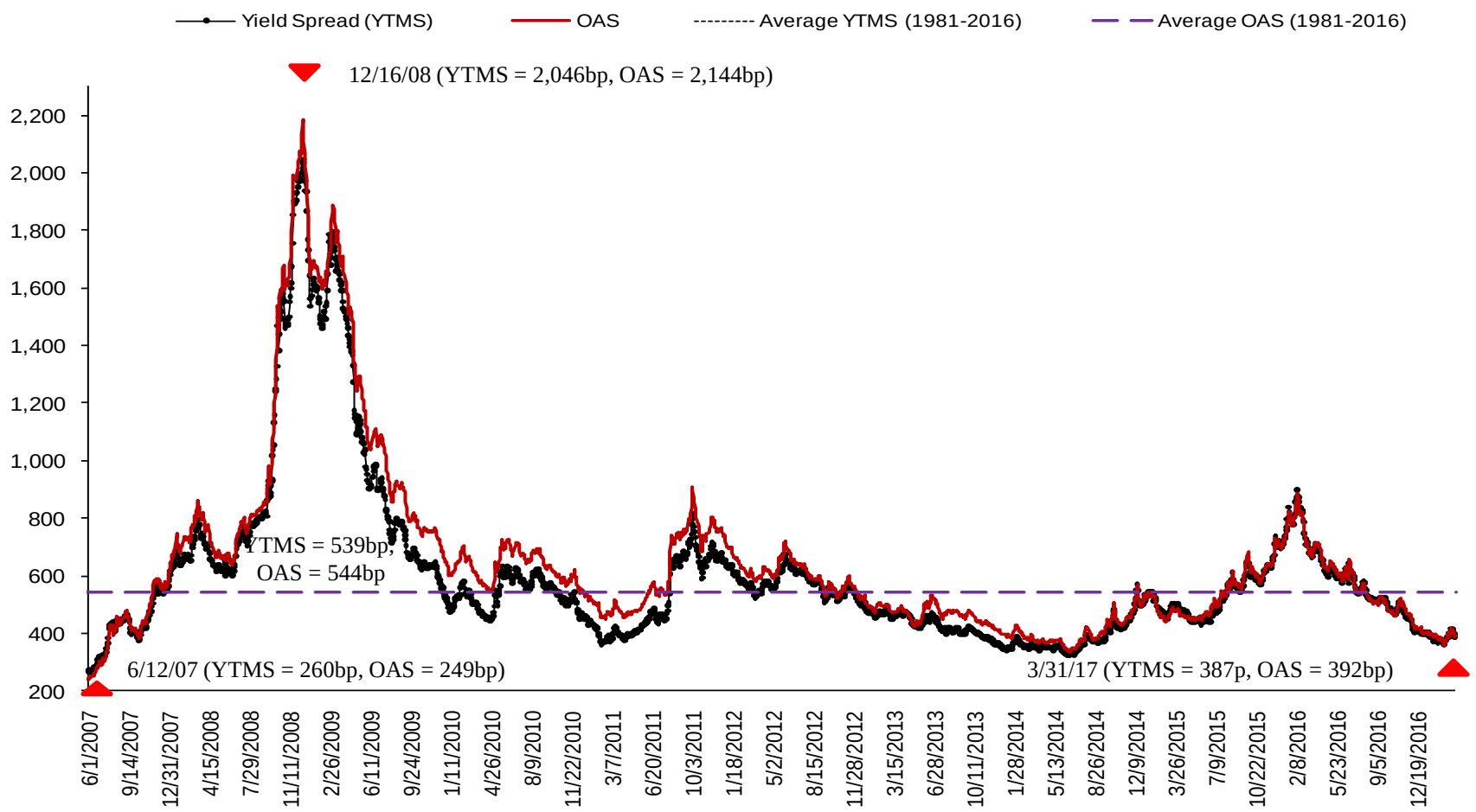
Periods of Recession: 11/73 - 3/75, 1/80 - 7/80, 7/81 - 11/82, 7/90 - 3/91, 4/01 – 12/01, 12/07 - 6/09

***All rates annual, except 1Q 2017 which is the LTM**

Source: E. Altman (NYU Salomon Center) & National Bureau of Economic Research

YTM & Option-Adjusted Spreads Between High Yield Markets & U.S. Treasury Notes

June 01, 2007 – March 31, 2017



Sources: Citigroup Yieldbook Index Data and Bank of America Merrill Lynch.

Comparative Health of High-Yield Firms (2007 vs. 2012/2014/3Q 2016)

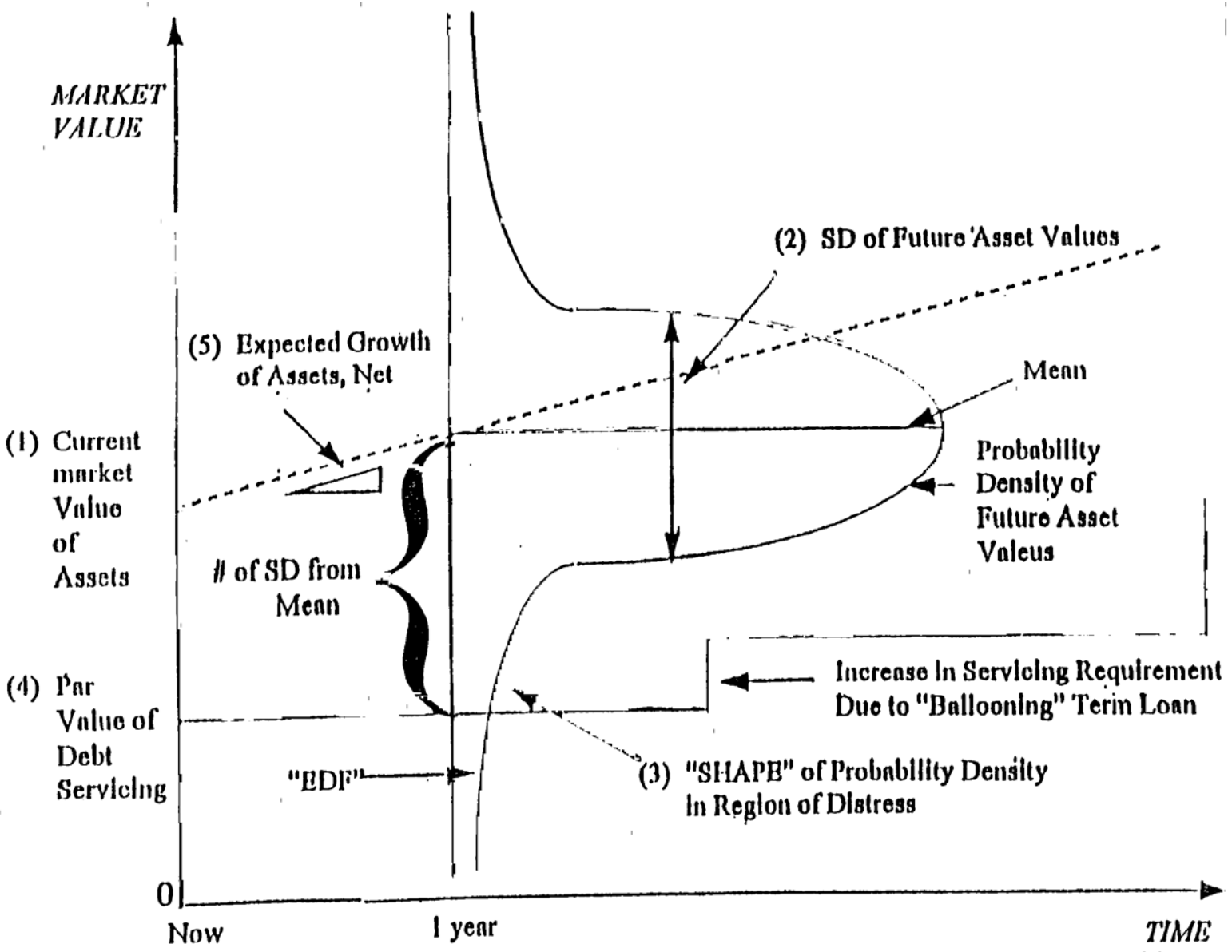
Comparing Financial Strength of High-Yield Bond Issuers in 2007& 2012/2014/3Q 2016

Number of Firms		
	Z-Score	Z”-Score
2007	294	378
2012	396	486
2014	577	741
2016 (3Q)	581	742

Year	Average Z-Score/ (BRE)*	Median Z-Score/ (BRE)*	Average Z”-Score/ (BRE)*	Median Z”-Score/ (BRE)*
2007	1.95 (B+)	1.84 (B+)	4.68 (B+)	4.82 (B+)
2012	1.76 (B)	1.73 (B)	4.54 (B)	4.63 (B)
2014	2.03 (B+)	1.85 (B+)	4.66 (B+)	4.74 (B+)
2016 (3Q)	1.97 (B+)	1.70 (B)	4.44 (B)	4.63 (B)

*Bond Rating Equivalent
Source: Authors’ calculations, data from Altman and Hotchkiss (2006) and S&P *Capital IQ/Compustat*.

KMV MODEL


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

Financial Distress (Z-Score) Prediction Applications

- Lenders
- Investors (e.g. Quality Junk Portfolio)
- Long/Short Investment Strategy on Stocks and Bonds
- Baskets of Strong Balance Sheet Companies & Indexes (e.g. STOXX)
- Security Analysts
- Regulators & Gov't Agencies
- Auditors (Audit Risk Model)
- Credit Rating Agencies
- Comparative Risk Profiles Over Time
- Sovereign Default Risk Assessment
- Advisors (Assessing Your Client's Health)
- M&A (e.g. Bottom Fishing)
- Purchasers, Suppliers
- Accounts Receivable Management (e.g. NACM)
- Researchers
- Chapter 22 Reduction
- Managers
  - Managing a Financial Turnaround

MANAGING A FINANCIAL TURNAROUND: APPLICATIONS OF THE Z-SCORE MODEL IN THE US AND CHINA

THE GTI CASE

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Assessing the Credit Worthiness of Italian SMEs and Mini-bond Issuers

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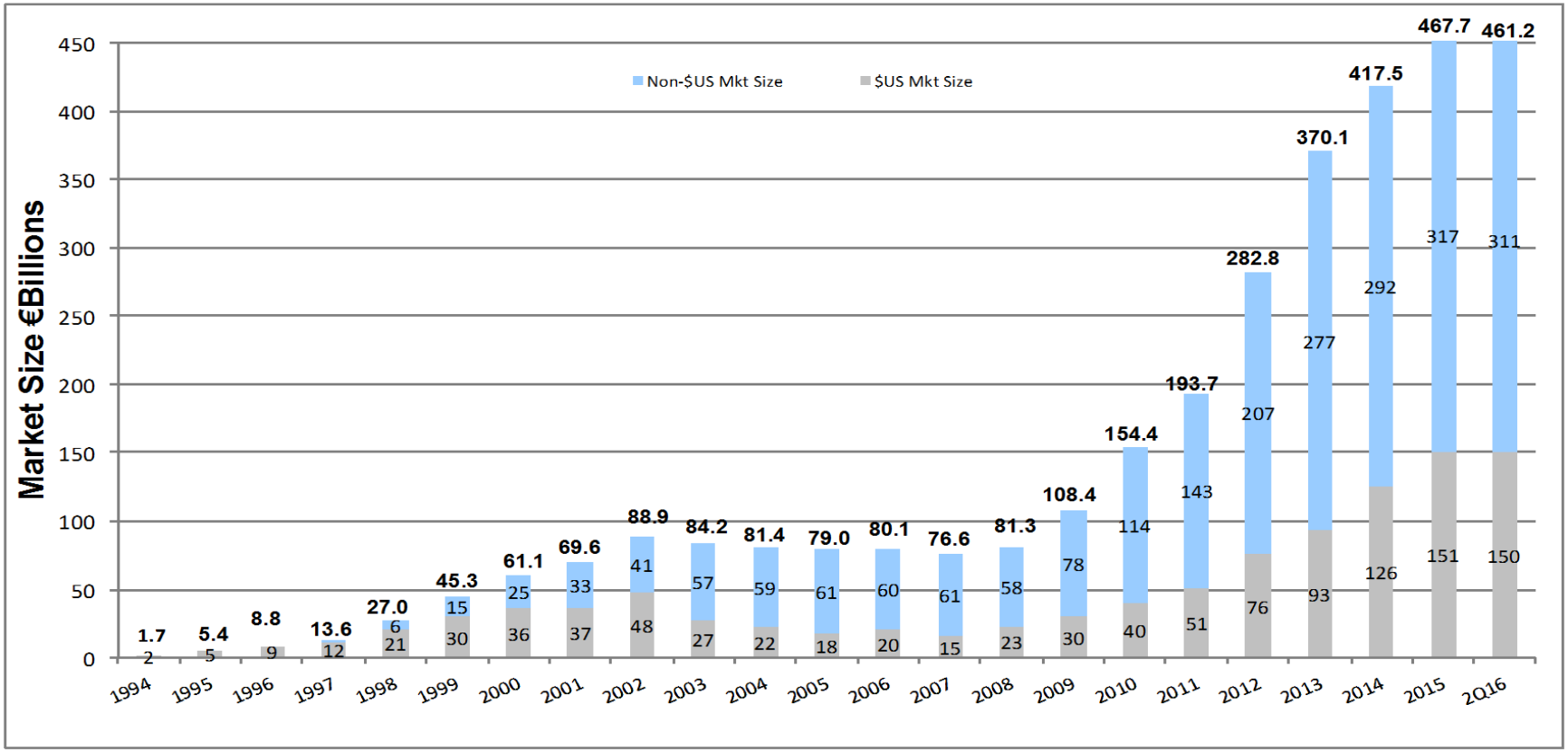
Dr. Gabriele Sabato
Maurizio G. Esentato

Size of Western European HY Market

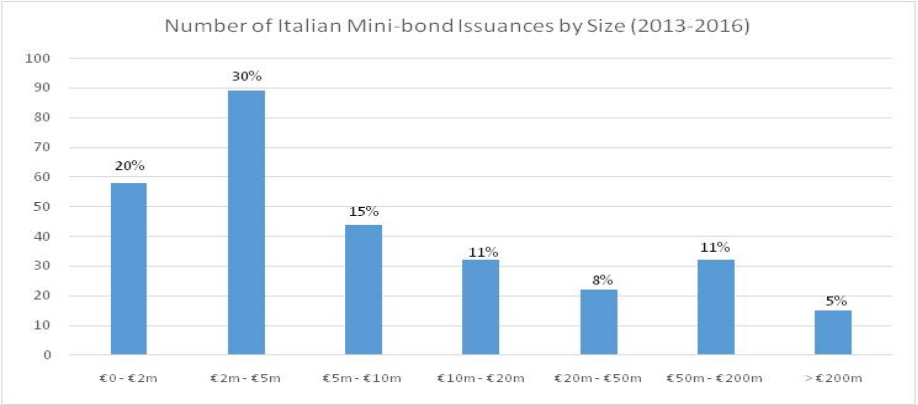


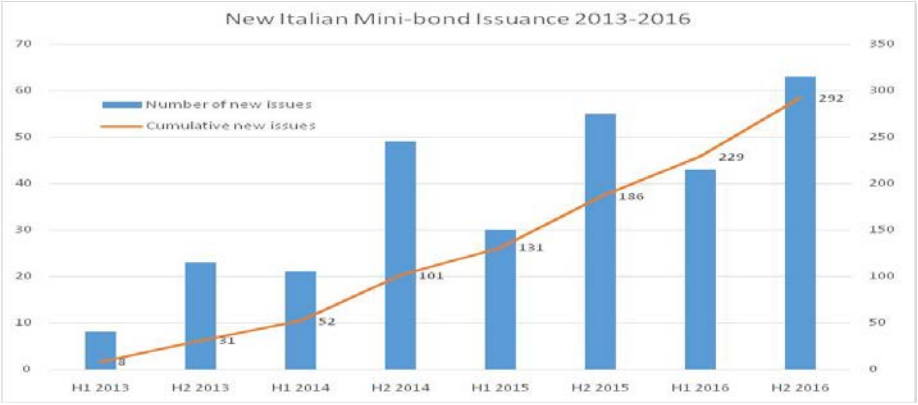
Includes non-investment grade straight corporate debt of issuers with assets located in or revenues derived from Western Europe, or the bond is denominated in a Western European currency. Floating-rate and convertible bonds and preferred stock are not included.

Source: Credit Suisse

The Italian Mini-bond Market

- Europe High-yield bond market is still lagging behind the US one, but the growth has accelerated in the last 3 years.
- In Italy, the market for SME bonds is known as Extra-MOT PRO "Mini-bond" market.
- The new segment of the Extra-MOT market dedicated to listing of bonds, commercial paper, and project finance bonds started in February 2013.
- The total amount of listed issuances since February 2013 is 177, for a total issued amount of about Euro 7,146bn. As of March 2016, there is Euro 4.491bn outstanding, from 130 issues.
- **In Q2 2016, 13 new issues have been launched.**





We believe "Mini-bonds" can be a success in Italy as long as the market supplies an attractive risk/return tradeoff to investors as well as affordable and flexible financing for borrowers.

What are the constraints to the success of the Italian ExtraMOT PRO Mini-bond market?

- All bond investments face three main risks (Market, Liquidity and Credit), but it is **credit risk that is perhaps most critical** for relatively unknown, smaller enterprises.
- Since the ExtraMOT PRO market is still quite young, there are not as yet aggregate default and recovery statistics. **We prefer,** therefore**, to concentrate on issuer default & return analytics based on Italian SME experience.**

The objective of our model is to help:

- **Italian SMEs to grow and succeed by assessing their risk profile and suggesting what would be the best funding option for them**
- **Lenders and investors to assess the risk-return trade offs in investing in either individual or portfolios of Italian SME mini-bonds**

SME Z_I-Score: Summary of Results

- We segmented the Italian SMEs by industrial sectors and developed four default prediction models for Manufacturing, Services, Retail and Real Estate firms.

- Models have been developed on a representative sample of more the 14.500 SMEs located in the north of Italy and then certified for their relevance at national level.

- Prediction power of the models is significantly high due to the use of informative variables and appropriate techniques applied.

- In addition to the Score, Firms/Analysts/Investors also receive an estimated **Bond Rating Equivalent** and **Probability of Default**.

- The **SME Z_I-Score** improves the matching of demand and supply in the capital markets between SMEs looking for funding options and investors.

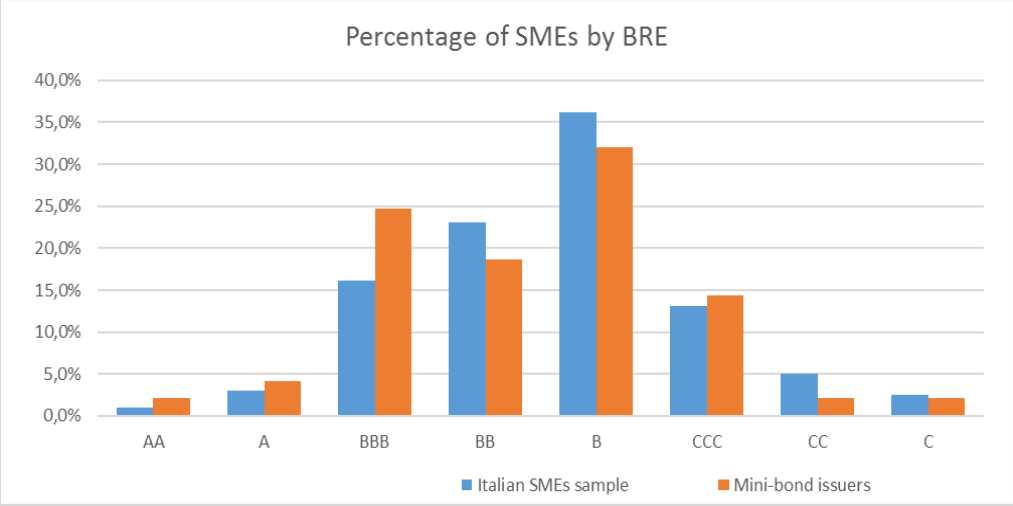
The Results

	Type I error rate	Type II error rate	1- Average Error Rate	Accuracy ratio
Manufacturing Model	6.92% (8.23%)	26.57% (27.64%)	83.26% (82.07%)	93.08% (92.21%)
Retail Model	16.77% (18.54%)	27.78% (28.89%)	77.73% (76.29%)	83.23% (81.76%)
Services Model	12.05% (14.88%)	24.54% (26.43%)	81.70% (79.35%)	87.94% (84.12%)
Constructions and Real Estate	8.89% (10.12%)	26.02% (28.24%)	82.55% (80.82%)	91.11% (89.86%)

Risk Profile of Mini-bond issuers (2015)

Bond Rating Equivalent	# SMEs	% SMEs	Avg. Coupon Yield
AA	2	2%	0,057
A	4	4%	0,062
BBB	24	25%	0,065
BB	18	19%	0,055
B	31	32%	0,059
CCC	14	14%	0,065
CC	2	2%	0,030
C	2	2%	0,060

Source: Firms listed on Borsa Italiana Extra MOT, calculations by the authors



Source: Firms listed on Borsa Italiana Extra MOT, calculations by the authors

Applying our SME Z_I-Score on the mini-bond issuers as of 2015, we find that:

- Risk profile of SMEs doesn't seem to influence the bond pricing;
- Majority of existing mini-bond issuers classified as non-investment grade;
- The risk profile of the mini-bond issuers is better (i.e. less risky) than total SME sample.

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Wiserfunding Ltd.: Helping Italian SMEs to Succeed

- Mission is to support small business growth by reducing information asymmetry by providing a common set of information to all market participants.
- The SME Z_I-Score should not to be used in isolation. Other factor (e.g. debt capacity, cash flow, recovery profile, market outlook, directors' experience) are assessed when evaluating SMEs' financial strength.
- We believe that by providing lenders/investors and small businesses with the same set of information, we can help them speak the same language.
- We are working with Classis Capital, Borsa Italiana, Confindustria, several PMI organizations and SMEs to apply our model effectively.