Credit Cycle Outlook and the Altman Z-Score Models After 50 Years

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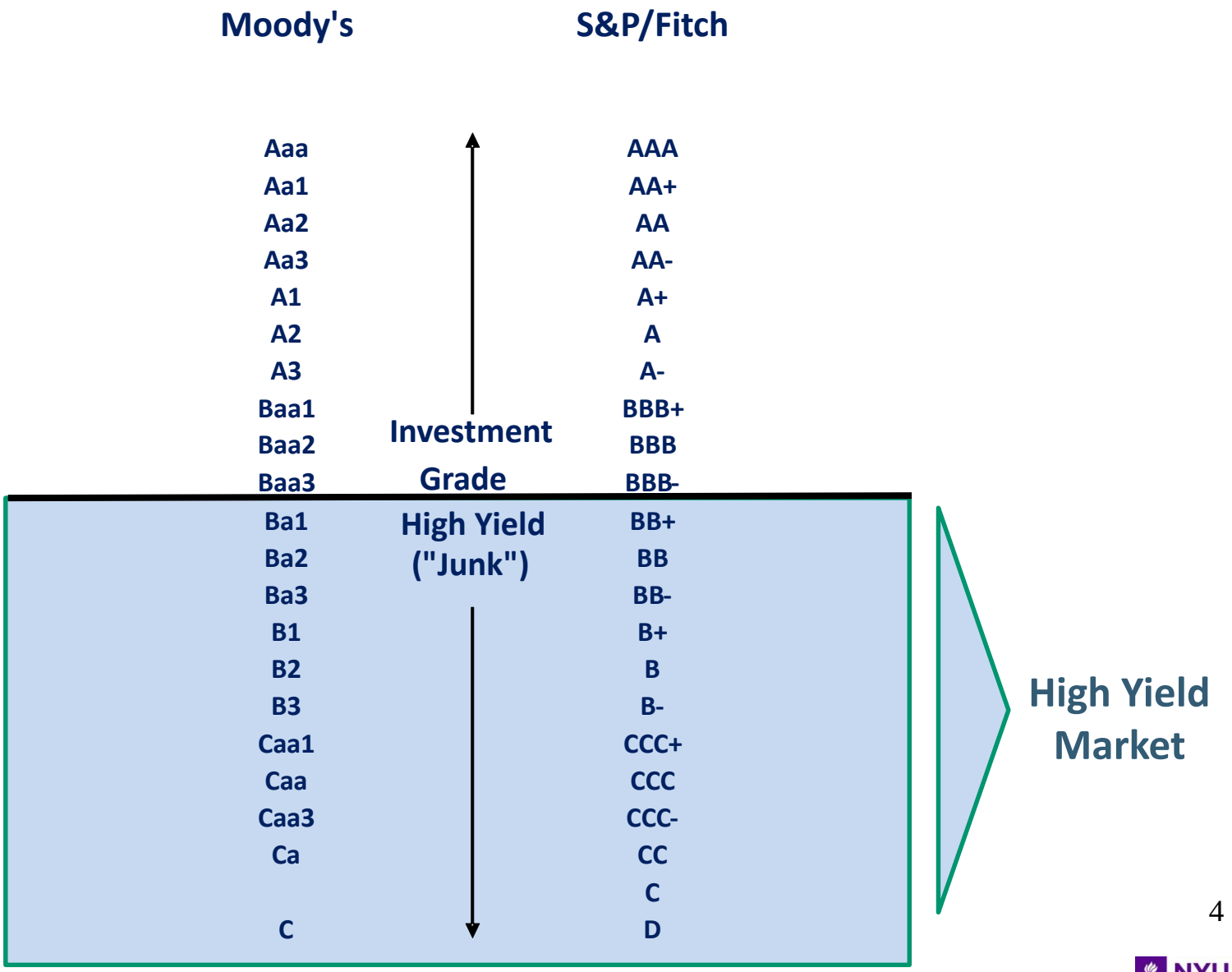
Scoring Systems

- Qualitative (Subjective) – 1800s
- Univariate (Accounting/Market Measures)
  - Rating Agency (e.g. *Moody's* (1909), *S&P Global Ratings* (1916) and Corporate (e.g., *DuPont*) Systems (early 1900s)
- Multivariate (Accounting/Market Measures) – 1968 (Z-Score) → Present
  - Discriminant, Logit, Probit Models (Linear, Quadratic)
  - Non-Linear and "Black-Box" Models (e.g., Recursive Partitioning, Neural Networks, 1990s), Machine Learning , Hybrid
- Discriminant and Logit Models in Use for
  - Consumer Models - *Fair Isaacs* (FICO Scores)
  - Manufacturing Firms (1968) – Z-Scores
  - Extensions and Innovations for Specific Industries and Countries (1970s – Present)
  - ZETA Score – Industrials (1977)
  - Private Firm Models (e.g., Z'-Score (1983), Z"-Score (1995))
  - EM Score – Emerging Markets (1995)
  - Bank Specialized Systems (1990s)
  - SMEs (e.g. Edmister (1972), Altman & Sabato (2007) & *Wiserfunding* (2016))
- Option/Contingent Claims Models (1970s – Present)
  - Risk of Ruin (Wilcox, 1973)
  - *KMVs* Credit Monitor Model (1993) – Extensions of Merton (1974) Structural Framework

Scoring Systems
(continued)

- Artificial Intelligence Systems (1990s – Present)
  - Expert Systems
  - Neural Networks
  - Machine Learning
- Blended Ratio/Market Value/Macro/Governance/Invoice Data Models
  - Altman Z-Score (*Fundamental Ratios and Market Values)* – 1968
  - Bond Score (*Credit Sights*, 2000; RiskCalc *Moody's*, 2000)
  - Hazard (Shumway), 2001)
  - *Kamakura's* Reduced Form, Term Structure Model (2002)
  - Z-Metrics (Altman, et al, *Risk Metrics*©, 2010)
- Re-introduction of Qualitative Factors/FinTech
  - Stand-alone Metrics, e.g., Invoices, Payment History
  - Multiple Factors – Data Mining (Big Data Payments, Governance, time spent on individual firm reports [e.g., *CreditRiskMonitor's* revised FRISK Scores, 2017], etc.)

Major Agencies Bond Rating Categories



Z-Score (1968) 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

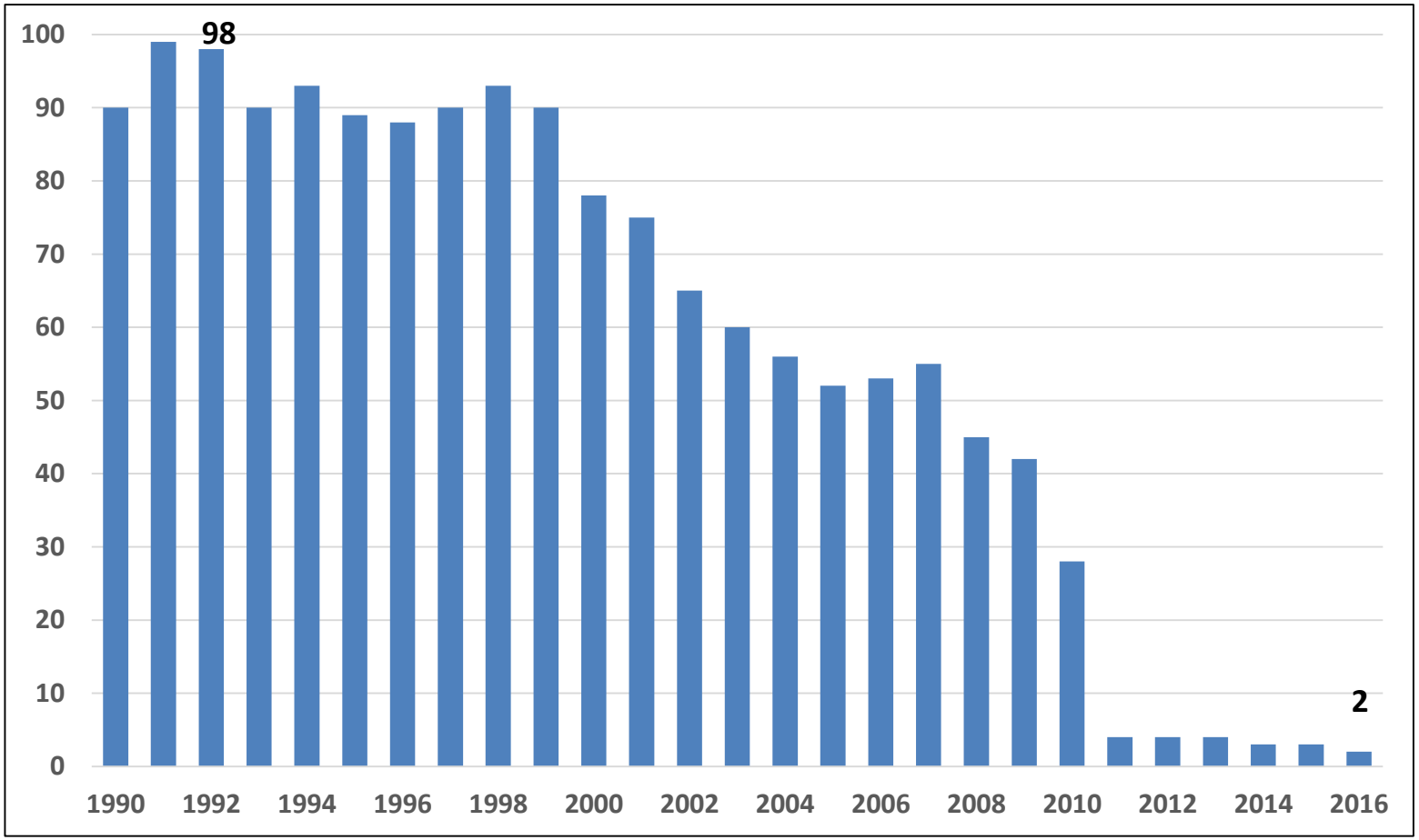
Time Series Impact On Corporate Z-Scores

- Credit Risk Migration
  - Greater Use of Leverage
  - Impact of HY Bond & Lev Loan Markets
  - Global Competition
  - More and Larger Bankruptcies
  - Near Extinction of U.S. AAA Firms

- Increased Type II Error

The Near Extinction of the U.S. AAA Rated Company

Number of AAA Rated Groups in the U.S.



Sources: Standard & Poor's, Estimated from Platt, E., "Triple A Quality Fades as Companies Embrace Debt", *Financial Times*, May 24, 2016.

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 - 2017

Rating	2017 (No.)	2013 (No.)	2004-2010	1996-2001	1992-1995
AAA/AA	4.20 (14)	4.13 (15)	4.18	6.20*	4.80*
A	3.85 (55)	4.00 (64)	3.71	4.22	3.87
BBB	3.10 (137)	3.01 (131)	3.26	3.74	2.75
BB	2.45 (173)	2.69 (119)	2.48	2.81	2.25
B	1.65 (94)	1.66 (80)	1.74	1.80	1.87
CCC/CC	0.73 (4)	0.23 (3)	0.46	0.33	0.40
D	-0.10 (6)[1]	0.01 (33)[2]	-0.04	-0.20	0.05

*AAA Only.
[1] From 1/2014-11/2017, [2]From 1/2011-12/2013.

Sources: S&P Global Market Intelligence's *Compustat* Database, mainly S&P 500 firms, compilation by NYU Salomon Center, Stern School of Business.

Marginal and Cumulative Mortality Rate Actuarial Approach

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

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,

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

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*
1971-2017

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%	0.19%	0.05%	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%
	Cumulative	0.00%	0.00%	0.19%	0.24%	0.26%	0.27%	0.28%	0.29%	0.30%	0.31%
A	Marginal	0.01%	0.03%	0.10%	0.11%	0.08%	0.04%	0.02%	0.23%	0.06%	0.03%
	Cumulative	0.01%	0.04%	0.14%	0.25%	0.33%	0.37%	0.39%	0.62%	0.68%	0.71%
BBB	Marginal	0.31%	2.34%	1.23%	0.97%	0.48%	0.21%	0.24%	0.15%	0.16%	0.32%
	Cumulative	0.31%	2.64%	3.84%	4.77%	5.23%	5.43%	5.66%	5.80%	5.95%	6.25%
BB	Marginal	0.91%	2.03%	3.83%	1.96%	2.40%	1.54%	1.43%	1.08%	1.40%	3.09%
	Cumulative	0.91%	2.92%	6.64%	8.47%	10.67%	12.04%	13.30%	14.24%	15.44%	18.05%
B	Marginal	2.85%	7.65%	7.72%	7.74%	5.72%	4.45%	3.60%	2.04%	1.71%	0.73%
	Cumulative	2.85%	10.28%	17.21%	23.62%	27.99%	31.19%	33.67%	35.02%	36.13%	36.60%
CCC	Marginal	8.09%	12.40%	17.71%	16.22%	4.88%	11.60%	5.39%	4.73%	0.62%	4.23%
	Cumulative	8.09%	19.49%	33.75%	44.49%	47.20%	53.33%	55.84%	57.93%	58.19%	59.96%

*Rated by S&P at Issuance
Based on 3,359 issues

Source: S&P Global Ratings and Author's Compilation

Mortality Losses by Original Rating

All Rated Corporate Bonds*
1971-2017

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%	0.02%	0.02%	0.01%	0.01%	0.00%	0.01%	0.01%	0.01%
	Cumulative	0.00%	0.00%	0.02%	0.04%	0.05%	0.06%	0.06%	0.07%	0.08%	0.09%
A	Marginal	0.00%	0.01%	0.04%	0.04%	0.05%	0.04%	0.02%	0.01%	0.05%	0.02%
	Cumulative	0.00%	0.01%	0.05%	0.09%	0.14%	0.18%	0.20%	0.21%	0.26%	0.28%
BBB	Marginal	0.22%	1.51%	0.70%	0.57%	0.25%	0.15%	0.09%	0.08%	0.09%	0.17%
	Cumulative	0.22%	1.73%	2.41%	2.97%	3.21%	3.36%	3.45%	3.52%	3.61%	3.77%
BB	Marginal	0.54%	1.16%	2.28%	1.10%	1.37%	0.74%	0.77%	0.47%	0.72%	1.07%
	Cumulative	0.54%	1.69%	3.94%	4.99%	6.29%	6.99%	7.70%	8.14%	8.80%	9.77%
B	Marginal	1.90%	5.36%	5.30%	5.19%	3.77%	2.43%	2.33%	1.11%	0.90%	0.52%
	Cumulative	1.90%	7.16%	12.08%	16.64%	19.78%	21.73%	23.56%	24.41%	25.09%	25.48%
CCC	Marginal	5.35%	8.67%	12.48%	11.43%	3.40%	8.60%	2.30%	3.32%	0.38%	2.69%
	Cumulative	5.35%	13.56%	24.34%	32.99%	35.27%	40.84%	42.20%	44.12%	44.33%	45.83%

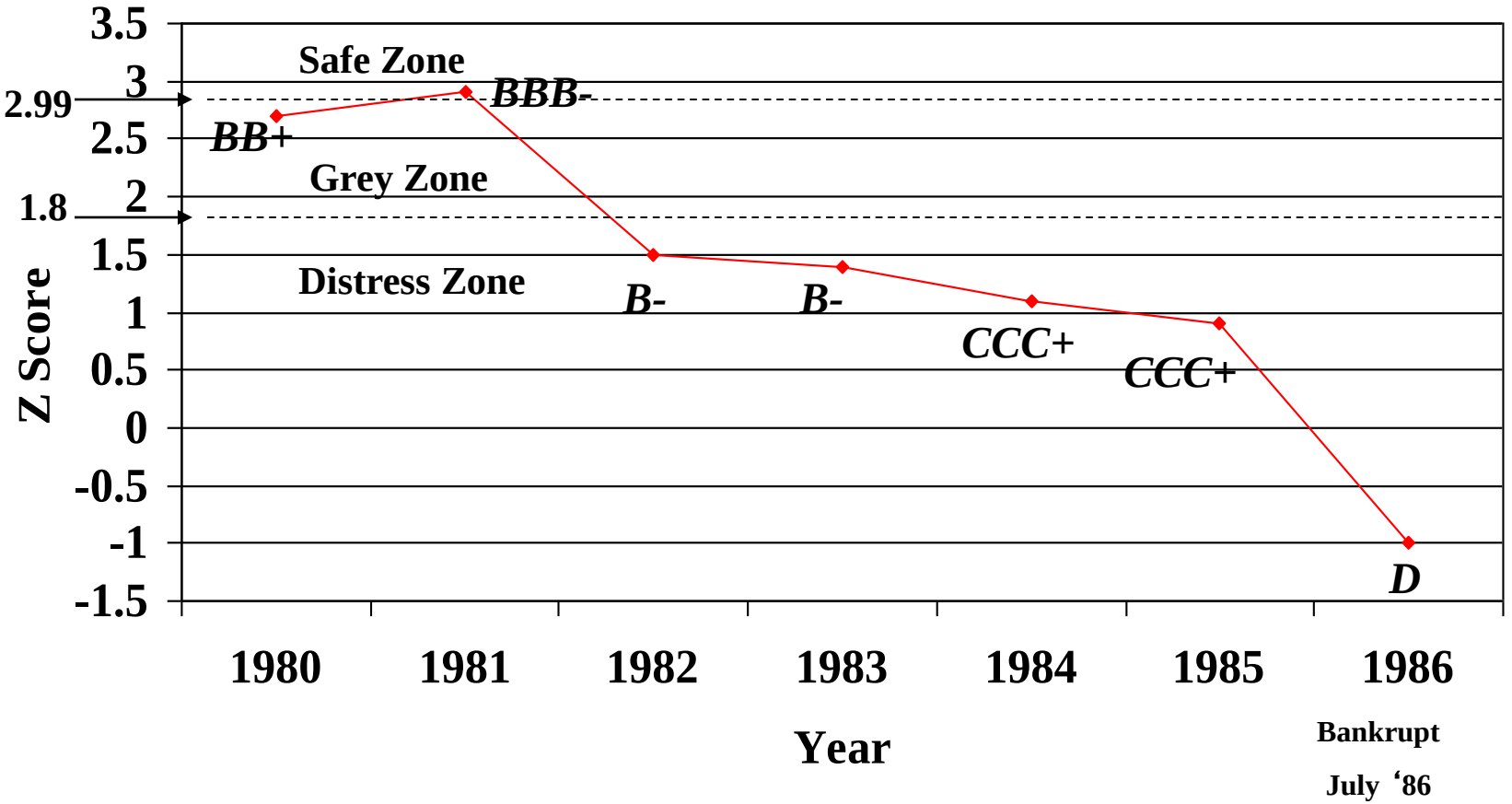
*Rated by S&P at Issuance
Based on 2,797 issues

Source: S&P Global Ratings and Author's Compilation

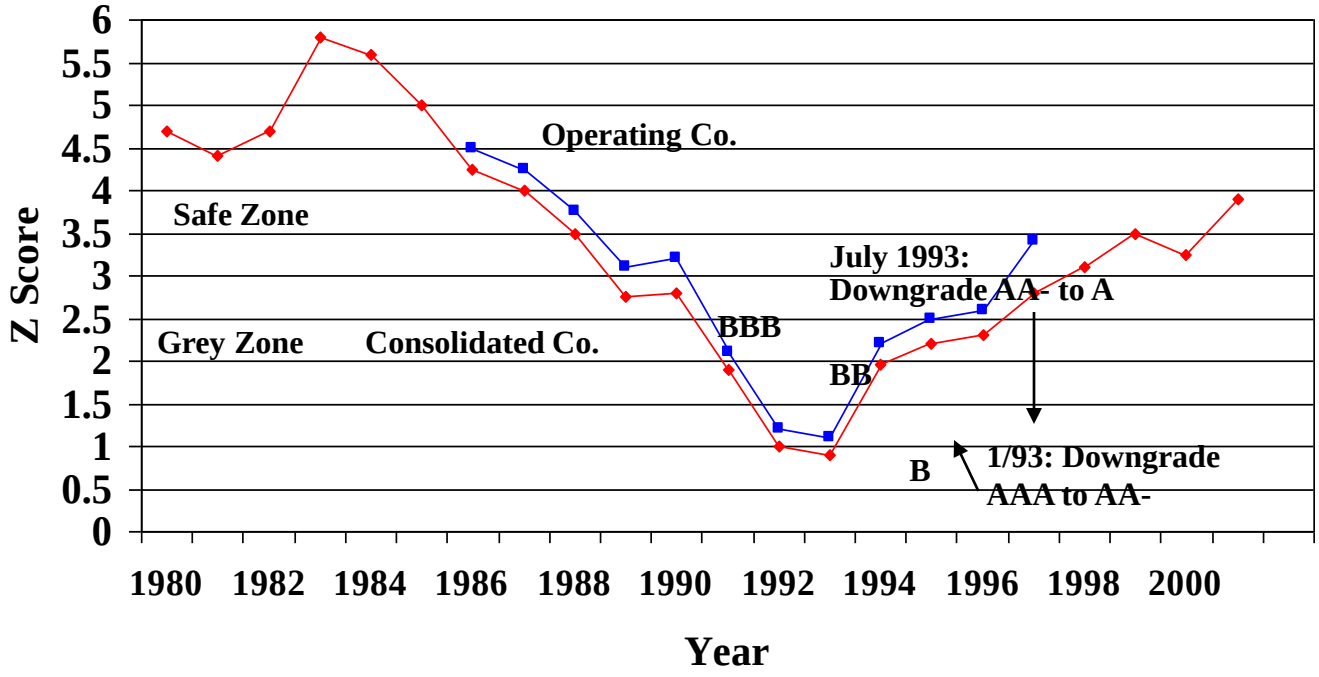
Financial Distress (Z-Score) Prediction Applications

External (To The Firm) Analytics	Internal (To The Firm) & Research Analytics
• **Lenders (e.g., Pricing, Basel Capital Allocation)** • Bond Investors (e.g., Quality Junk Portfolio • Long/Short Investment Strategy on Stocks (e.g. Baskets of Strong Balance Sheet Companies & Indexes, e.g. STOXX, Goldman, Nomura) • Security Analysts & Rating Agencies • Regulators & Government Agencies • Auditors (Audit Risk Model) – Going Concern • Advisors (e.g., Assessing Client's Health) • M&A (e.g., Bottom Fishing)	• **To File or Not (e.g., General Motors)** • **Comparative Risk Profiles Over Time** • **Industrial Sector Assessment (e.g., Energy)** • Sovereign Default Risk Assessment • Purchasers, Suppliers Assessment • Accounts Receivables Management • Researchers – Scholarly Studies • Chapter 22 Assessment • Managers – Managing a Financial Turnaround

Z Score Trend - LTV Corp.



IBM Corporation
Z Score (1980 – 2001, update 2015-2017)



Recent Z-Scores & BREs			
Year -End	Z-Score	BRE	Actual S&P Rating
2015	3.63	A-	
2016	3.58	A-	
2017	3.27	BBB+	A+

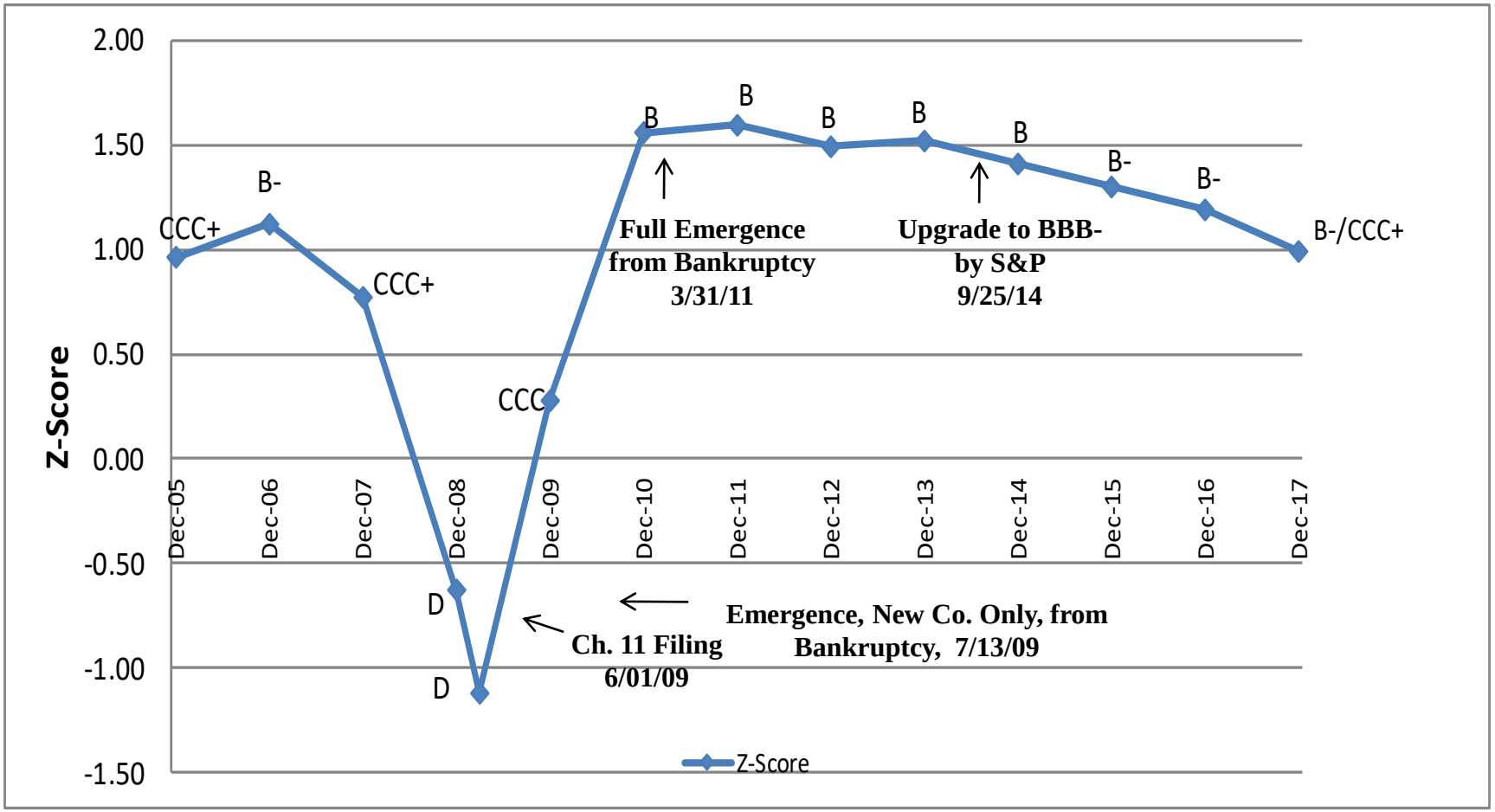
Z-Score Model Applied to General Motors (Consolidated Data): Bond Rating Equivalents and Scores from 2005 – 2017

	Z-Scores	BRE
12/31/17	0.99	B-/CCC+
12/31/16	1.19	B-
12/31/15	1.30	B-
12/31/14	1.41	B
12/31/13	1.52	B
12/31/12	1.49	B
12/31/11	1.59	B
12/31/10	1.56	B
12/31/09	0.28	CCC
03/31/09	(1.12)	D
12/31/08	(0.63)	D
12/31/07	0.77	CCC+
12/31/06	1.12	B-
12/31/05	0.96	CCC+

Note: Consolidated Annual Results. Data Source: S&P Global Market Intelligence's S&P Capital IQ platform, Bloomberg., Edgar

Z-Score Model Applied to GM (Consolidated Data): Bond Rating Equivalents and Scores from 2005 – 2017

Z- Score: General Motors Co.



Additional Altman Z-Score Models:

Private Firm Model (1968)

Non-U.S., Emerging Markets Models for Non Financial Industrial Firms (1995)

e.g. Latin America (1977, 1995), China (2010), etc.

Sovereign Risk Bottom-Up Model (2011)

SME Models for the U.S. (2007) & Europe

e.g. Italian Minibonds (2016), U.K. (2017), Spain (2018)

An Example of A European SME Model

Italian SME & Mini-Bond Market

Our Work with U.S. H.Y. Bond Market, Classis Capital,

Italian Borsa, & Wiserfunding

Providing a Credit Market Discipline to the Italian Mini-bond Market

Models to Assess the Risk & Return Trade-Off for Investors & Issuers of Mini-bonds

Z" Score Model for Manufacturers, Non-Manufacturer Industrials; Developed and Emerging Market Credits (1995)

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

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

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

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

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

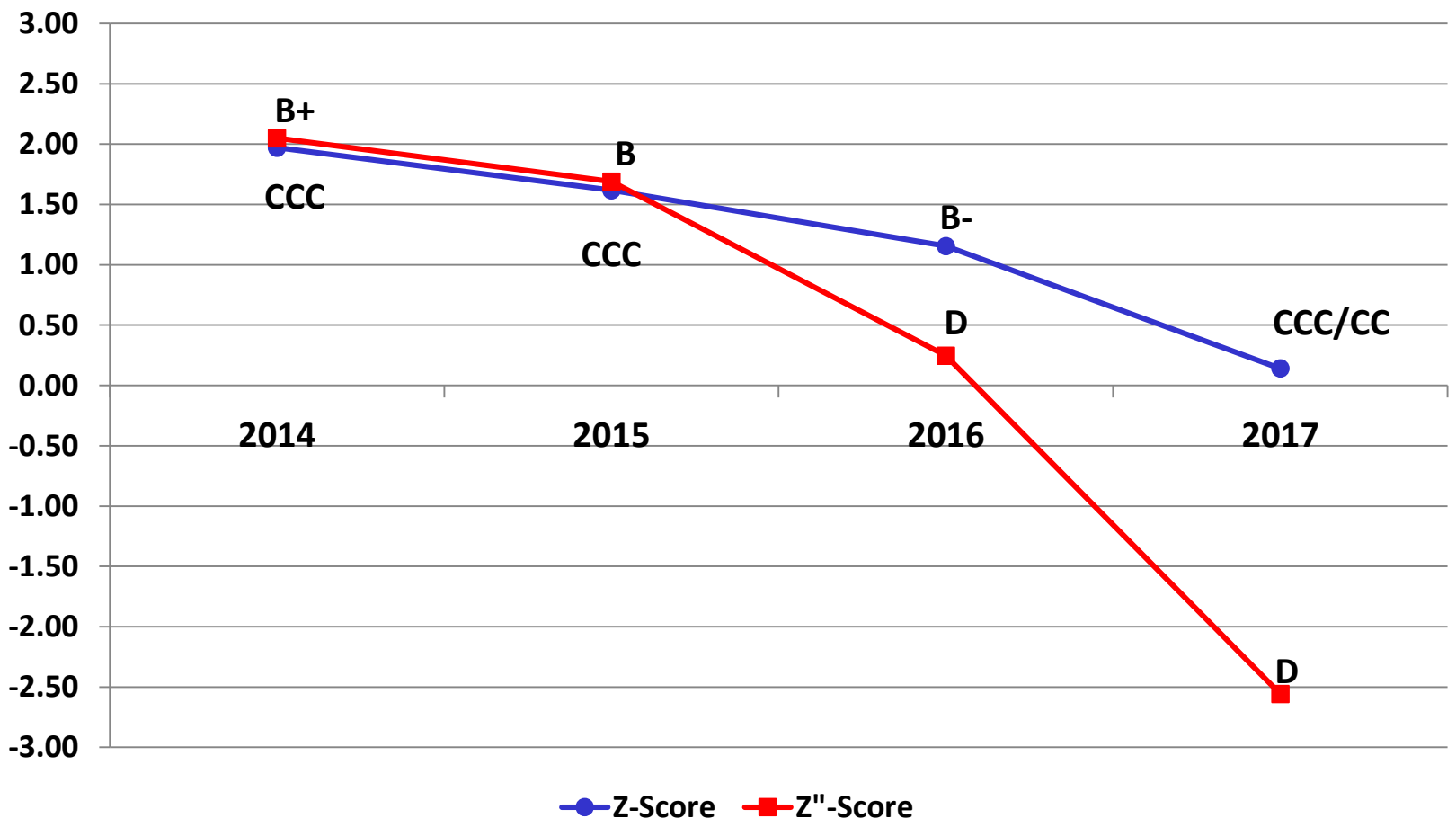
US Bond Rating Equivalents Based on Z”-Score Model

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

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]

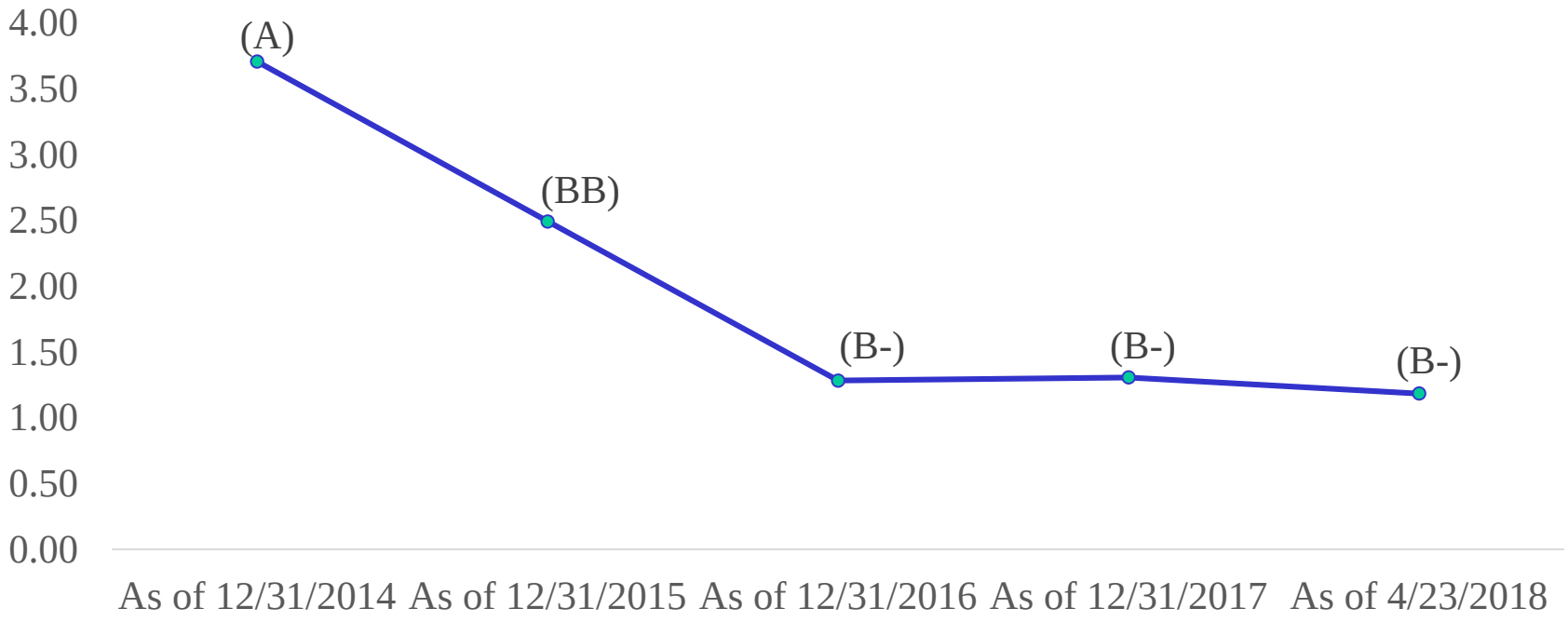
[a]Sample Size in Parantheses. [b]Interpolated between CCC and CC/D. [c]Based on 94 Chapter 11 bankruptcy filings, 2010-2013.
Sources: Compustat, Company Filings and S&P.

Z and Z”-Score Models Applied to Sears, Roebuck & Co.: Bond Rating Equivalents and Scores from 2014 – 2017



Source: E. Altman, NYU Salomon Center

Tesla Z Scores and BREs (2014 – April 2018)



Source: E. Altman, NYU Salomon Center

Current Conditions and Outlook in Global Credit Markets

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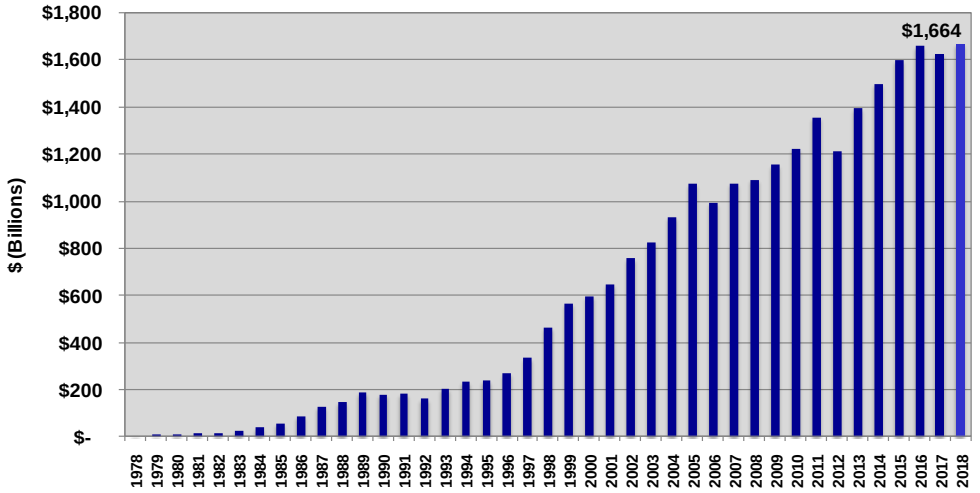
Size Of High-Yield Bond Market

US Market

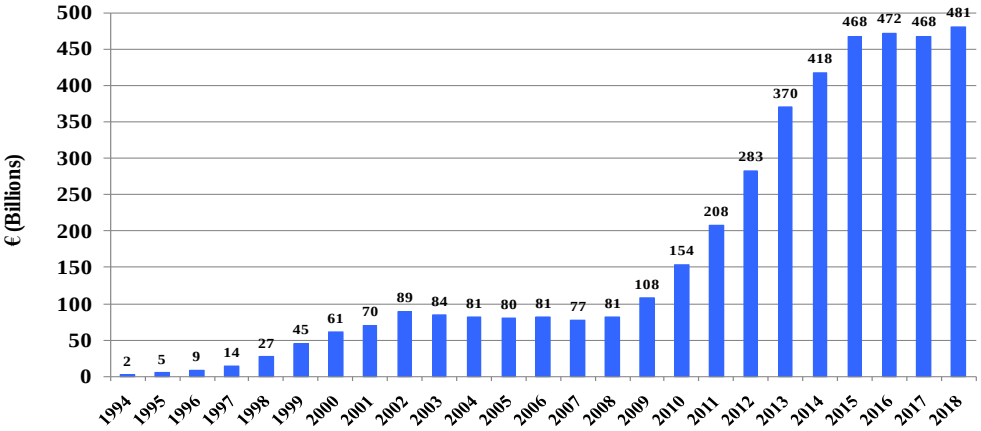
1978 – 2018 *(Mid-year US$ billions)*



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

Western Europe Market

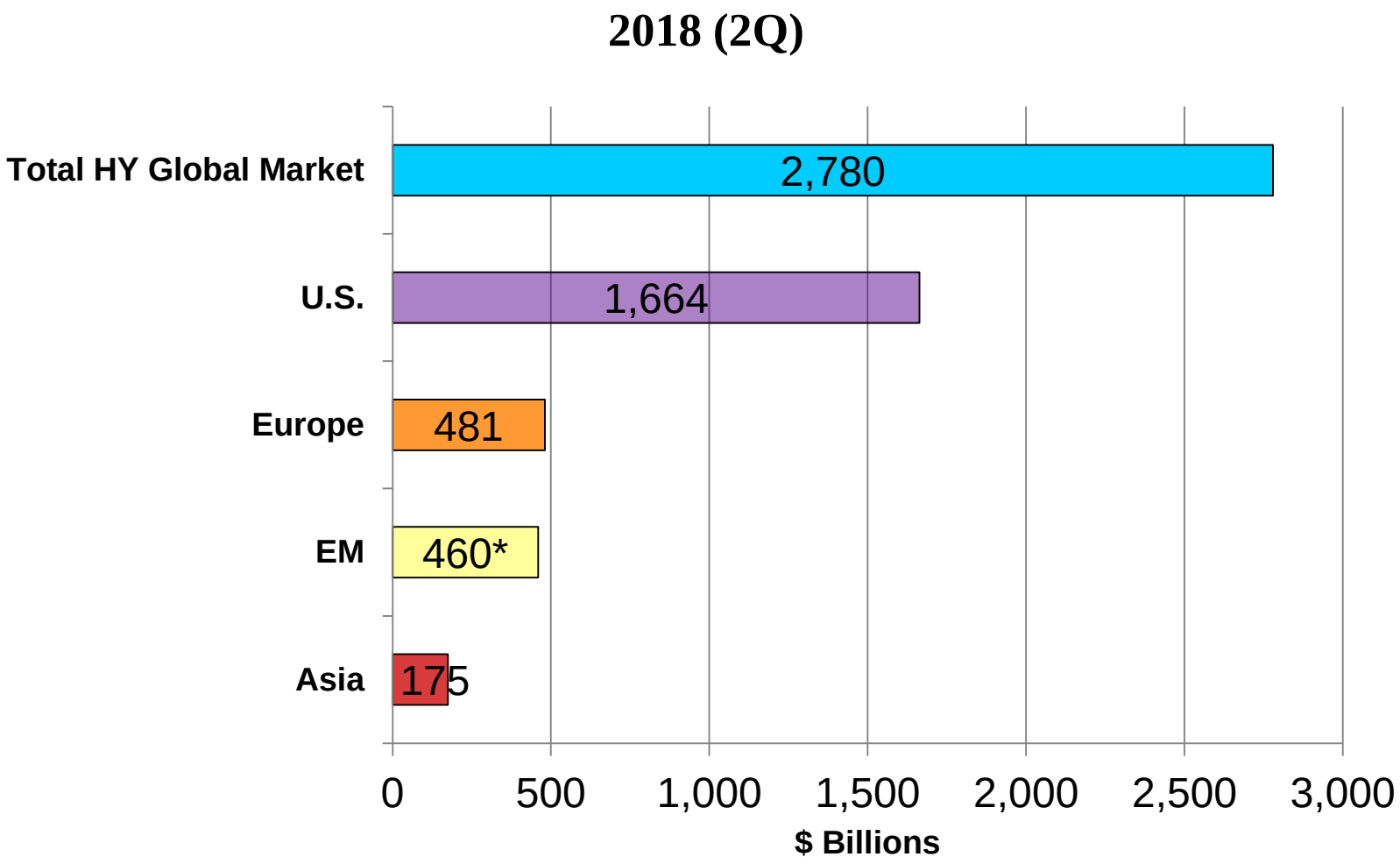
1994 – 2018 *(Mid-year € billions)**



Source: Credit Suisse

*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.

Size of Corporate HY Bond Market: U.S., Europe, Emerging Markets & Asia (ex. Japan) ($ Billions)

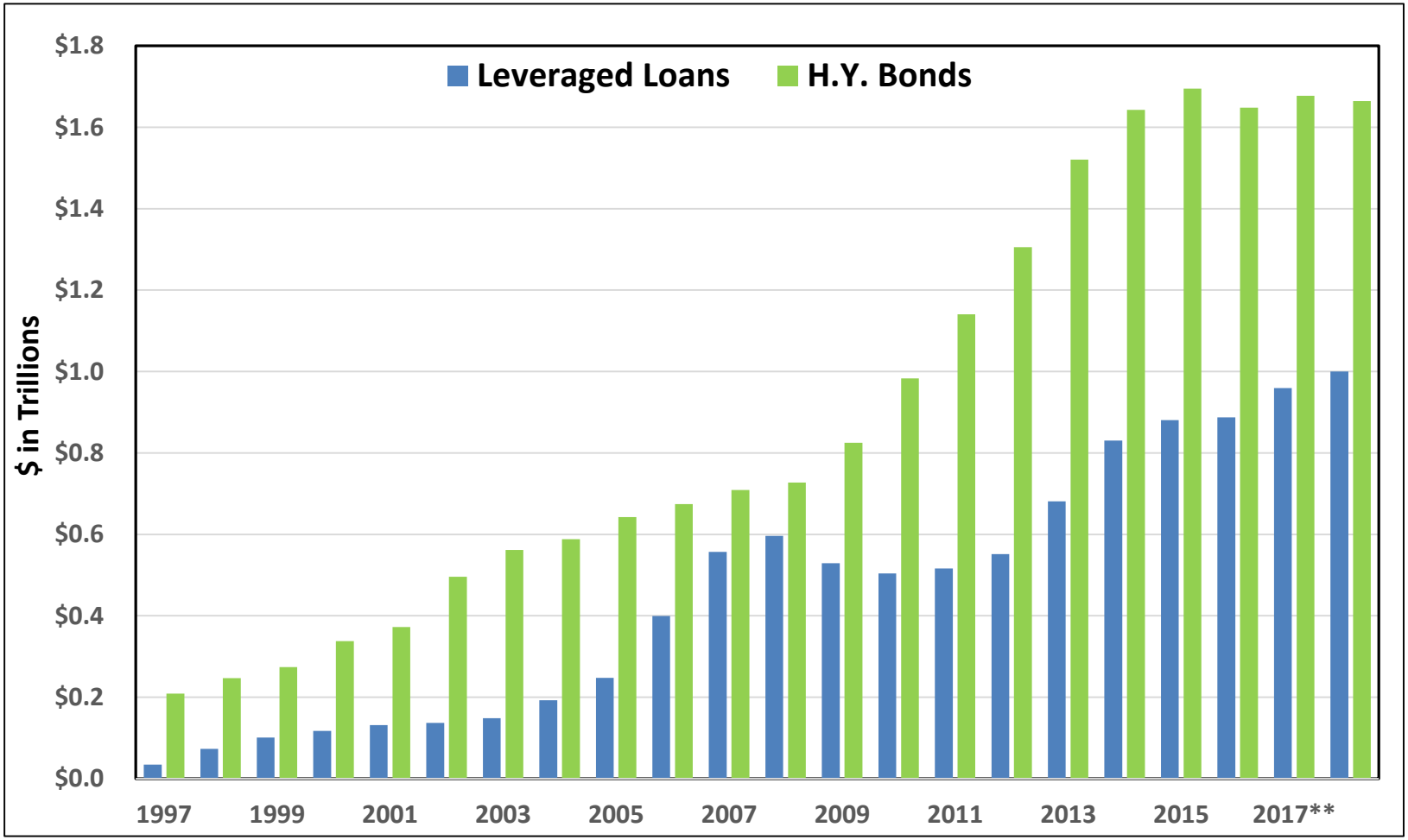


*Mainly Latin America. Note: EM & Asia value as of 2017.

Source: NYU Salomon Center, Credit Suisse, LIM Advisors Ltd.

Size of The U.S. High-Yield and Leveraged Loan* Markets

1997-2Q18



*Primarily Institutional Tranches. **NYU Salomon Center High-Yield Market Size as of 12/31/17 and 6/30/2018.
Source: S&P Global Market Intelligence.

Benign Credit Cycle: Is It Over?

- **Length of Benign Credit Cycles: Is the Current Cycle Over? No.**
- **Default Rates (no), Default Forecast (no), Recovery Rates (no), Yields (no) & Liquidity (no)**
- **Coincidence with Recessions: U.S. & European Scenarios**
- **Level of Non-financial Debt as a Percent of GDP**
- **Global Debt Levels**
- **Comparative Health of High-Yield Firms (2007 vs. 2017)**
- **High-Yield CCC New Issuance as a Liquidity Measure**
- **LBO Statistics and Trends**
- **Liquidity Concerns (Market and Market-Makers)**
- **Possible Timing of the Bubble Burst (Short-term versus Longer-term)**

Benign Credit Cycle? Is It Over?

- **Length of Benign Credit Cycles: Is the Current Cycle Over? No.**
- **Default Rates (no), but Rising**
- **Default Forecast (no)**
- **Recovery Rates (no)**
- **Yields (no)**
- **Liquidity (no)**

Historical H.Y. Bond Default Rates

Straight Bonds Only Excluding Defaulted Issues From Par Value Outstanding, (*US$ millions)*, 1971 – 3Q18 (Preliminary)

Year	Par Value Outstanding[a] ($)	Par Value Defaults ($)	Default Rates (%)
3Q18	**1,664,166**	**22,671**	**1.362**
2017	1,622,365	29,301	1.806
2016	1,656,176	68,066	4.110
2015	1,595,839	45,122	2.827
2014	1,496,814	31,589	2.110
2013	1,392,212	14,539	1.044
2012	1,212,362	19,647	1.621
2011	1,354,649	17,963	1.326
2010	1,221,569	13,809	1.130
2009	1,152,952	123,878	10.744
2008	1,091,000	50,763	4.653
2007	1,075,400	5,473	0.509
2006	993,600	7,559	0.761
2005	1,073,000	36,209	3.375
2004	933,100	11,657	1.249
2003	825,000	38,451	4.661
2002	757,000	96,855	12.795
2001	649,000	63,609	9.801
2000	597,200	30,295	5.073
1999	567,400	23,532	4.147
1998	465,500	7,464	1.603
1997	335,400	4,200	1.252
1996	271,000	3,336	1.231
1995	240,000	4,551	1.896
1994	235,000	3,418	1.454
1993	206,907	2,287	1.105
1992	163,000	5,545	3.402
1991	183,600	18,862	10.273

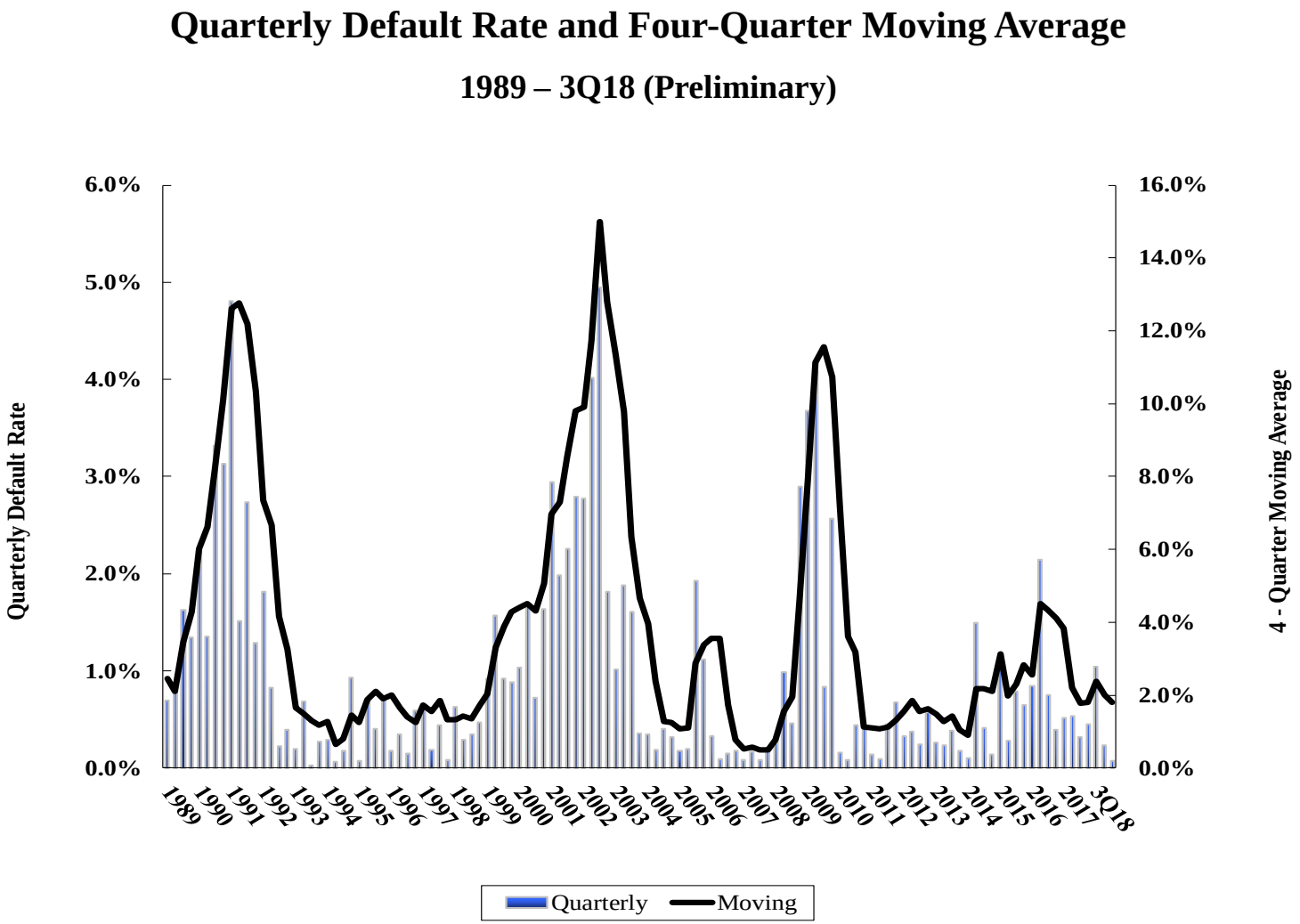
[a] Weighted by par value of amount outstanding for each year.

Year	Par Value Outstanding* ($)	Par Value Defaults ($)	Default Rates (%)
1990	181,000	18,354	10.140
1989	189,258	8,110	4.285
1988	148,187	3,944	2.662
1987	129,557	7,486	5.778
1986	90.243	3,156	3.497
1985	58,088	992	1.708
1984	40,939	344	0.840
1983	27,492	301	1.095
1982	18,109	577	3.186
1981	17,115	27	0.158
1980	14,935	224	1.500
1979	10,356	20	0.193
1978	8,946	119	1.330
1977	8,157	381	4.671
1976	7,735	30	0.388
1975	7,471	204	2.731
1974	10,894	123	1.129
1973	7,824	49	0.626
1972	6,928	193	2.786
1971	6,602	82	1.242

		Standard Deviation (%)
Arithmetic Average Default Rate (%)		
1971 to 2017	3.104	3.006
1978 to 2017	3.308	3.160
1985 to 2017	3.759	3.280
Weighted Average Default Rate (%)		
1971 to 2017	3.378	
1978 to 2017	3.381	
1985 to 2017	3.394	
Median Annual Default Rate (%)		
1971 to 2017	1.806	

Source: NYU Salomon Center and Citigroup/Credit Suisse estimates

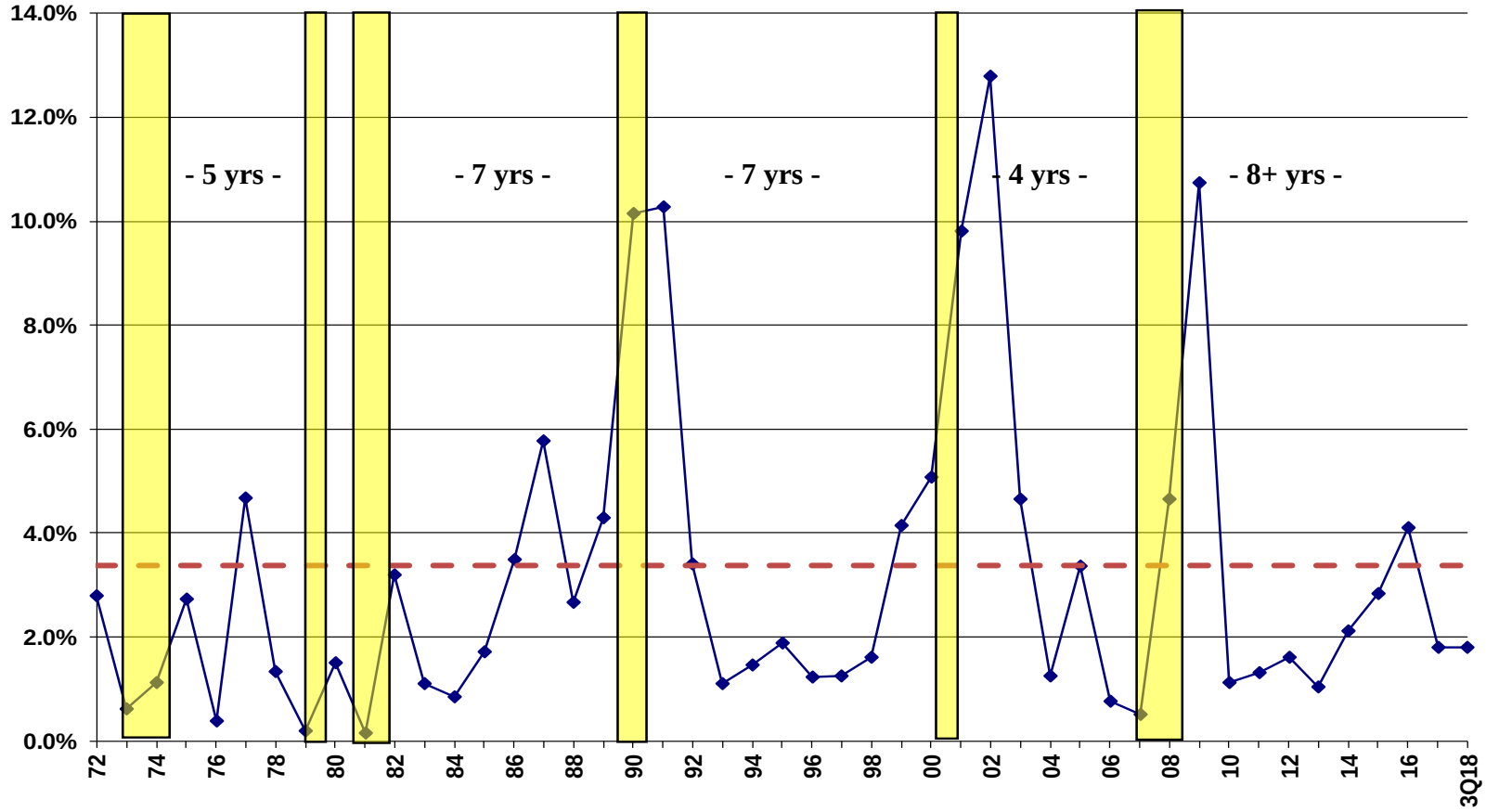
Default Rates on High-Yield Bonds



Source: Author's Compilations

Historical Default Rates, Benign Credit Cycles and Recession Periods in the U.S.*

High-Yield Bond Market (1972 – 3Q18 (Preliminary))



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

***Benign credit cycles are approximated. All rates annual, except for 3Q18, which is the LTM**

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

Forecasting Default Rates

Mortality Rate Approach (1989)

Yield-Spread vs. Default Rate Method (2008)

Distress Ratio vs. Default Rate Method (2008)

Default and Recovery Forecasts: Summary of Forecast Models

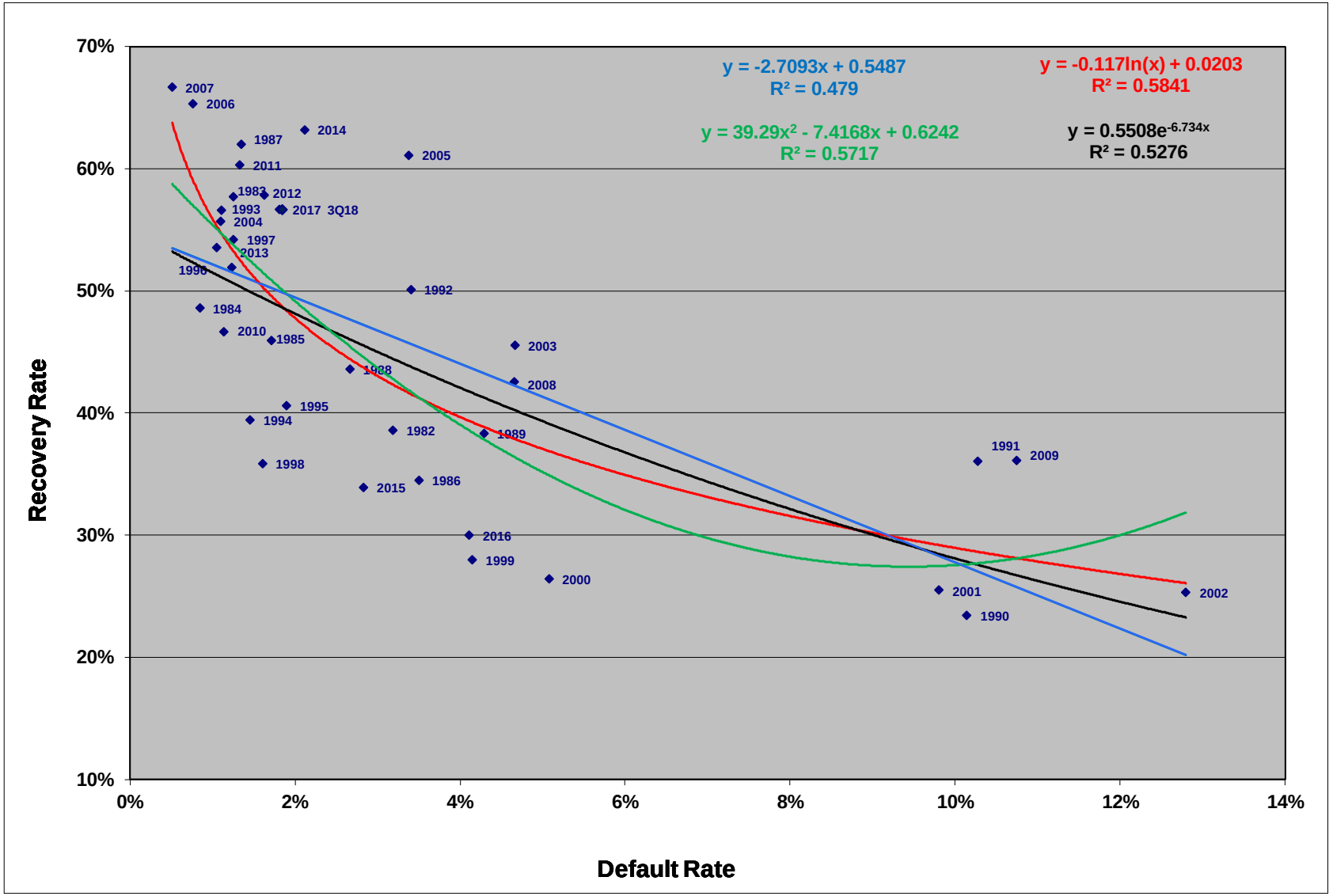
Model	2017 (12/31) Default Rate Forecast as of 12/31/2016	2018 (12/31) Default Rate Forecast as of 12/31/2017	2019 (9/30) Default Rate Forecast as of 9/30/2018
Mortality Rate	4.20%	3.90%	3.90%
Yield-Spread	2.18%[c]	1.95%[c]	1.48%[e]
Distress Ratio	1.94%[d]	1.75%[d]	1.48%[f]
Average of Models	2.77%	2.53%	2.29%
Recovery Rates*	43.8%	45.1%	46.2%

* Recovery rate based on the log Linear equation between default and recovery rates, see Altman, et al (2005) Journal of Business, November and Slide 45. [a] Based on Dec. 31, 2016 yield-spread of 412.1bp. [b] Based on Dec. 31, 2016 Distress Ratio of 7.37%. [c] Based on Dec. 31, 2017 yield-spread of 394.6bp. [d] Based on Dec. 31, 2017 Distress Ratio of 6.11%. [e] Based on Sept. 30, 2018 yield-spread of 356.5bp. [f] Based on Aug., 31, 2018 Distress Ratio of 4.16%.

Source: All Corporate Bond Issuance and Authors' Estimates of Market Size in 2017 & 2018.

Recovery Rates

Recovery Rate/Default Rate Association: Dollar-Weighted Average Recovery Rates to Dollar Weighted Average Default Rates, 1982 – 3Q18 (Preliminary)



Source: E. Altman, et. al., "The Link Between Default and Recovery Rates", NYU Salomon Center, S-03-4.

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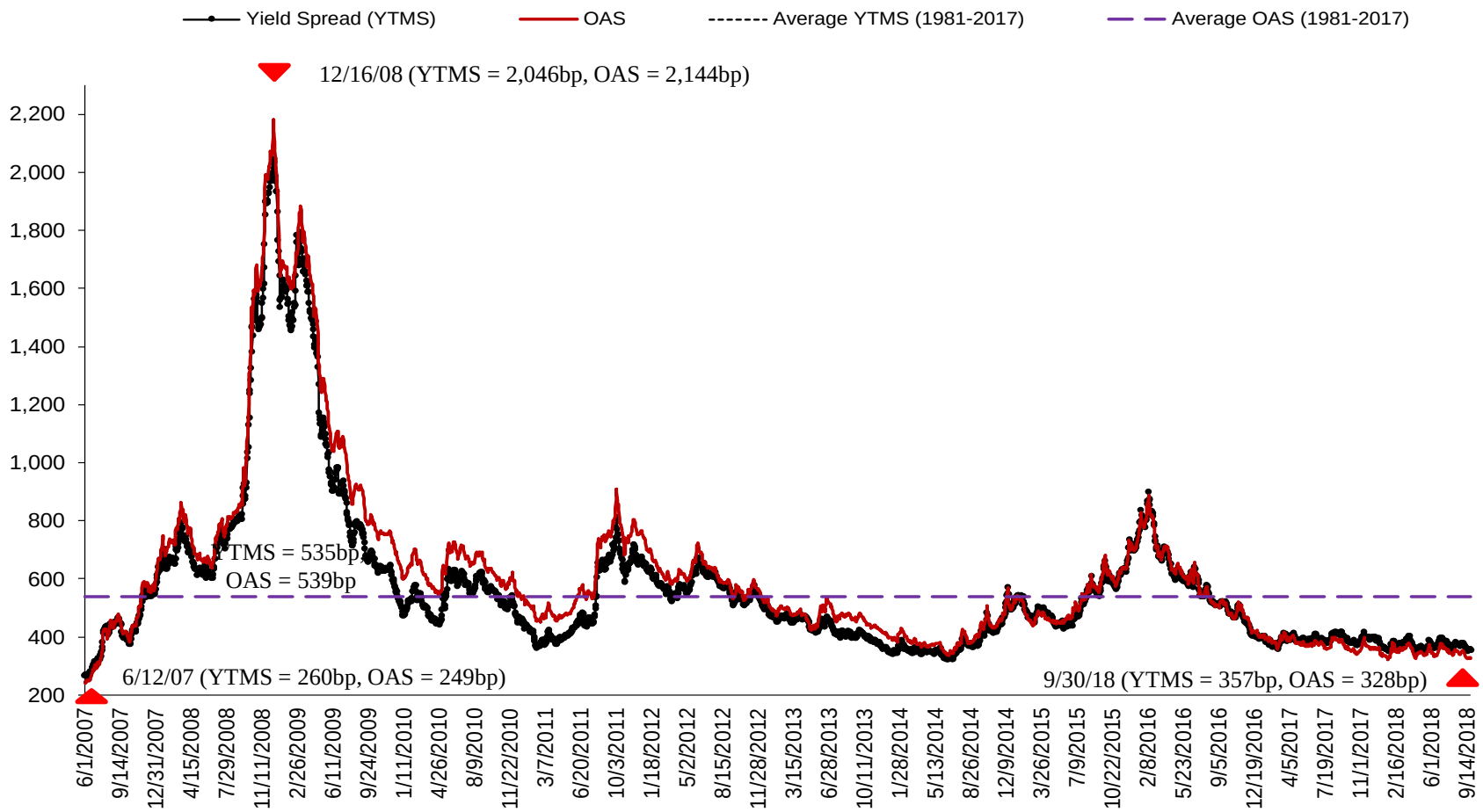
YTM & Option-Adjusted Spreads Between High Yield Markets & U.S. Treasury Notes

June 01, 2007 – September 30, 2018



Sources: FTSE Fixed Income Index Data and Bank of America Merrill Lynch.

Annual Returns (1978 – 2018 (9/30))

Yields and Spreads on 10-Year Treasury (Treas) and High Yield (HY) Bonds[a]

	Return (%)			Promised Yield (%)		
Year	HY	Treas	Spread	HY	Treas	Spread
2018 (9/30)	2.70	(3.74)	6.44	6.62	3.05	3.57
2017	7.05	2.13	4.92	6.35	2.41	3.95
2016	17.83	(0.14)	17.96	6.55	2.43	4.12
2015	(5.56)	0.90	(6.46)	9.27	2.27	7.00
2014	1.83	10.72	(8.89)	7.17	2.17	5.00
2013	7.22	(7.85)	15.06	6.45[b]	3.01	3.45
2012	15.17	4.23	10.95	6.80	1.74[b]	5.06
2011	5.52	16.99	(11.47)	8.41	1.88	6.54
2010	14.32	8.10	6.22	7.87	3.29	4.58
2009	55.19	(9.92)	65.11	8.97	3.84	5.14
2008	(25.91)	20.30	(46.21)	19.53	2.22	17.31
2007	1.83	9.77	(7.95)	9.69	4.03	5.66
2006	11.85	1.37	10.47	7.82	4.70	3.11
2005	2.08	2.04	0.04	8.44	4.39	4.05
2004	10.79	4.87	5.92	7.35	4.21	3.14
2003	30.62	1.25	29.37	8.00	4.26	3.74
2002	(1.53)	14.66	(16.19)	12.38	3.82	8.56
2001	5.44	4.01	1.43	12.31	5.04	7.27
2000	(5.68)	14.45	(20.13)	14.56	5.12	9.44
1999	1.73	(8.41)	10.14	11.41	6.44	4.97
1998	4.04	12.77	(8.73)	10.04	4.65	5.39
1997	14.27	11.16	3.11	9.20	5.75	3.45
1996	11.24	0.04	11.20	9.58	6.42	3.16
1995	22.40	23.58	(1.18)	9.76	5.58	4.18
1994	(2.55)	(8.29)	5.74	11.50	7.83	3.67
1993	18.33	12.08	6.25	9.08	5.80	3.28
1992	18.29	6.50	11.79	10.44	6.69	3.75
1991	43.23	17.18	26.05	12.56	6.70	5.86
1990	(8.46)	6.88	(15.34)	18.57	8.07	10.50
1989	1.98	16.72	(14.74)	15.17	7.93	7.24
1988	15.25	6.34	8.91	13.70	9.15	4.55
1987	4.57	(2.67)	7.24	13.89	8.83	5.06
1986	16.50	24.08	(7.58)	12.67	7.21	5.46
1985	26.08	31.54	(5.46)	13.50	8.99	4.51
1984	8.50	14.82	(6.32)	14.97	11.87	3.10
1983	21.80	2.23	19.57	15.74	10.70	5.04
1982	32.45	42.08	(9.63)	17.84	13.86	3.98
1981	7.56	0.48	7.08	15.97	12.08	3.89
1980	(1.00)	(2.96)	1.96	13.46	10.23	3.23
1979	3.69	(0.86)	4.55	12.07	9.13	2.94
1978	7.57	(1.11)	8.68	10.92	8.11	2.81
Arithmetic Annual Average						
1978-2017	10.39	7.55	2.84	11.25	6.07	5.18
Compound Annual Average						
1978-2017	9.51	7.02	2.49			

[a] End-of-year yields. [b] Lowest yield in time series. Source: FTSE's High Yield Composite Index

HY Annual Total Returns and Yields (2000 – 2018)

European and US HY Index Total Return and Yield spreads over Govt. Bonds

	Total Return (TR)		TR spread over Govt. Bond		Promised Yield		YLD Spread over 10yr Govt. Bond	
Year	EUR HY	US HY	EUR HY	US HY	EUR HY	US HY	EUR HY	US HY
2018	-0,05%	-0,38%	1,32%	3,34%	3,51%	6,62%	2,86%	3,74%
2017	6,24%	7,05%	7,00%	4,92%	3,32%	6,35%	2,89%	3,95%
2016	6,48%	17,83%	2,15%	17,96%	4,13%	6,55%	3,93%	4,12%
2015	2,92%	-5,56%	2,10%	-6,46%	5,37%	9,27%	4,74%	7,00%
2014	7,02%	1,83%	-6,37%	-8,89%	4,65%	7,17%	4,10%	5,00%
2013	9,90%	7,22%	11,76%	15,06%	5,08%	6,45%	3,15%	3,45%
2012	28,49%	15,17%	21,55%	10,95%	6,63%	6,80%	5,32%	5,06%
2011	-2,39%	5,52%	-15,23%	-11,47%	11,74%	8,41%	9,91%	6,54%
2010	16,18%	14,32%	9,27%	6,22%	8,60%	7,87%	5,63%	4,58%
2009	86,67%	55,19%	85,05%	65,11%	10,74%	8,97%	7,35%	5,14%
2008	-34,90%	-25,91%	-49,86%	-46,21%	26,05%	19,53%	23,10%	17,31%
2007	-2,99%	1,83%	-4,65%	-7,95%	9,36%	9,69%	5,05%	5,66%
2006	11,66%	11,85%	12,51%	10,47%	6,71%	7,82%	2,76%	3,11%
2005	6,71%	2,08%	0,81%	0,04%	7,79%	8,44%	4,48%	4,05%
2004	13,98%	10,79%	4,78%	5,92%	6,70%	7,35%	3,02%	3,14%
2003	28,52%	30,62%	24,20%	29,37%	7,80%	8,00%	3,51%	3,74%
2002	-3,31%	-1,53%	-14,59%	-16,19%	14,34%	12,38%	10,14%	8,56%
2001	-8,11%	5,44%	-12,46%	1,43%	17,52%	12,31%	12,52%	7,27%
2000	-11,17%	-5,68%	-19,97%	-20,13%	16,82%	14,56%	11,97%	9,44%

Source: Bloomberg Barclays Indices; Citigroup Indices; Classis Capital

EUR HY: Bloomberg Barclays Pan-European High Yield Total Return Index

US HY: Citigroup's High Yield Composite Index

EUR Govt.Bond TR: Bloomberg Barclays Germany Govt 7 to 10 Year TR

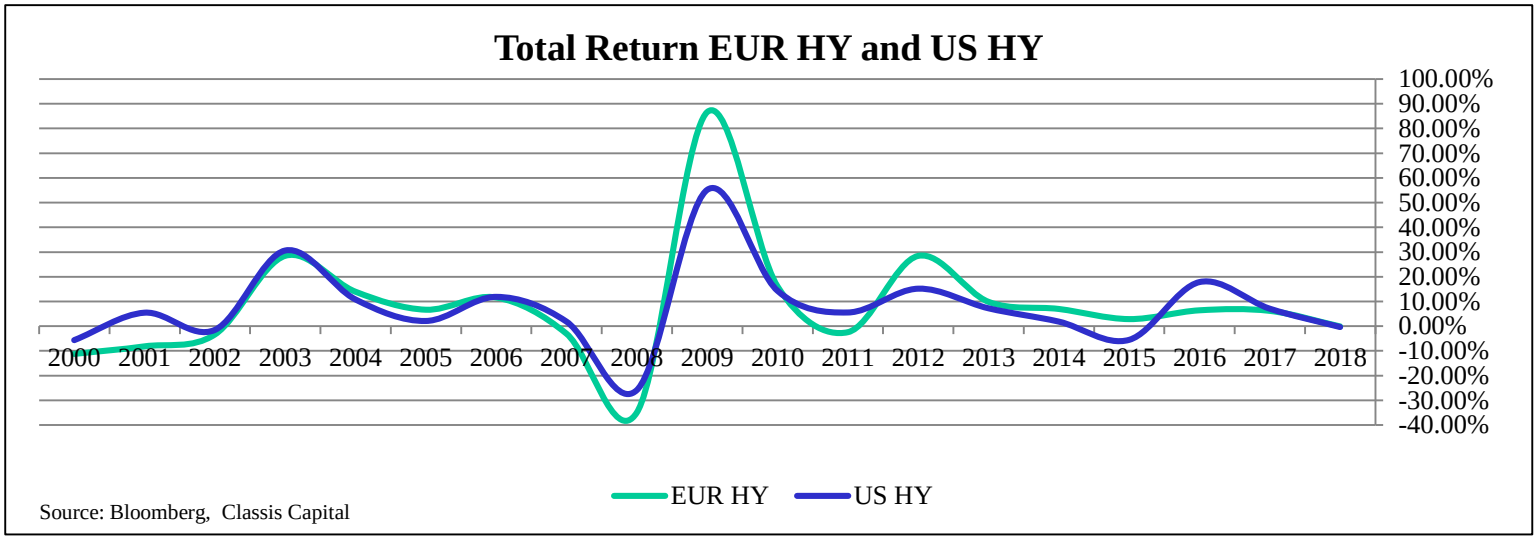
Compounded Annual Growth Rate (CAGR)	EUR HY	US HY
2001-2017	7,91%	7,88%
2008-2017	9,26%	7,59%
2010-2017	9,02%	7,68%

Arithmetic Average Return	EUR HY	US HY
2001-2017	10,18%	9,04%
2008-2017	12,66%	9,27%
2010-2017	9,35%	7,92%

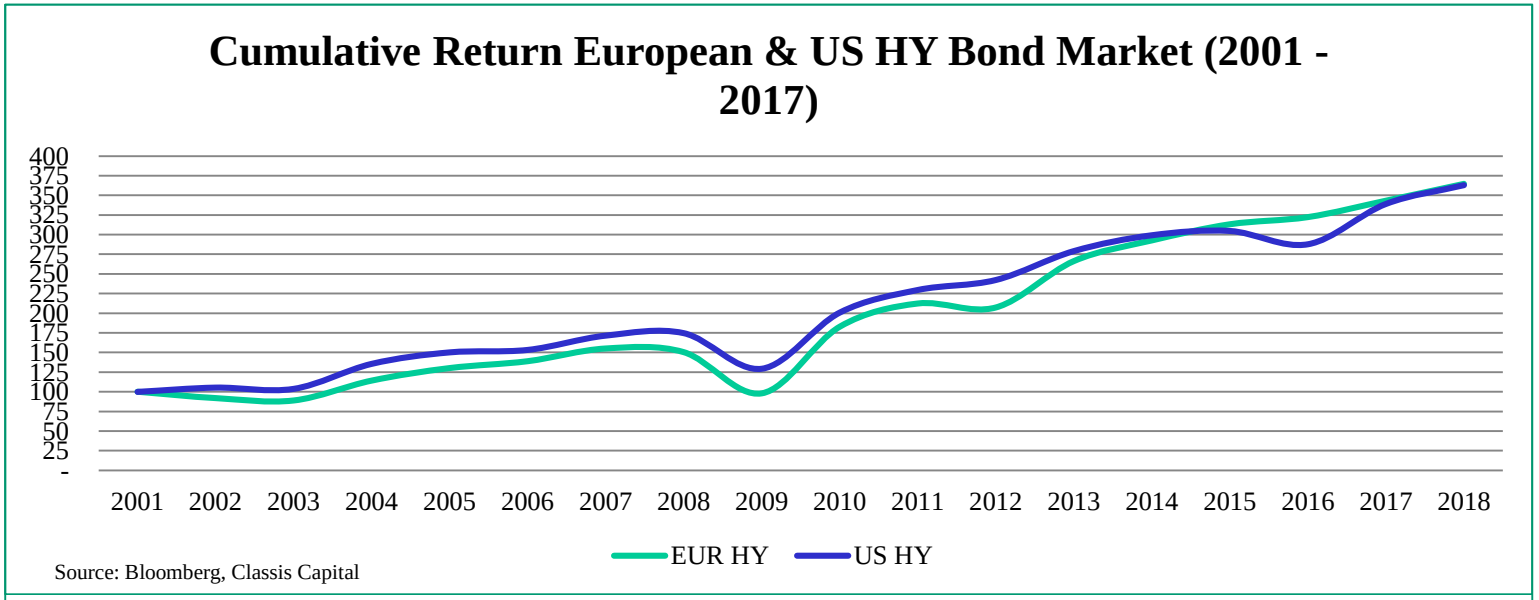
Correlation Between US & EUR HY Market	Annual	Monthly
2001-2017	0,99	0,87
2008-2017	0,96	0,91
2010-2017	0,69	0,87

Source: Bloomberg Barclays Indices; ICE BOFAML Indices; Citigroup Indices; Classis Capital

European and US HY Bond Market Return



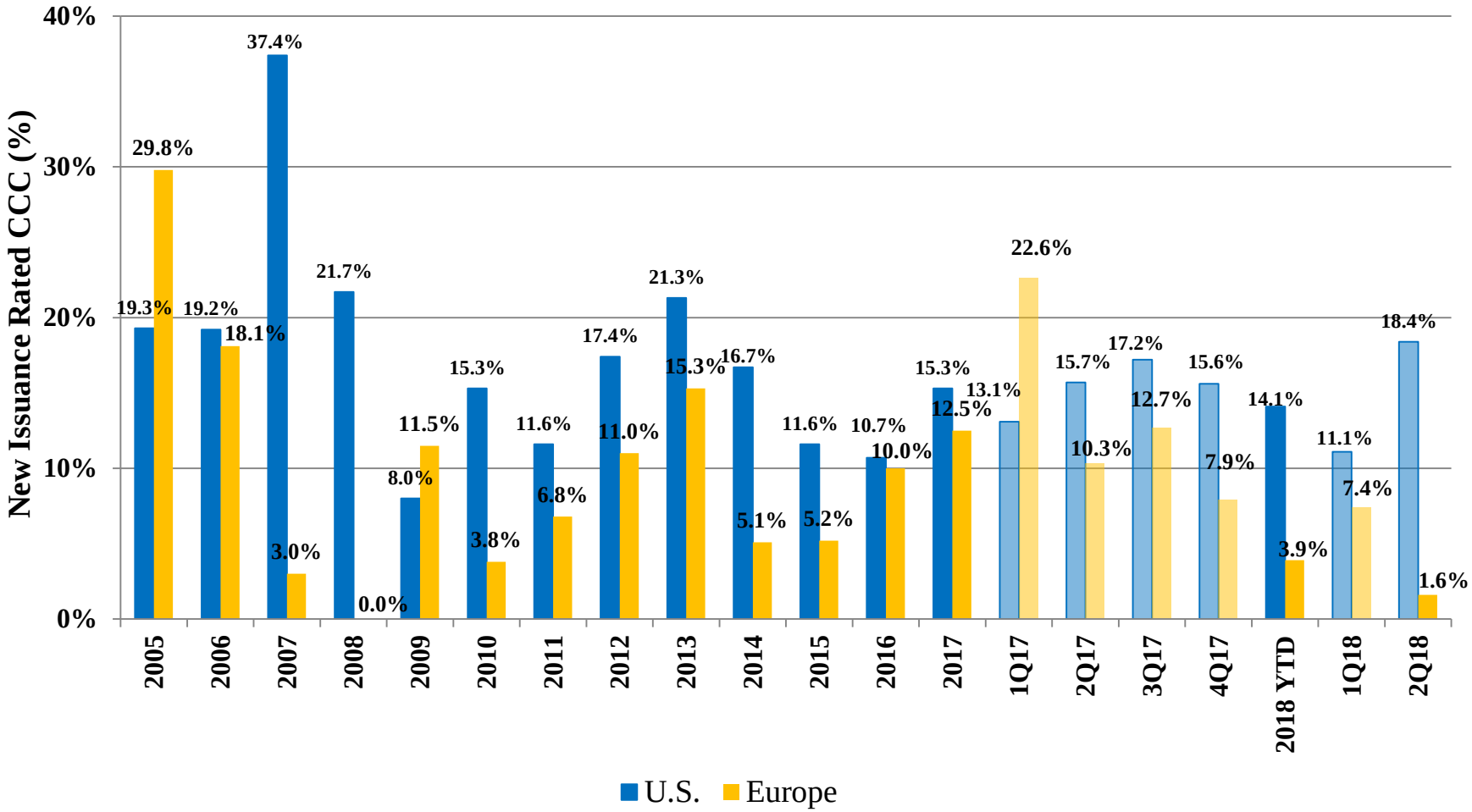
Source: Bloomberg, Classis Capital



Source: Bloomberg, Classis Capital

U.S. & European High-Yield Bond Market: CCC Rated New Issuance (%)

2005 – 2Q18

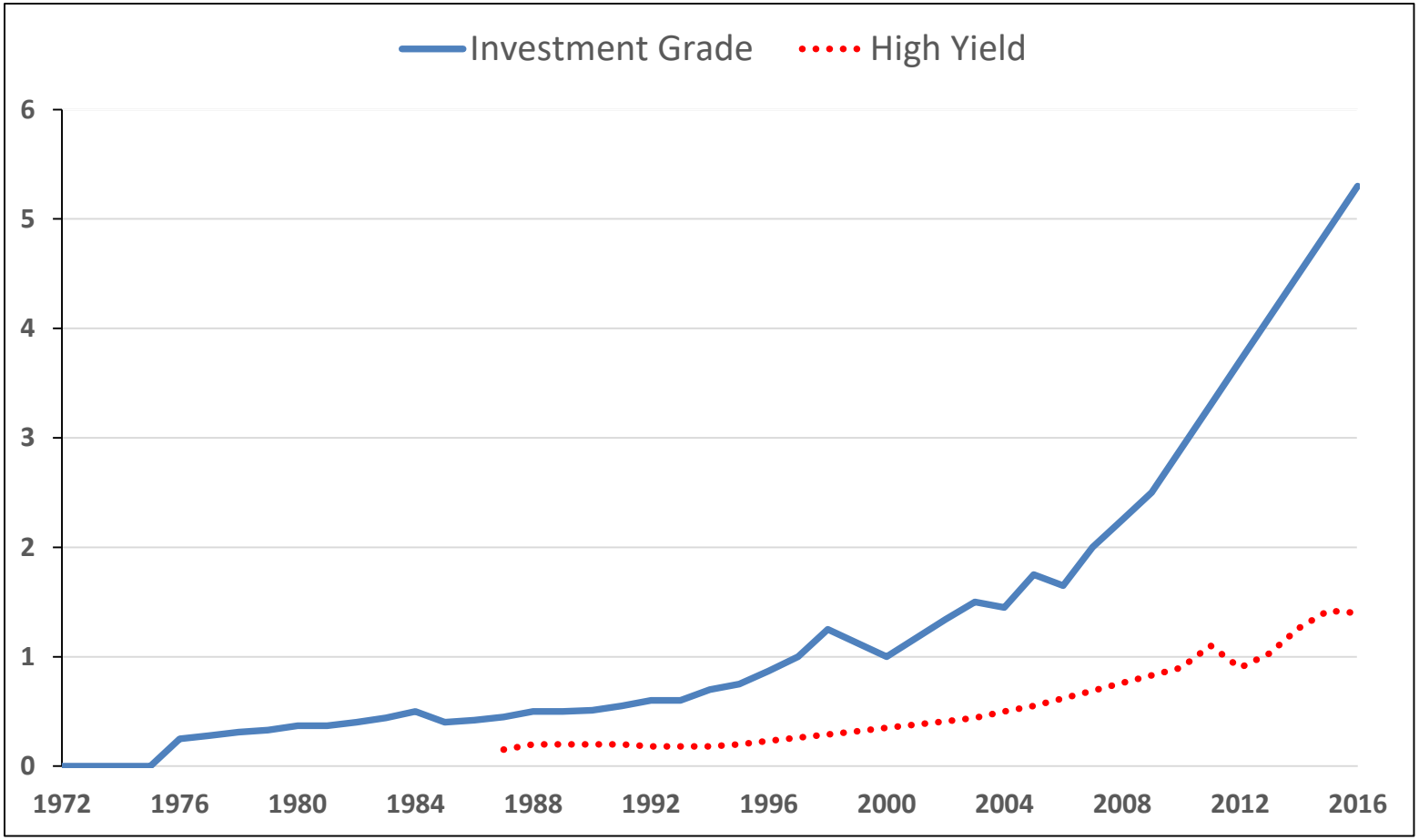


Source: Bank of America Merrill Lynch

Some Concerns About the Benign Credit Cycle

U.S. Corporate Leverage Surges

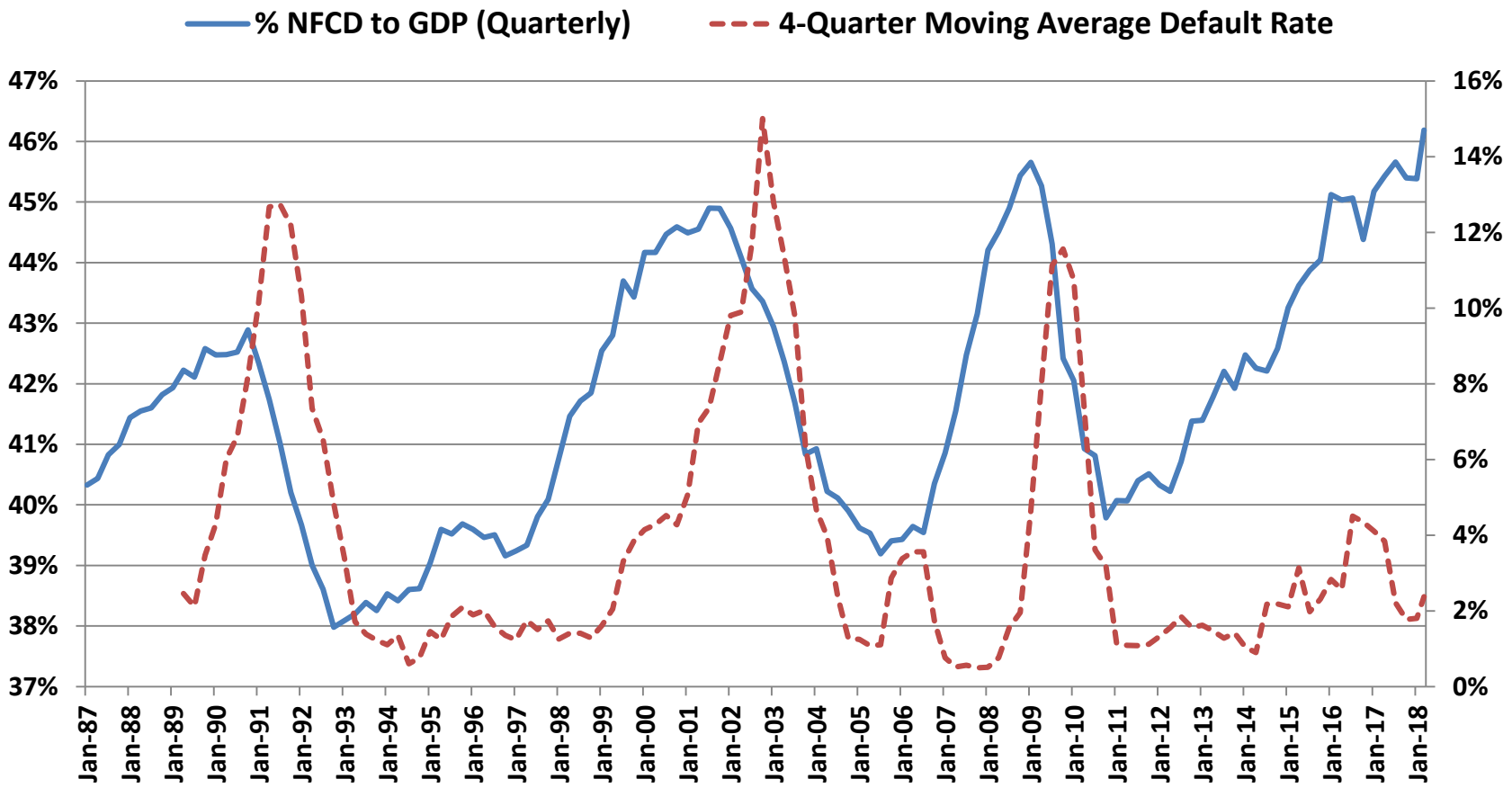
Outstanding Corporate Bonds, by Rating ($tn)



Sources: Bank of America Merrill Lynch, Estimated from Platt, E., "Triple A Quality Fades as Companies Embrace Debt", *Financial Times*, May 24, 2016.

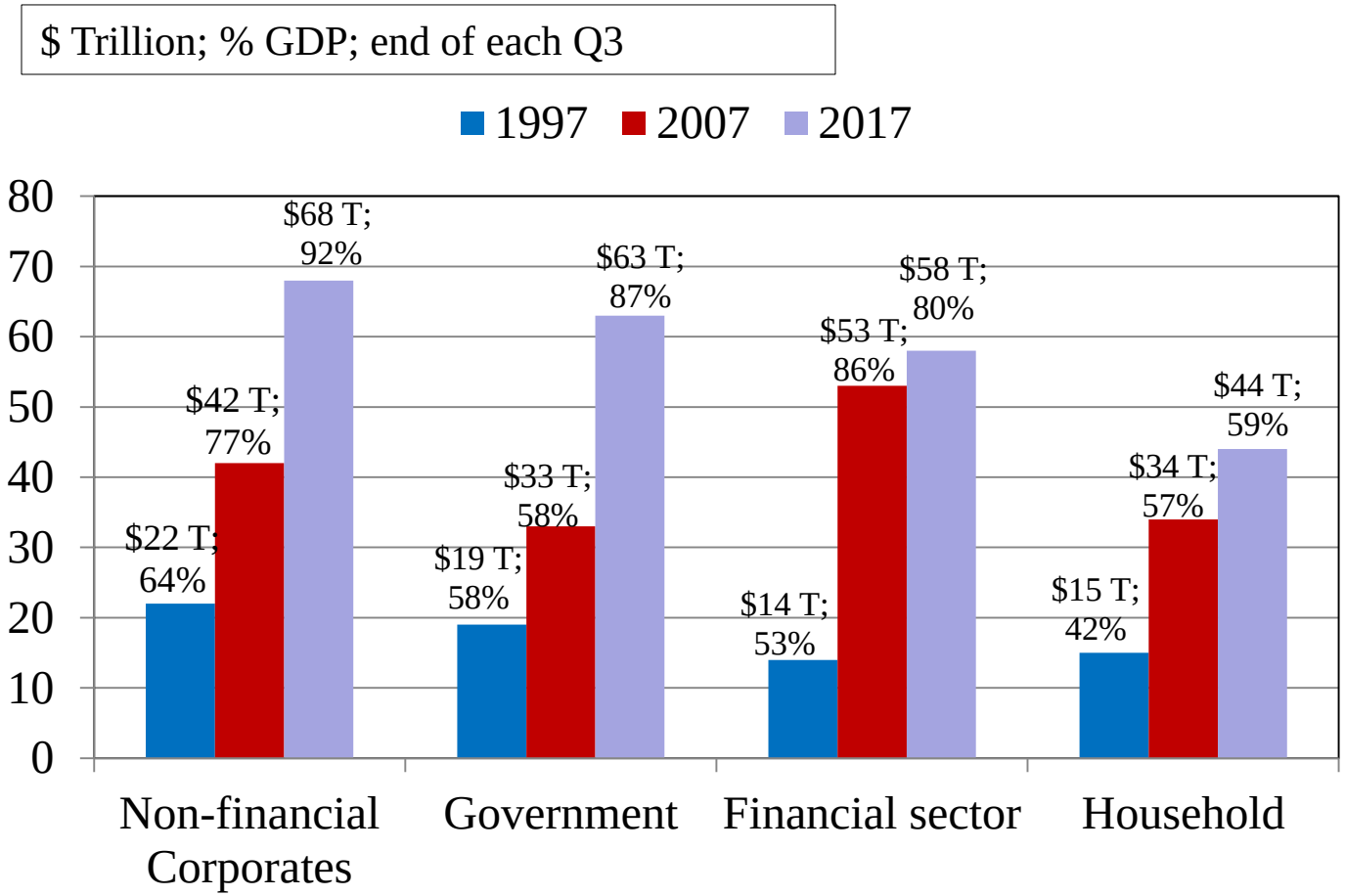
U.S. Non-financial Corporate Debt (Credit Market Instruments) to GDP: Comparison to 4-Quarter Moving Average Default Rate

January 1, 1987 – March 31, 2018



Sources: FRED, Federal Reserve Bank of St. Louis and Altman/Kuehne High-Yield Default Rate data.

Global Sectoral Indebtedness



Year	% of GDP	Total $ Amt. ($ T)
1997	217%	70
2007	278%	162
2017	318%	233

Sources: Chart from *Independent UK* using IIF, BIS, IMF and Haver data.

Comparative Health of High-Yield Firms (2007 vs. 2016)

Comparing Financial Strength of High-Yield Bond Issuers in 2007& 2012/2014/2017

Number of Firms		
	Z-Score	Z”-Score
2007	294	378
2012	396	486
2014	577	741
2017	529	583

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+)
2017	2.08 (B+)	1.98 (B+)	5.08 (BB-)	5.09 (BB-)

*Bond Rating Equivalent

Source: Authors’ calculations, data from Altman and Hotchkiss (2006) and S&P Global Market Intelligence’s S&P *Capital IQ platform/Compustat database.*

Major Risks Going Forward

- Global Economic Performance – Primarily U.S., China and Europe: Impact on Default Rates, Credit Availability and Quality (No Current Major Concern)
- Falling Oil Prices (No Current Major Concern)
- Global Debt Excess and Increasing Interest Rates
- High-Yield Fundamentals Still Fairly Weak
- Contagion Between Markets – Risky Debt and Equity
- Interest Rates and Inflation – Reduced Importance of the Search-for-Yield
- LBO, Covenant-Lite and CCC New Issuance
- Sovereign Debt Crisis – Asia (1997), Europe (2009-13), Emerging Markets?
- Uncertainties (non-quantifiable) – e.g. Political, Trade, Other