



CDIAC

CALIFORNIA
DEBT AND
INVESTMENT
ADVISORY
COMMISSION

ADVANCED CREDIT ANALYSIS: LOOKING AT NEGOTIABLE CERTIFICATE OF DEPOSITS, COMMERCIAL PAPER, CORPORATES, AND ASSET-BACKED SECURITIES

Kevin Webb, CFA, Director, Cantor Fitzgerald

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Disclaimer

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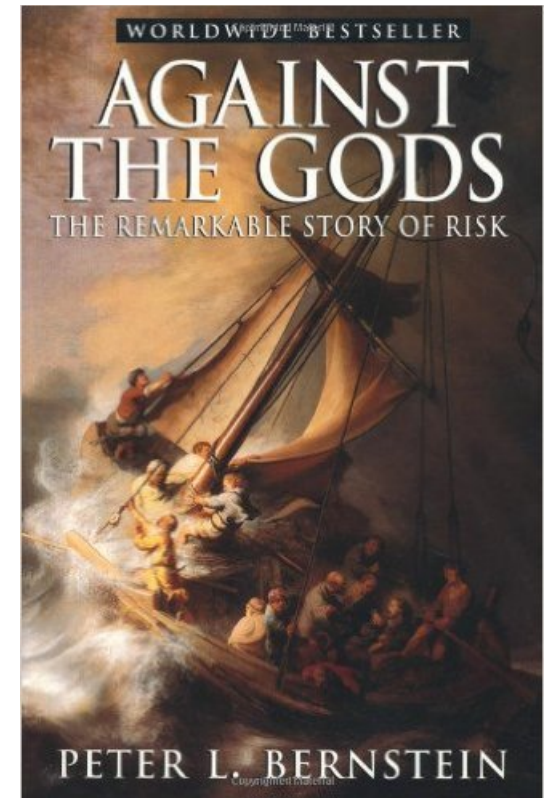
Agenda

- It's All About Risk & Reward
 - ▣ Treasury Yield Curve
 - ▣ Credit Risk Breakdown
 - ▣ Credit Ratings: Letters & Numbers
 - ▣ One Credit Rating to Rule Them All

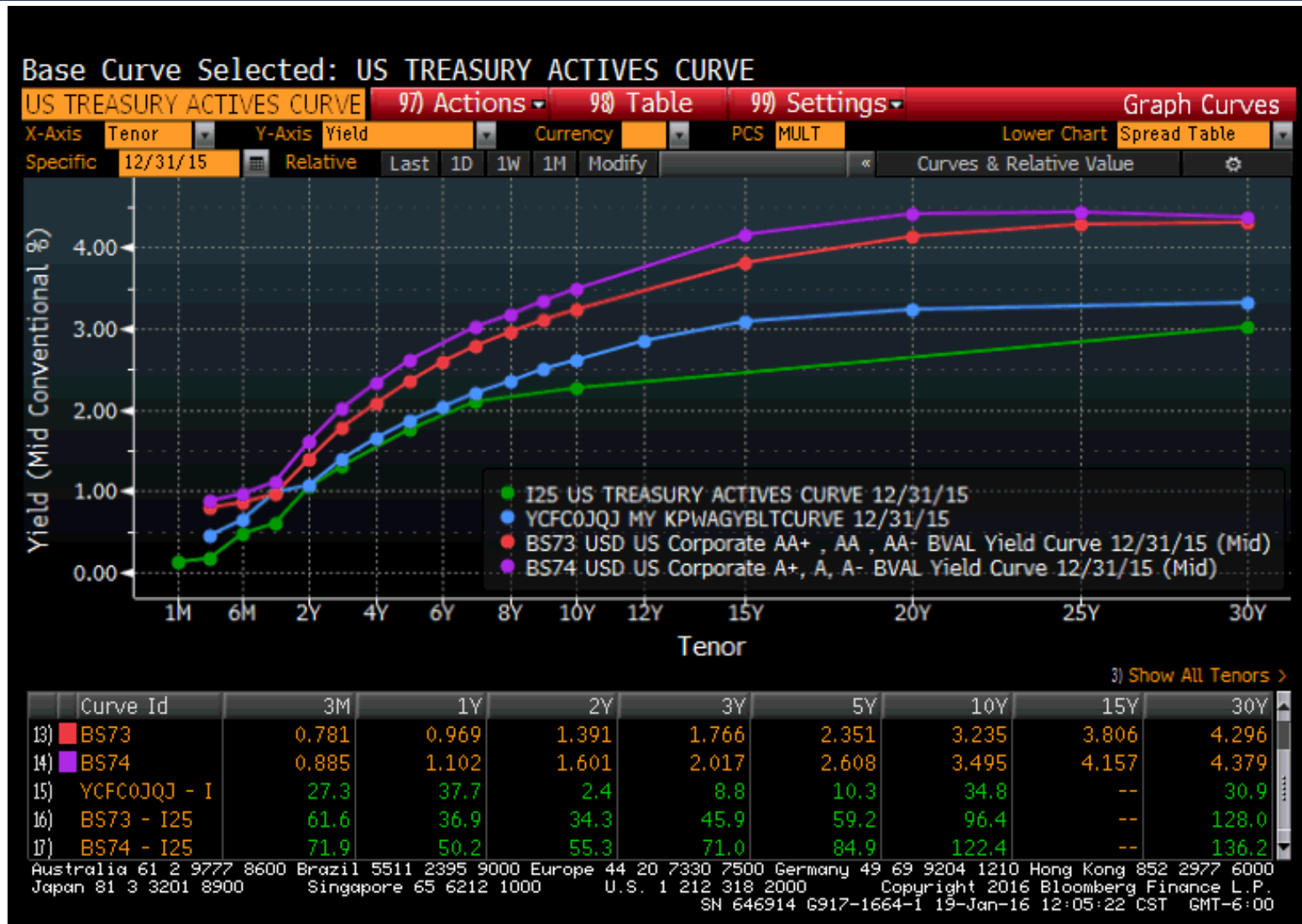
- Limited Time, Staff & Resources: What to do?
 - ▣ WolframAlpha
 - ▣ FRED

Risk & Reward

"You want a valve that doesn't leak and you try everything possible to develop one. But the real world provides you with a leaky valve. You have to determine how much leaking you can tolerate."



The Yield Curve Framework



Credit Risk

□ Default Risk

- The risk that the issuer will fail to satisfy the terms of the obligation with respect to the timely payment of interest and principal.

□ Credit Spread Risk

- The risk that an issuer's debt obligation will decline due to an increase in the credit spread is called credit spread risk.

□ Downgrade Risk

- An unanticipated downgrading of an issue or issuer

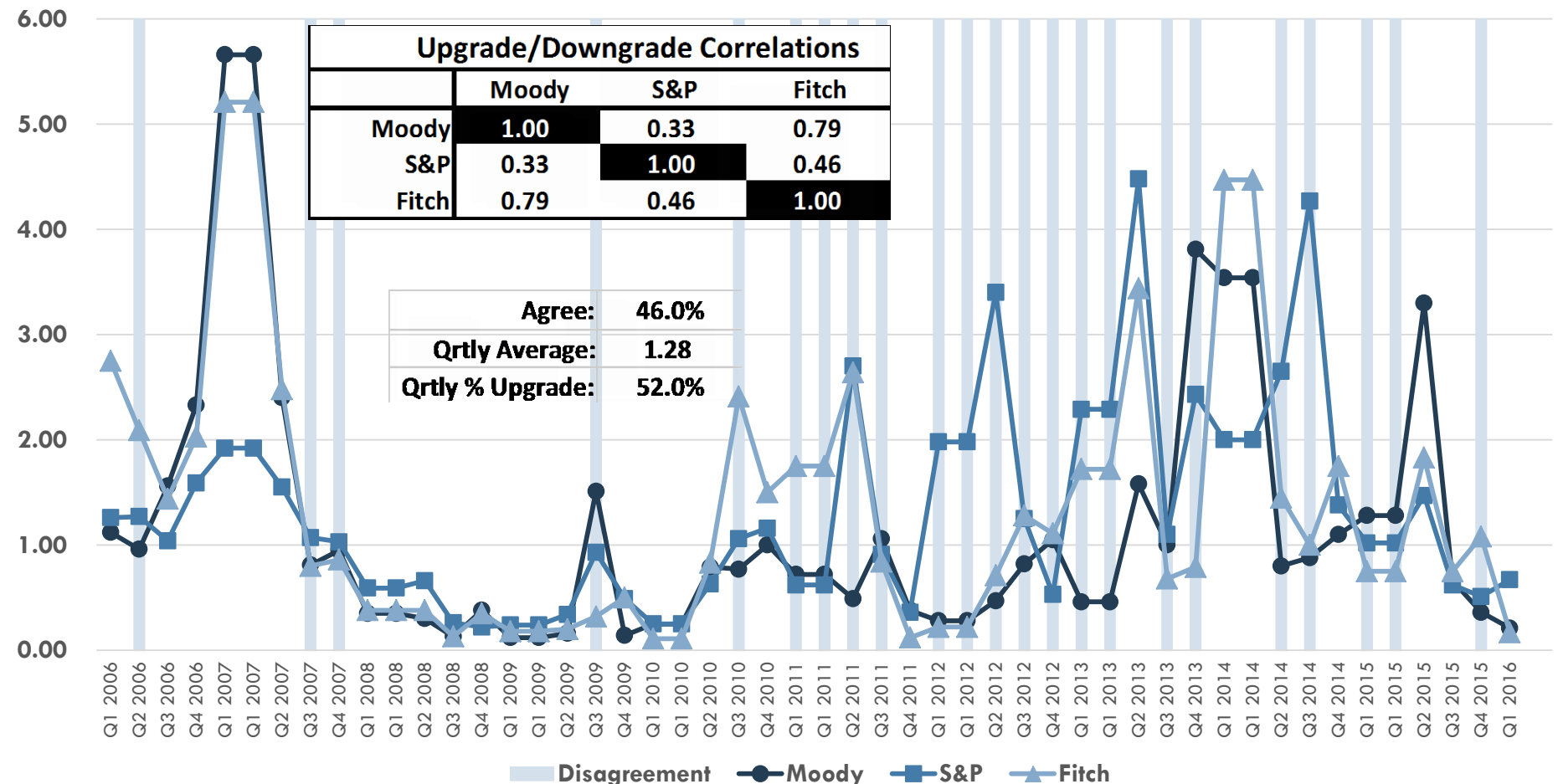
Ratings: Letters

Moody's		S&P		Fitch		Rating description	
Long-term	Short-term	Long-term	Short-term	Long-term	Short-term		
Aaa	P-1	AAA	A-1+	AAA	F1+	Prime	Investment-grade
Aa1		AA+		AA+		High grade	
Aa2		AA		AA			
Aa3		AA−		AA−			
A1		A+	A-1	A+	F1	Upper medium grade	
A2		A		A			
A3	P-2	A−	A-2	A−	F2	Lower medium grade	
Baa1		BBB+		BBB+			
Baa2	P-3	BBB	A-3	BBB	F3		
Baa3		BBB−		BBB−			

Upgrade/Downgrade Ratios

Moody, S&P and Fitch Upgrade/Downgrade Ratio History Q1 2006 - Q1 2016

[US Investment Grade Debt, All industries, All Rating Types, Credit Watches Included]



Default Rates

Average Cumulative Default Rates For Corporates By Region (1981-2014) (%)

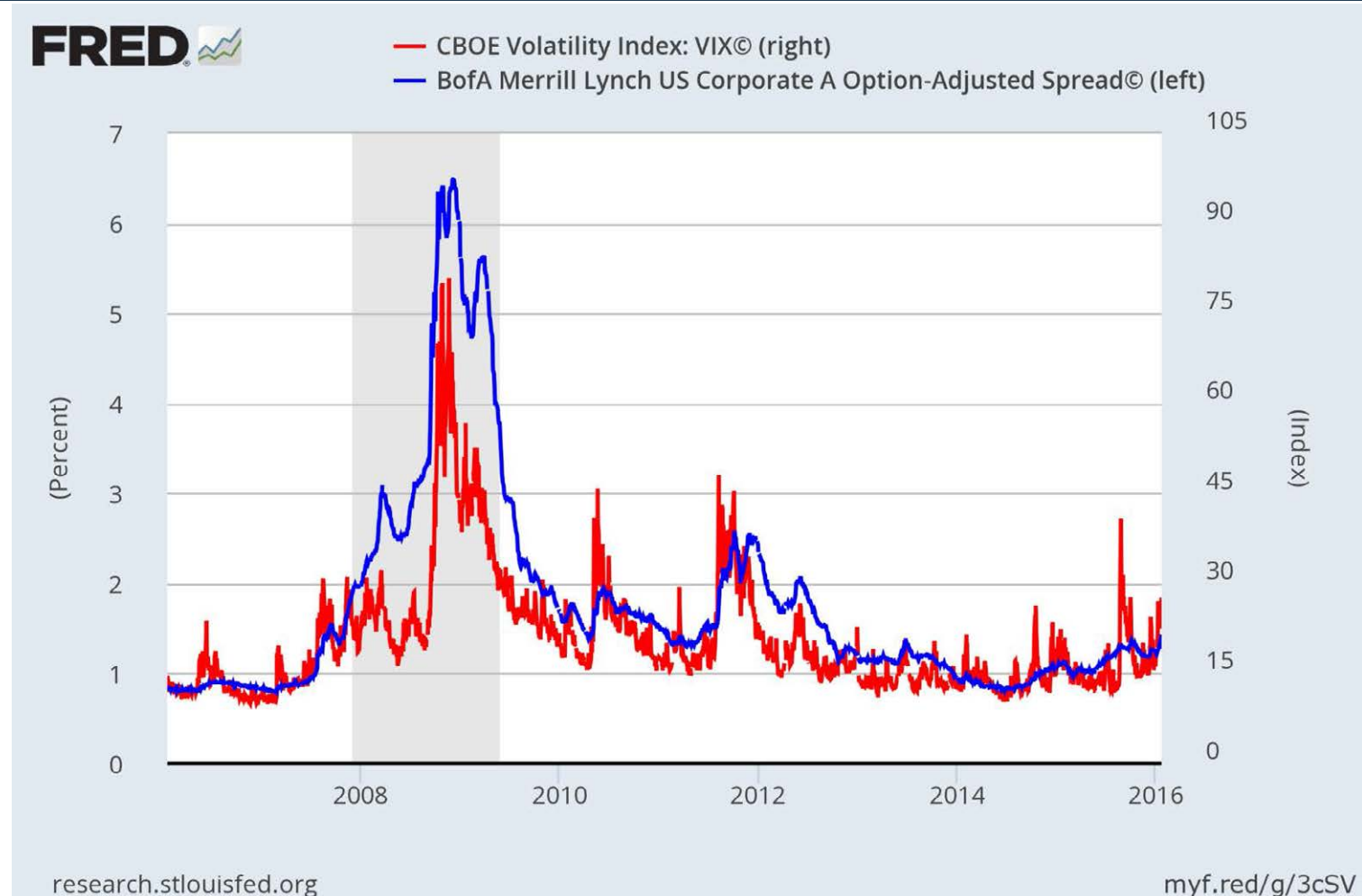
Rating	--Time horizon (years)--														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
U.S.															
AAA	0.00	0.04	0.17	0.29	0.42	0.55	0.59	0.68	0.77	0.87	0.92	0.97	1.02	1.12	1.24
AA	0.04	0.09	0.19	0.32	0.47	0.62	0.77	0.90	1.00	1.11	1.22	1.31	1.40	1.48	1.59
A	0.08	0.21	0.38	0.58	0.77	1.00	1.26	1.49	1.75	2.01	2.24	2.45	2.64	2.82	3.02
BBB	0.24	0.63	1.06	1.60	2.18	2.76	3.29	3.81	4.33	4.84	5.35	5.75	6.12	6.51	6.91
BB	0.84	2.60	4.75	6.79	8.58	10.35	11.81	13.13	14.34	15.43	16.31	17.09	17.76	18.32	18.91
B	4.03	9.21	13.68	17.20	19.95	22.21	24.08	25.57	26.85	28.06	29.08	29.92	30.67	31.33	31.98
CCC/C	28.10	38.61	44.43	48.28	51.26	52.45	53.65	54.51	55.59	56.30	56.97	57.73	58.58	59.28	59.28
Investment grade	0.13	0.34	0.59	0.90	1.23	1.56	1.88	2.19	2.50	2.81	3.10	3.33	3.55	3.77	4.01
Speculative grade	4.20	8.32	11.91	14.83	17.18	19.16	20.81	22.18	23.41	24.53	25.47	26.27	26.98	27.59	28.17
All rated	1.77	3.53	5.09	6.41	7.50	8.45	9.25	9.94	10.57	11.16	11.66	12.07	12.45	12.79	13.13

Credit Spread Risk

□ What is it?

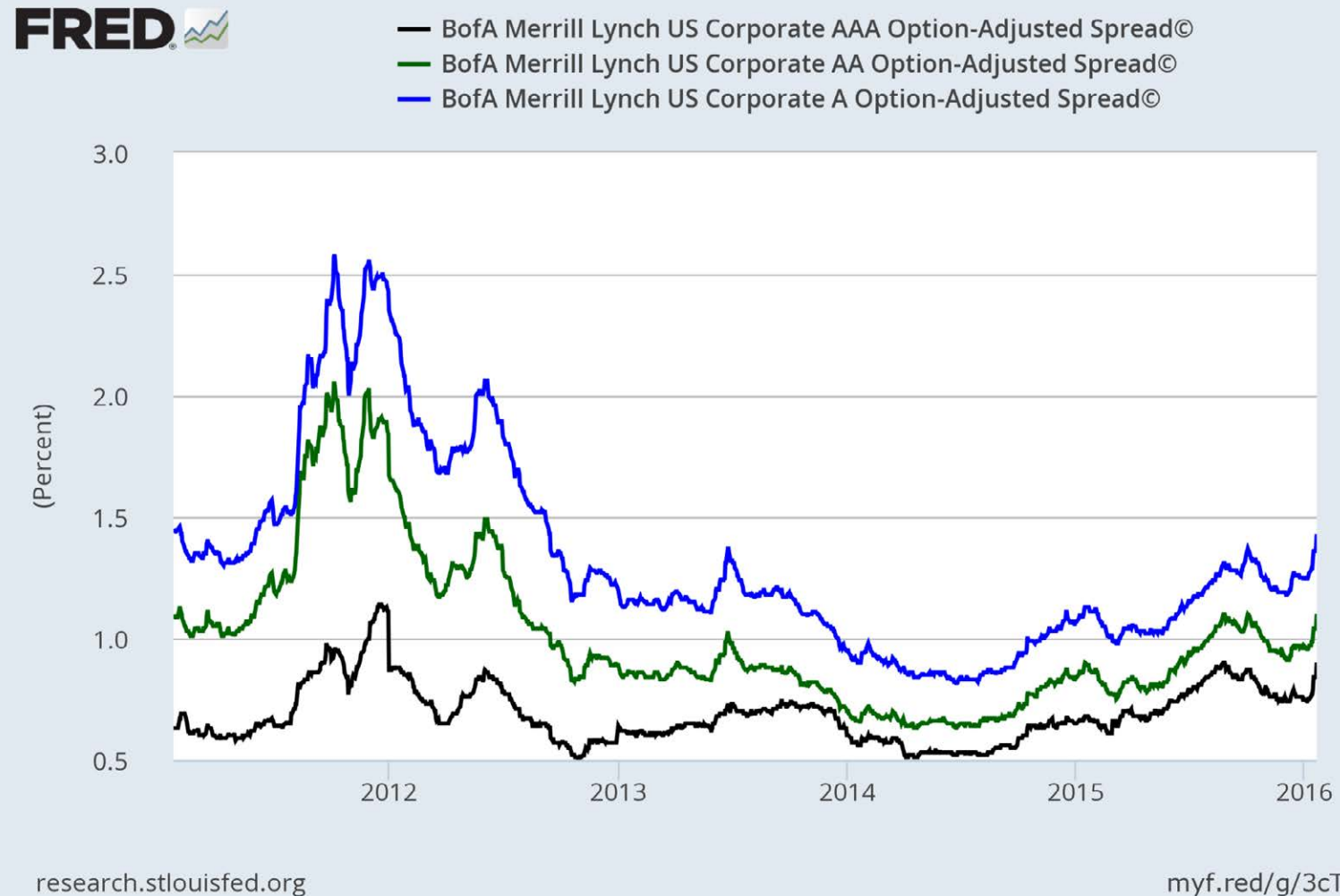
- ▣ “Even in the absence of default, an investor is concerned that the market value of a bond will decline and/or the price performance of a bond will be worse than that of other bonds. To understand this, recall that the price of a bond changes in the opposite direction to the change in the yield required by the market. Thus, if yields in the economy increase, the price of a bond declines, and vice versa.” ...
- ▣ “The risk that an issuer's debt obligation will decline due to an increase in the credit spread is called credit spread risk.”

Spreads & Volatility



Chicago Board Options Exchange, CBOE Volatility Index: VIX® [VIXCLS], retrieved from FRED, Federal Reserve Bank of St. Louis <https://research.stlouisfed.org/fred2/series/VIXCLS/>, January 21, 2016.
BofA Merrill Lynch, BofA Merrill Lynch US Corporate A Option-Adjusted Spread® [BAMLCOA3CA], retrieved from FRED, Federal Reserve Bank of St. Louis <https://research.stlouisfed.org/fred2/series/BAMLCOA3CA/>, January 21, 2016.

OAS: AAA vs AA vs A

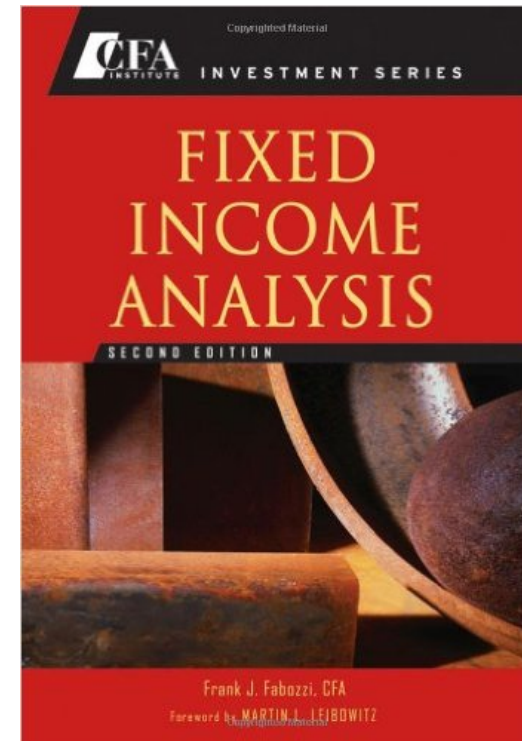


BofA Merrill Lynch, *BofA Merrill Lynch US Corporate AAA Option-Adjusted Spread©* [BAMLC0A1CAAA], retrieved from FRED, Federal Reserve Bank of St. Louis <https://research.stlouisfed.org/fred2/series/BAMLC0A1CAAA/>, January 21, 2016.

Transition Matrix

□ What is it?

- ▣ “A popular tool used by managers to gauge the prospects of an issue being downgraded or upgraded is a rating transition matrix. This is simply a table constructed by the rating agencies that shows the percentage of issues that were downgraded or upgraded in a given time period. So, the table can be used to approximate downgrade risk and default risk.”



Transition Rates: 1 Year

Average Multiyear Global Corporate Transition Matrix (1981-2014) (%)

--One-year transition rates--									
From/to	AAA	AA	A	BBB	BB	B	CCC/C	D	NR
AAA	87.03	9.03	0.54	0.05	0.08	0.03	0.05	0.00	3.19
	(7.11)	(7.16)	(0.83)	(0.25)	(0.25)	(0.17)	(0.35)	(0.00)	(2.44)
AA	0.54	86.53	8.14	0.54	0.06	0.07	0.02	0.02	4.07
	(0.52)	(5.30)	(4.32)	(0.70)	(0.20)	(0.21)	(0.07)	(0.08)	(1.93)
A	0.03	1.83	87.55	5.38	0.35	0.14	0.02	0.07	4.64
	(0.10)	(1.04)	(3.61)	(2.19)	(0.39)	(0.28)	(0.07)	(0.11)	(1.84)
BBB	0.01	0.11	3.58	85.44	3.75	0.56	0.13	0.20	6.23
	(0.04)	(0.16)	(1.71)	(3.91)	(1.59)	(0.73)	(0.23)	(0.27)	(1.68)
BB	0.01	0.03	0.14	5.16	76.62	6.96	0.66	0.76	9.64
	(0.06)	(0.10)	(0.27)	(1.90)	(4.56)	(3.31)	(0.79)	(0.89)	(2.55)
B	0.00	0.03	0.10	0.21	5.40	74.12	4.37	3.88	11.89
	(0.00)	(0.09)	(0.22)	(0.23)	(2.09)	(4.53)	(2.35)	(3.49)	(2.31)
CCC/C	0.00	0.00	0.14	0.22	0.65	13.26	43.85	26.38	15.49
	(0.00)	(0.00)	(0.47)	(0.73)	(1.01)	(8.31)	(9.50)	(12.11)	(5.61)

Note: Numbers in parentheses are weighted standard deviations, weighted by the issuer base. Sources: Standard & Poor's Global Fixed Income Research and Standard & Poor's CreditPro®.

Transition Rates: 7 Year

Average Multiyear Global Corporate Transition Matrix (1981-2014) (%)

--Seven-year transition rates--									
From/to	AAA	AA	A	BBB	BB	B	CCC/C	D	NR
AAA	39.20	30.08	7.13	1.55	0.26	0.20	0.12	0.55	20.91
	(9.93)	(10.62)	(2.82)	(1.90)	(0.49)	(0.44)	(0.32)	(0.75)	(6.62)
AA	1.60	39.15	27.89	5.06	0.82	0.41	0.03	0.61	24.44
	(0.91)	(4.95)	(3.74)	(1.51)	(0.61)	(0.52)	(0.09)	(0.53)	(4.56)
A	0.08	5.56	44.74	16.77	2.77	0.96	0.17	1.05	27.89
	(0.12)	(1.92)	(5.81)	(1.55)	(1.15)	(0.95)	(0.18)	(0.47)	(3.83)
BBB	0.04	0.68	10.71	40.84	7.47	2.62	0.42	3.28	33.95
	(0.12)	(0.61)	(3.03)	(6.02)	(0.91)	(1.14)	(0.35)	(1.57)	(3.44)
BB	0.00	0.07	1.51	12.47	20.72	9.79	1.03	11.98	42.43
	(0.00)	(0.20)	(1.12)	(3.44)	(4.90)	(2.37)	(0.71)	(4.91)	(3.84)
B	0.01	0.03	0.44	2.17	8.71	14.93	1.76	25.22	46.75
	(0.09)	(0.09)	(0.63)	(1.60)	(1.86)	(4.13)	(0.65)	(7.97)	(5.49)
CCC/C	0.00	0.00	0.28	1.08	3.30	8.76	1.37	48.72	36.48
	(0.00)	(0.00)	(0.67)	(2.39)	(1.76)	(4.13)	(2.26)	(12.04)	(9.99)

Note: Numbers in parentheses are weighted standard deviations, weighted by the issuer base. Sources: Standard & Poor's Global Fixed Income Research and Standard & Poor's CreditPro®.

Standard & Poor's "Default, Transition, and Recovery: 2014 Annual Global Corporate Default Study And Rating Transitions", Table 37 on Page 77.

Ratings: Letters & Numbers

Numeric Rating	Composite Rating	Moody Rating	S&P Rating	Fitch Rating
21	AAA	Aaa	AAA	AAA
20	AA1	Aa1	AA+	AA+
19	AA2	Aa2	AA	AA
18	AA3	Aa3	AA-	AA-
17	A1	A1	A+	A+
16	A2	A2	A	A
15	A3	A3	A-	A-
14	BBB1	Baa1	BBB+	BBB+
13	BBB2	Baa2	BBB	BBB
12	BBB3	Baa3	BBB-	BBB-

Ratings: Numbers Example 1

AMZN	AMAZON.COM INC	
NRSRO	Rating	Number
Moody	Baa1	14.00
S&P	AA-	18.00
Fitch		
Average		16.00
Rounded		16.00
Composite	A2	

Ratings: Numbers Example 2

MON	MONSANTO CO	
NRSRO	Rating	Number
Moody	A3	15.00
S&P	BBB+	14.00
Fitch	A-	15.00
Average		14.67
Rounded		15.00
Composite	A3	

Ratings: Numbers Example 3

MS	MORGAN STANLEY	
NRSRO	Rating	Number
Moody	A3	15.00
S&P	BBB+	14.00
Fitch	A	16.00
Average		15.00
Rounded		15.00
Composite	A3	

The Numbers on the Letters

	Issuers Rated	Average Issuer Composite Rating
Total Issuers	211	A2
Moody	148 / 70%	A2
S&P	171 / 81%	A2
Fitch	99 / 47%	A2
Rated by All 3	94 / 45%	A2

Ratings Correlation Matrix			
	Moody	S&P	Fitch
Moody	1.00	0.80	0.83
S&P	0.80	1.00	0.68
Fitch	0.83	0.68	1.00

The 211 Issuers are companies with at least 1 Senior bond with 250MM outstanding that is shorter than 5 years from final maturity and has a weighted average composite category rating of A or better (A3, A2, A1, AA3, AA2, AA1 and AAA) as of 1/19/16.

# Issuers with at least 1 rating modifier difference:	99
# Issuers with at least 2 rating modifier difference:	40
# Issuers with at least 3 rating modifier difference:	6
# Issuers with at least 4 rating modifier difference:	1
# Issuers with at least 5 rating modifier difference:	0

A Ratings Digression Part 1

Lehman Brothers Credit Rating History

Moody's Senior Unsecured Debt

Rating	Watch	Effective
WR		12/10/2008
C		12/08/2008
B3	*-	09/15/2008
A2	*	09/10/2008
A2		07/17/2008
A1	*-	06/13/2008
A1		10/22/2003
A2	*+	06/24/2003
A2		11/03/2000

Up / Down / No Change / Initial

Close

S&P LT Local Issuer Credit

Rating	Watch	Effective
NR		09/25/2008
D		09/16/2008
SD		09/15/2008
A	*	09/12/2008
A	*-	09/09/2008
A		06/02/2008
A+		10/11/2005
A		02/22/2002

Fitch Senior Unsecured Debt

Rating	Watch	Effective
NR		10/27/2008
CCC		09/15/2008
A+	*-	09/09/2008
A+		06/09/2008
AA-		06/28/2007
A+		06/20/2001
A		05/31/1994

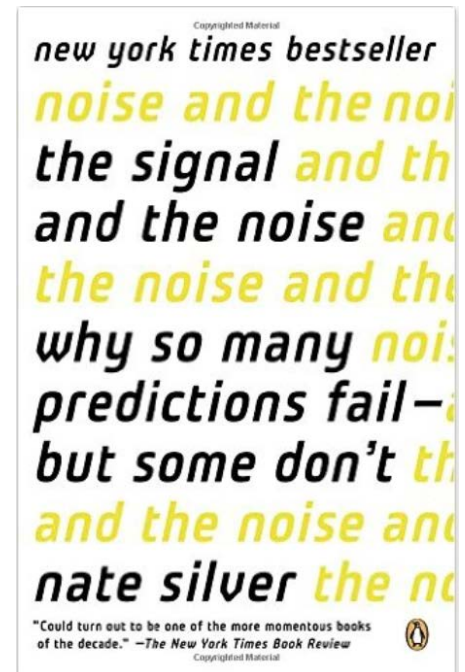
Up / Down / No Change / Initial

Close

A Ratings Digression Part 2

“The ratings agencies had given their AAA rating, normally reserved for a handful of the world’s most solvent governments and best-run businesses, to thousands of mortgage-backed securities, financial instruments that allowed investors to bet on the likelihood of someone else defaulting on their home. The ratings issued by these companies are quite explicitly meant to be predictions: estimates of the likelihood that a piece of debt will go into default. Standard & Poor’s told investors, for instance, that when it rated a particularly complex type of security known as a collateralized debt obligation (CDO) at AAA, there was only a 0.12 percent probability— about 1 chance in 850— that it would fail to pay out over the next five years. ...

In fact, around 28 percent of the AAA-rated CDOs defaulted, according to S&P’s internal figures. ... This is just about as complete a failure as it is possible to make in a prediction: trillions of dollars in investments that were rated as being almost completely safe instead turned out to be almost completely unsafe. It was as if the weather forecast had been 86 degrees and sunny, and instead there was a blizzard.”



Silver, Nate (2012-09-27).
*The Signal and the Noise: Why
So Many Predictions Fail-but
Some Don't* (pp. 20-21).
Penguin Group US. Kindle
Edition.

WolframAlpha

□ Computational Knowledge Engine

□ www.wolframalpha.com



what are you? ☆

⌨ 📷 📄 📌

≡ Examples ↺ Random

Assuming "what are you" is a phrase | Use as [a word](#) instead

Input interpretation:

What are you?

Response:

I am a computational knowledge engine.

What is a Computational Knowledge Engine?



what is a computational knowledge engine?



Examples Random

Input interpretation:

What is a computational knowledge engine?

Response:

An engine, such as Wolfram | Alpha, that generates output by doing computations from its own internal knowledge base instead of searching the web and returning links.

So What? What Can It Do?



what is the probability of 4 heads in a row with 50 coin tosses?



Examples Random

Input interpretation:

sequence of coin flips	number of flips	50
	consecutive heads	4

Probability:

More digits

$$\frac{931585354543339}{1125899906842624} \approx 0.827414$$

Approximate chance:

1 in 1.2

Approximate expected length of longest run of heads:

More digits

$$-\frac{1}{2} + \frac{\gamma}{\log(2)} + \frac{\log(25)}{\log(2)} \approx 4.9766$$

$\log(x)$ is the natural logarithm
 γ is the Euler-Mascheroni constant

Simulation:

Flip again

H | T | H | T | H | H | H | T | H | T | T | H | T |
H | H | T | H | T | H | T | H | H | H | T | H |
T | H | T | H | H | T | H | T | H | H | H | T | T |
H | H | T | H | H | T | H | H | H | T | T



what airplanes are overhead?



Examples Random

Input interpretation:

flights seen from current geoIP location

Result:

Show metric

	altitude	angle
SkyWest Airlines flight 6238	19 700 feet	43° up
Lufthansa flight 454	31 000 feet	8.4° up
Asiana Airlines flight 204	39 000 feet	6.1° up
China Eastern Airlines flight 2856	34 000 feet	5.9° up

	type	slant distance
SkyWest Airlines flight 6238	Embraer 175	5.5 miles WSW
Lufthansa flight 454		38 miles NNW
Asiana Airlines flight 204		66 miles SW
China Eastern Airlines flight 2856	Airbus A330-200	61 miles SSE

Hmmm... What else?



San Diego, CA | San Francisco, CA



Examples Random

Input interpretation:

San Diego, California | San Francisco, California

Populations:

	San Diego	San Francisco
city population	1.381 million people (country rank: 8 th) (2014)	852 469 people (country rank: 14 th) (2014)
urban area population	2.674 million people (San Diego (CA) urban area) (country rank: 15 th) (2000)	3.229 million people (San Francisco - Oakland urban area) (country rank: 12 th) (2000)
metro area population	3.14 million people (San Diego-Carlsbad-San Marcos metro area) (country rank: 17 th) (2011)	4.391 million people (San Francisco-Oakland-Fremont metro area) (country rank: 11 th) (2011)

Demographics:

Less

	San Diego	San Francisco
race	white: 65.2% Asian: 16.2% black/African American: 6.8% other: 6.1% two or more races: 4.5% American Indian/Alaska native: 0.6% Hawaiian/Pacific Islander: 0.6%	white: 50.7% Asian: 33.5% black/African American: 6% other: 4.8% two or more races: 4.1% American Indian/Alaska native: 0.5% Hawaiian/Pacific Islander: 0.4%

Hide enrollment

Educational attainment:

	San Diego	San Francisco
college degree and above	49% (1.35 × national average)	57.4% (1.59 × national average)
high school diploma	16.3% (0.577 × national average)	13.7% (0.485 × national average)
less than high school diploma	13.4% (0.939 × national average)	14.1% (≈ national average)

(for population age 25 and older)

Current enrollment:

	San Diego	San Francisco
college, graduate or professional school	12.1% (1.56 × national average)	11.5% (1.48 × national average)
pre-K to 12th grade	17.8% (0.892 × national average)	10.6% (0.533 × national average)
not enrolled	70.1% (0.97 × national average)	77.9% (1.08 × national average)

(for population age 3 and older)

female:

15 to +:

I bet it doesn't know football!



Tom Brady games versus the Denver Broncos



season	local time	game	score
2015-16	7:30 pm MST Sun, Nov 29	Patriots (10-1) at Broncos (9-2)	24 - 30
2014-15	Sun, Nov 2	Broncos (6-2) at Patriots (7-2)	21 - 43
2013-14	Sun, Nov 24	Broncos (9-2) at Patriots (8-3)	31 - 34
2012-13	Sun, Oct 7	Broncos (2-3) at Patriots (3-2)	21 - 31
2011-12	Sun, Dec 18	Patriots (11-3) at Broncos (8-6)	41 - 23
2009-10	Sun, Oct 11	Patriots (3-2) at Broncos (5-0)	17 - 20
2006-07	Sun, Sep 24	Broncos (2-1) at Patriots (2-1)	17 - 7
2005-06	Sun, Oct 16	Patriots (3-3) at Broncos (5-1)	20 - 28
2003-04	Mon, Nov 3	Patriots (7-2) at Broncos (5-4)	30 - 26
2002-03	Sun, Oct 27	Broncos (6-2) at Patriots (3-4)	24 - 16
2001-02	Sun, Oct 28	Patriots (3-4) at Broncos (4-3)	20 - 31

(total: 11)

Overall totals:

	Broncos	Patriots
wins	6	5
plays	750	766
yards	4343 yards	3995 yards
first downs	247	249
touchdowns	37	34
interceptions	9	7
fumbles lost	11	7
own fumbles recovered	9	13
opponent fumbles recovered	7	11
penalties	69	77
penalty yards	564 yards	643 yards
two point conversions attempted	1	2
two point conversions	0	0

Less

Overall ▼

Overall
Passing
Rushing
Defense
Returns
Kicking
Punting

WolframAlpha & Credit Analysis



AAPL vs IBM vs MSFT



Fundamentals and financials:

Fundamentals ▼

	Apple	IBM	Microsoft
market cap	\$539.6 billion	\$118.2 billion	\$405.7 billion
revenue	\$233.7 billion	\$83.8 billion	\$90.76 billion
employees	110 000	412 775	118 000
revenue / employee	\$2.125 million	\$203 000	\$769 100
net income	\$53.39 billion	\$14.21 billion	\$12.27 billion
shares outstanding	5.575 billion	970.1 million	7.988 billion
annual earnings / share	\$9.25	\$14.44	\$1.50
P/E ratio	10.46	8.441	33.78
annual dividends / share	\$2.50	\$7.40	\$1.60
dividend yield	2.1%	5.17%	2.54%

(based on trailing 12-month totals, last close price and annual employees)

Fundamentals and financials:

Ratios ▼

	Apple	IBM	Microsoft
P/E ratio	10.46	8.441	33.78
price / book			
price / sales			
price / free cash flow			
return on equity	+ 46.25%	+ 21.87%	+ 5.87%
return on assets	+ 20.45%	+ 2.67%	+ 2.65%
leverage	2.434	8.173	2.233
current ratio	1.109	1.248	2.463
debt / capital	0.3094	0.7073	0.2643
net profit margin	+ 21.6%	+ 15.3%	+ 22.67%

(based on last close price, 12-month sales and 12-month averages)

WolframAlpha & Credit Analysis

Relative price history:

Last 5 years ▼

Separate plots



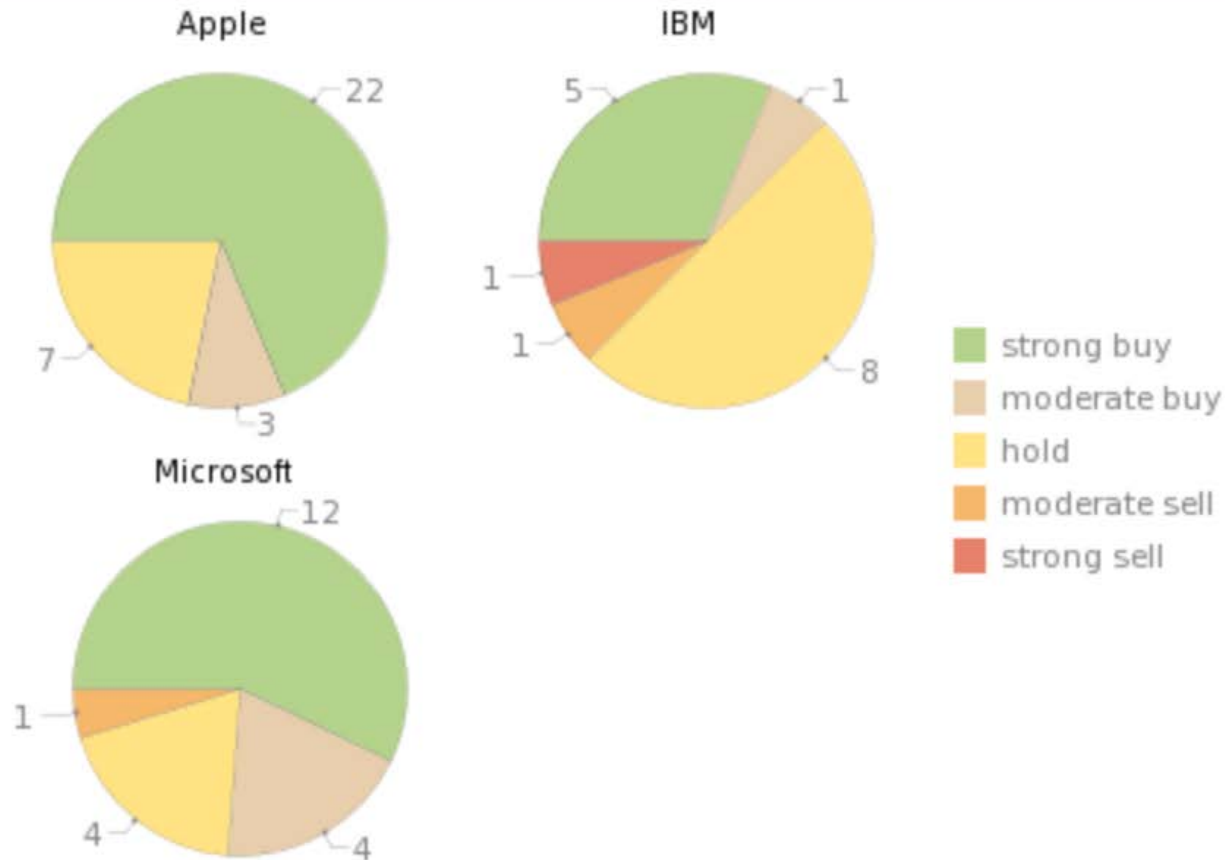
(normalized relative to January 25, 2011 starting date)

WolframAlpha & Credit Analysis

Individual analyst recommendations:

	Apple (AAPL)	IBM (IBM)	Microsoft (MSFT)
strong buy	22 (69%)	5 (31%)	12 (57%)
moderate buy	3 (9%)	1 (6%)	4 (19%)
hold	7 (22%)	8 (50%)	4 (19%)
moderate sell	0	1 (6%)	1 (5%)
strong sell	0	1 (6%)	0
total	32 analysts	16 analysts	21 analysts

WolframAlpha & Credit Analysis



[Definitions and notes »](#)

(Apple: 32 analysts, IBM: 16 analysts, Microsoft: 21 analysts)

WolframAlpha & Credit Analysis

Performance comparisons:

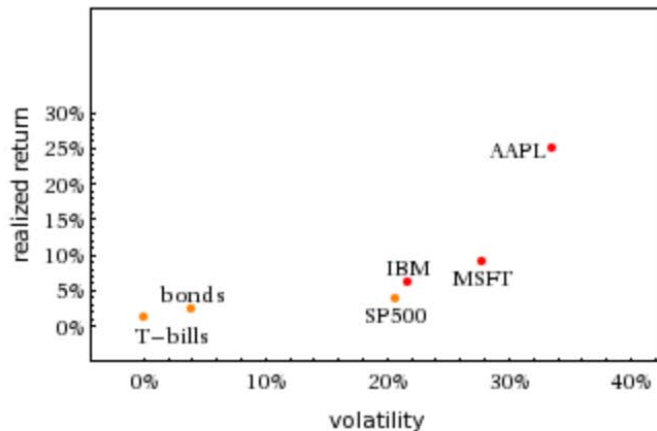
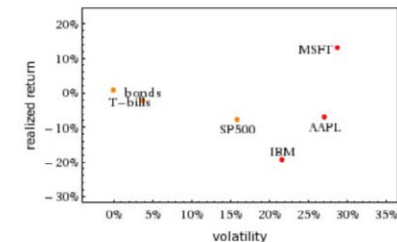
Last 10 years ▼

	average daily return	daily volatility	annual return	annual volatility
AAPL	+ 0.089%	2.12%	+ 24.88%	33.62%
IBM	+ 0.023%	1.37%	+ 6.01%	21.75%
MSFT	+ 0.034%	1.76%	+ 8.89%	27.88%
SP500	+ 0.015%	1.31%	+ 3.75%	20.7%
bonds	+ 0.01%	0.25%	+ 2.46%	3.99%
T-bills	+ 0.005%	0%	+ 1.32%	0%

Performance comparisons:

Last year ▼

	average daily return	daily volatility	annual return	annual volatility
AAPL	- 0.029%	1.71%	- 7.13%	27.11%
IBM	- 0.085%	1.37%	- 19.3%	21.74%
MSFT	+ 0.048%	1.82%	+ 12.83%	28.77%
SP500	- 0.033%	1.01%	- 7.87%	15.95%
bonds	- 0.01%	0.24%	- 2.53%	3.84%
T-bills	+ 0.002%	0%	+ 0.5%	0%



Correlation matrix:

	AAPL	IBM	MSFT	SP500
AAPL	1	0.401	0.44	0.01
IBM	0.401	1	0.49	-0.01
MSFT	0.44	0.49	1	0.092
SP500	0.01	-0.01	0.092	1

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* The 64-bit compatibility issue has been fixed as of July 26, 2013.

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- Create graphs with NBER recession shading and an auto update feature.

