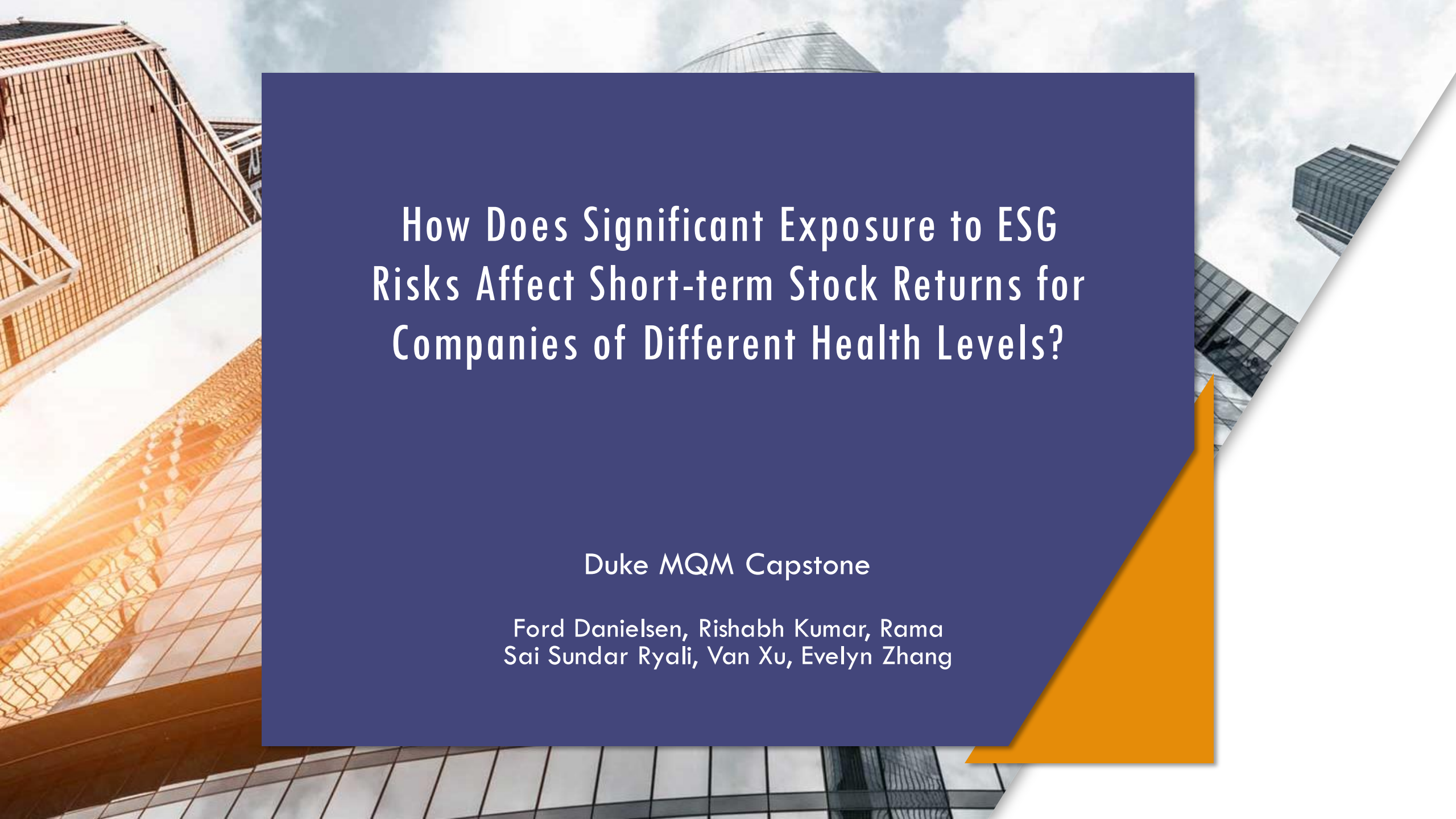


How Does Significant Exposure to ESG Risks Affect Short-term Stock Returns for Companies of Different Health Levels?

Duke MQM Capstone

Ford Danielsen, Rishabh Kumar, Rama Sai Sundar Ryali, Van Xu, Evelyn Zhang

TEAM INTRODUCTION

Ford Danielsen	Evelyn Zhang	Rama Sai Sundar Ryali	Van Xu	Rishabh Kumar
				
Project Manager	Data Manager	Model Specialist	Model Specialist	Data Viz Specialist

EXECUTIVE SUMMARY

Objectives

- Do the short-term stock returns of healthy companies and unhealthy companies react to negative ESG news in the same way?

  NO! THEY REACT IN THE OPPOSITE WAY

- Should all companies have the same ESG risks management goals? **NO!**

Analytical Approach

- Alpha & Beta
  - Linear Regression Model
- Cumulative Abnormal Return
  - Fama-French Three Factor Model

AGENDA

- Introduction
- Data Overview
- Exploratory Data Analysis
- Model and Analysis
- Recommendation

Introduction

- What is ESG
- Study Methodology
- Company Health Definition

ESG

Environmental

- Climate Change
- Energy and Fuel
- Environmental Compliance
- Greenhouse Gas Emissions
- Pollution Control
- Resource Scarcity
- Waste and Recycling
- Water Use

Social

- Diversity and Equality
- Employee Relations
- Environmental Justice
- Health and Safety
- Human Rights
- Non-Discrimination
- Security
- Training and Education

Governance

- Board Diversity
- Bribery and Corruption
- Ethics
- Executive Compensation
- Political Lobbying
- Procurement Practices
- Resilience
- Risk Management

METHODOLOGY

SCOPE:

S&P500 INDEX

PERIOD:

JAN 2016 – DEC 2020
(5 YEARS)

EVENT DEFINITION:

10-POINT INCREASE IN REPRISK INDEX

COMPANY HEALTH DEFINITION

Times Interest Earned

- Fails to adequately companies who reinvest heavily to avoid claiming income
- Bad measure for Financials

Credit Rating

- Multiple Rating agencies
- Even across Industries

Revenue Ratio

- Over values high revenue companies with slim profit margins

Altman Z-Score

- Primarily used in the manufacturing space
- Fails to adequately service all industries

Data

- Database Overview
- Data Collection & Cleaning

DATABASE OVERVIEW

RepRisk

- Provides ESG ratings and assesses global ESG risks
- RepRisk Index (RRI), a score for current ESG risk exposure

CRSP & Yahoo Finance

- Stock prices, stock returns
- SPY prices and returns

Bloomberg

- S&P 500 Global credit ratings
- Other rating systems, e.g. Moody's as backups

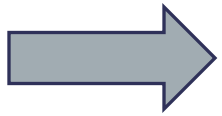
HOW REPRISK INDEX IS CALCULATED

The RepRisk Index (RRI), ranges from 0 to 100, is an algorithm developed by RepRisk that dynamically captures and quantifies a company's reputational risk exposure to ESG issues.

The RRI is purely performance-based:

- The RRI of company A depends only on A's risk incidents.
- The RRI reflects a company's actual risk management performance as opposed to its communicated goals and policies.

Initial assessment of the ESG risks



Tracks ESG-related news over time and issues score updates

A company's RRI gets updated by the end of each month. It represents the combined effect of risk incidents throughout the month (or decaying effect if no significant risk incidents).

CREATION OF "MASTER TABLE"

Links the data together for each date and ticker symbol

RepRisk

- Date
- Ticker
- Current RRI
- RRI trend (the change from last score)
- Peak RRI (in past 2 years)

Stock Returns:

- Date
- Ticker
- Price
- Volume
- Daily returns
- 5/10/30-day returns

Credit Ratings:

- Ticker
- Year
- Rating

SPY Returns:

- Date
- Price
- Daily returns
- 5/10/30-day returns

* Click to see the appendix for a sample Master Table

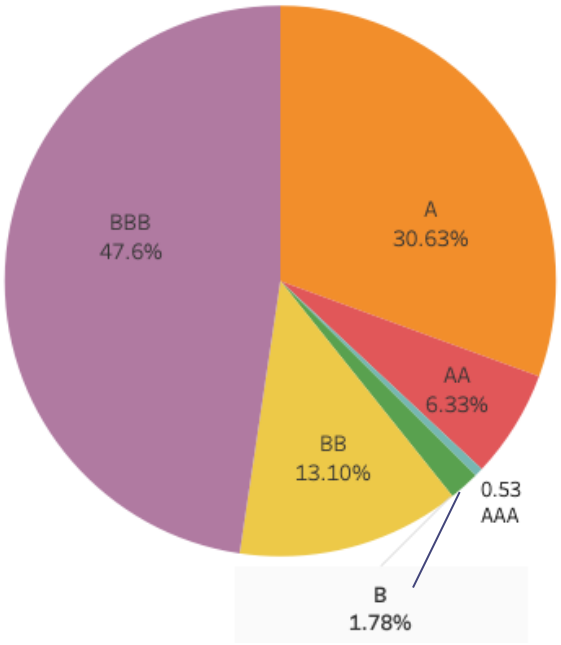
Exploratory Data Analysis

- General EDA
- ESG Risk Analysis
- ESG Risk and Return Analysis

GENERAL ANALYSIS

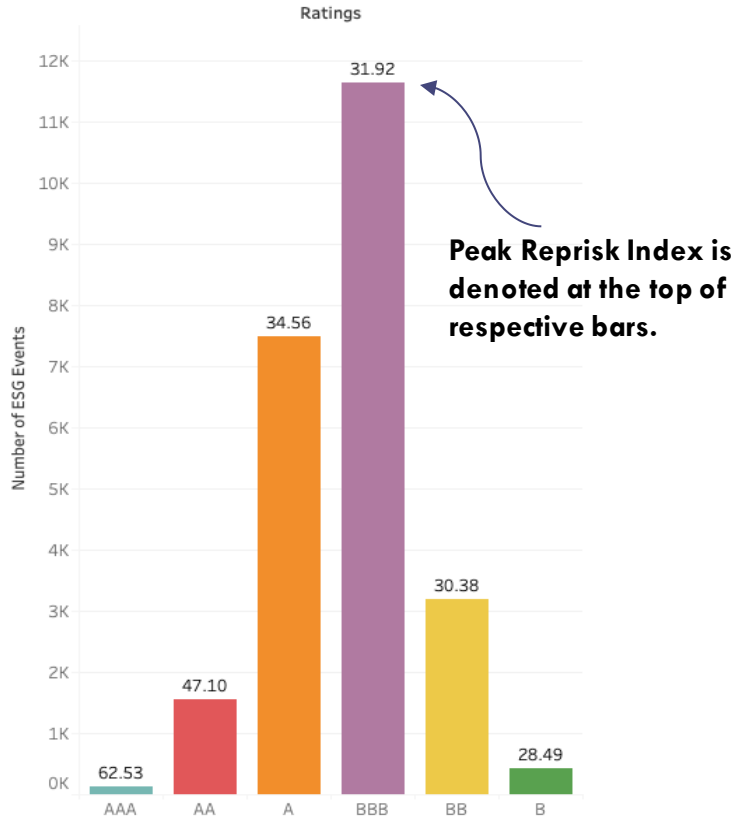
Objective: To understand the data with reference to credit ratings and ESG

Rating Distribution



- Most of the companies in our data fall in the 'good' credit rating zone (A, BBB and BB)
- Companies in the 'good' credit rating zone have highest number of ESG events
- Peak reprisk index decreases as the health of a company decreases

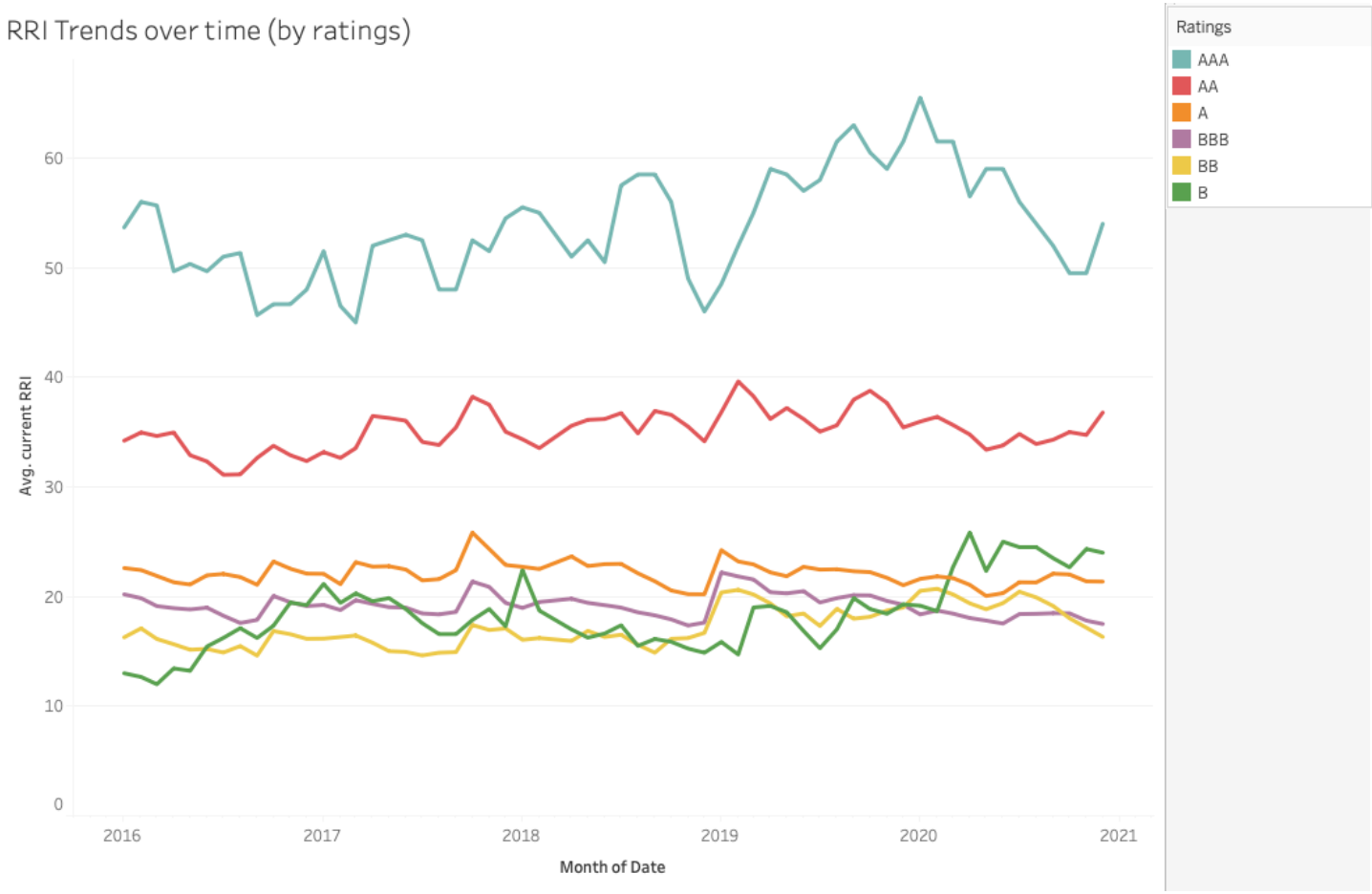
ESG Distribution by rating (year wise)



RRI TRENDS BY RATINGS

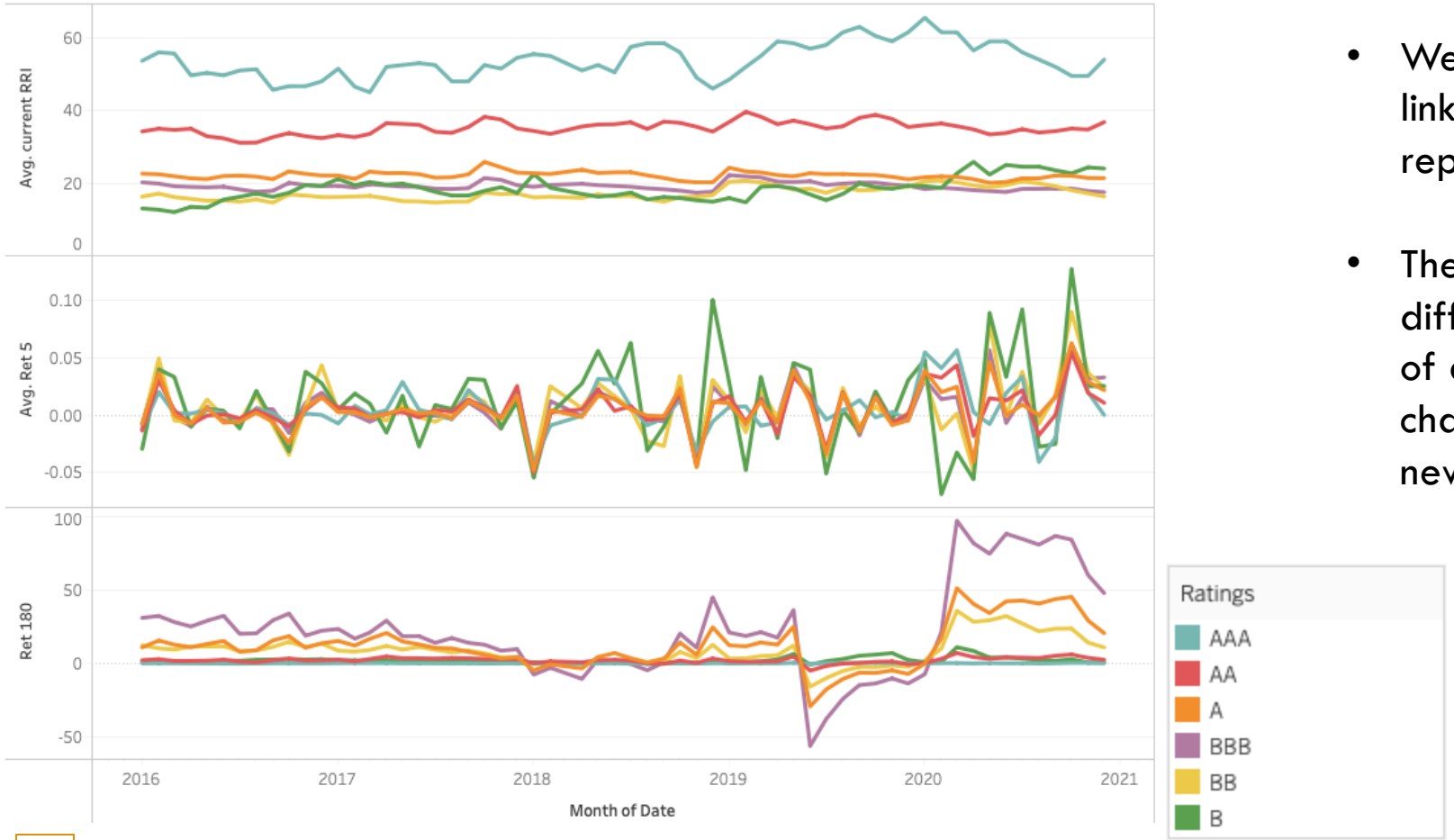
Objective: To understand the ESG risk exposure based on the health of an organization

- The RRI for each rating can be seen to fluctuate within their respective ranges, with overlapping at only few points.
- Historically, companies with better health (ratings) are shown to have higher exposure to ESG risk and vice versa



LONG/SHORT TERM RETURNS BY ESG RISK

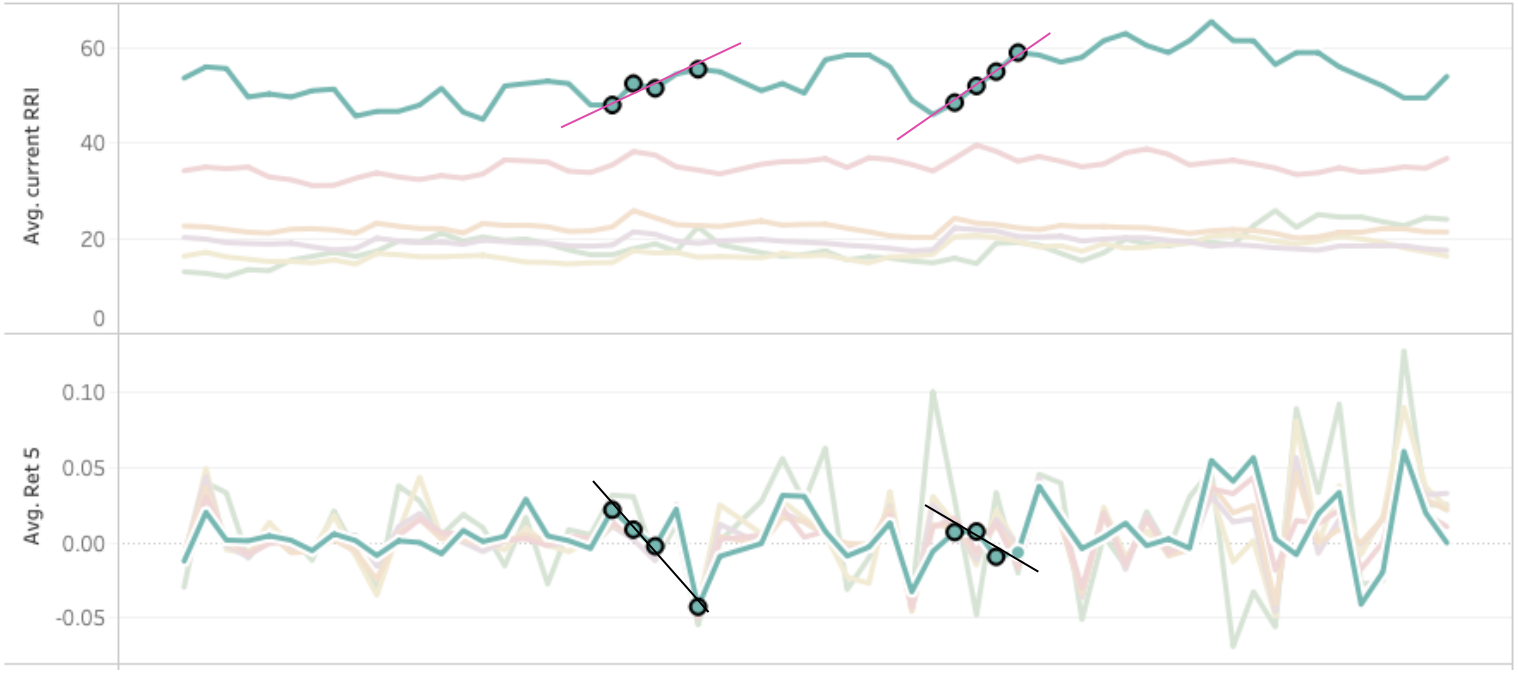
Objective: To understand the impact of ESG risk exposure in different ratings on short and long term returns



- We try to observe a general trend linkage between increase in the reprisk index and change in return
- These trends are observed over different ratings to establish if health of a company controls the return changes when there is negative ESG news.

LONG/SHORT TERM RETURNS BY ESG RISK

Objective: To understand the impact of ESG risk exposure in different ratings on short and long term returns



There are multiple factors that influence the return of a stock but with the intention of understanding changes in stock return with ESG risk, we observe a divergence movement in high rated stocks

Models & Analysis

- Excess Returns
- Alpha & Beta
- Cumulative Abnormal Return (CAR)

GENERAL ASSUMPTIONS:

Base case: 5/10/30-day returns after >10 risk increases; later extended to >5 and >20 risk increases

Used excess returns over SPY in order to minimize fluctuation of the market

Healthy companies: companies with higher credit ratings (AAA, AA, A)

Unhealthy companies: those with lower credit ratings (BBB, BB, B)

AVERAGE 5/10/30-DAY EXCESS RETURNS (ACROSS CREDIT RATINGS) FOR >10 ESG RISK INCREASES

Excess Return Table

	5-day Excess Return	10-day Excess Return	30-day Excess Return
AAA	-0.529	-0.296	0.059
AA	-0.220	-0.072	0.001
A	-0.036	0.072	-0.032
BBB	-0.020	0.023	0.004
BB	0.162	0.141	0.135
B	0.206	1.310	1.184

*All returns annualized

After > 10 risk increases:

- Healthier companies tend to see decreased stock returns in 5/10-day periods
- Unhealthy companies would have relatively higher returns in a 30-day period

T STATISTICS:
AVERAGE 5/10/30-DAY EXCESS RETURNS

Null hypothesis: excess return = 0
Alternative hypothesis: excess return != 0

T-statistics Table

	5-day Excess Return	10-day Excess Return	30-day Excess Return
AAA	-2.123	-1.851	0.230
AA	-2.290	-0.727	0.016
A	-0.403	0.999	-0.742
BBB	-0.208	0.343	0.088
BB	0.791	1.021	1.456
B	0.184	0.963	1.557

If we just focus on the top-left and bottom-right corners:

- Both have relatively high t-values, which suggest that there's significant evidence to reject the null hypothesis (excess return = 0)
- Supports our findings from the previous slide

* Click to see the appendix for more cases

Alpha & Beta -- Definition

- **Alpha (α)**
  - Used in investing to describe an investment strategy's ability to beat the market, or its "edge"
  - Also referred to as "excess return" or "abnormal rate of return," which refers to the idea that markets are efficient, and so there is no way to systematically earn returns that exceed the broad market as a whole

- **Beta (β)**
  - A measure of the volatility—or systematic risk—of a security or portfolio compared to the market as a whole
  - Used in the capital asset pricing model (CAPM), which describes the relationship between systematic risk and expected return for assets (usually stocks)

Alpha & Beta -- Model

- **Linear Regression Model**
  - Essential to the Capital Asset Pricing Model (CAPM)
  - Determines the relationship between an asset's expected return and the associated market risk premium
- The general equation of this type of line is

$$r - R_f = \alpha + \beta * (K_m - R_f) + \varepsilon$$

- where:
  - β is the slope of this line
  - α is the vertical intercept, tells you how much better the fund did than CAPM predicted (or more typically, a negative alpha tells you how much *worse* it did, e.g. due to high management fees)

ALPHAS AND BETAS

- Alpha and Beta is calculated considering SPY returns as the Benchmark
- Base case: 5/10/30-day returns after >10 risk increases; later extended to >5 and >20 risk increases (Appendix)
- Used the "lm" function on R to do the regression
- The results for all companies are as follows;

	30 Day Returns	**10 Day Returns**	**5 Day Returns**
Alpha	-0.419%	0.1154%	-0.0744%
Beta	1.3295	1.2110	1.0871

OUTPUT & T-STATISTIC TABLE

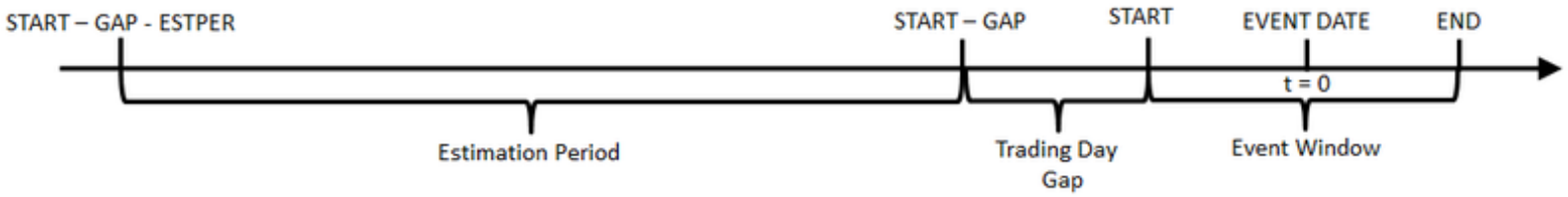
Credit Rating		alpha (%)	*p*-value	*t*-statistic	beta	*p*-value	*t*-statistic
AAA	5-day	-1.9472%	0.0403	-2.9920	2.45	0.0441	2.9010
	10-day	-1.3610%	0.0770	-2.3680	1.47	0.0027	6.6230
	30-day	3.4960%	0.8050	0.2640	0.24	0.9470	0.0710
AA	5-day	-0.6453%	0.0052	-2.9090	1.27	1.46E-13	9.6320
	10-day	-0.5039%	0.2380	-1.1930	1.23	1.61E-11	8.3800
	30-day	-0.4240%	0.6800	-0.4140	1.17	2.04E-05	4.6540
A	5-day	0.0983%	0.6080	0.5130	0.79	7.47E-16	8.6510
	10-day	0.4253%	0.1420	1.4740	0.88	<2e-16	11.8240
	30-day	-0.2665%	0.6600	-0.4410	0.95	< 2.2e-16	8.9770
BBB	5-day	-0.0901%	0.6540	-0.4480	1.07	<2e-16	10.5670
	10-day	-0.0811%	0.7620	-0.3040	1.21	<2e-16	17.4450
	30-day	-0.4562%	0.4480	-0.7600	1.16	<2e-16	9.8670
BB	5-day	0.1062%	0.8010	0.2530	1.22	7.13E-08	5.7570
	10-day	0.2108%	0.6700	0.4270	1.42	2.00E-16	12.8690
	30-day	-0.1674%	0.8680	-0.1670	1.93	2.00E-16	10.7580
B	5-day	0.4328%	0.8193	0.2320	2.97	0.0067	3.0880
	10-day	1.8030%	0.6243	0.4990	2.36	0.0298	2.3710
	30-day	5.8150%	0.2530	0.7100	0.06	0.2190	1.2760

KEY TAKEAWAYS ON ALPHA AND BETA

- Overall, we observed negative alpha (excess returns) for healthy companies and positive alpha for unhealthy ones
  - Significant evidence that healthy companies underperform in 5/10-day
    - All positive alphas are not statistically significant (t-stats < 1.96)
- Systematic risk (β) is high for AAA and B companies
  - All statistically significant except for two
- Limitation of the model:
  - Neglects the impacts of firm size and value

Cumulative Abnormal Return -- Methodology

- **Cumulative Abnormal Return** $= \sum$ Abnormal Return
  - Abnormal Return = Actual Return – Expected Return
    - Sometimes triggered by "events"
  - Expected Return $= \alpha + \beta(R_m)$
- **Tool: Event Study – WRDS Analytics**



- Estimation Period: 100
- Trading Day Gap: 50
- Event Window: t = 0 to t = 30

Cumulative Abnormal Return -- Model

- **Fama-French Three Factor Model**
  - An asset pricing model that expands on CAPM by adding size risk and value risk factors to the market risk factor
- The formula:

$$R_{RiskModel} = R_f + \alpha + \beta_1 * (R_m - R_f) + \beta_2 * SMB + \beta_3 * HML$$

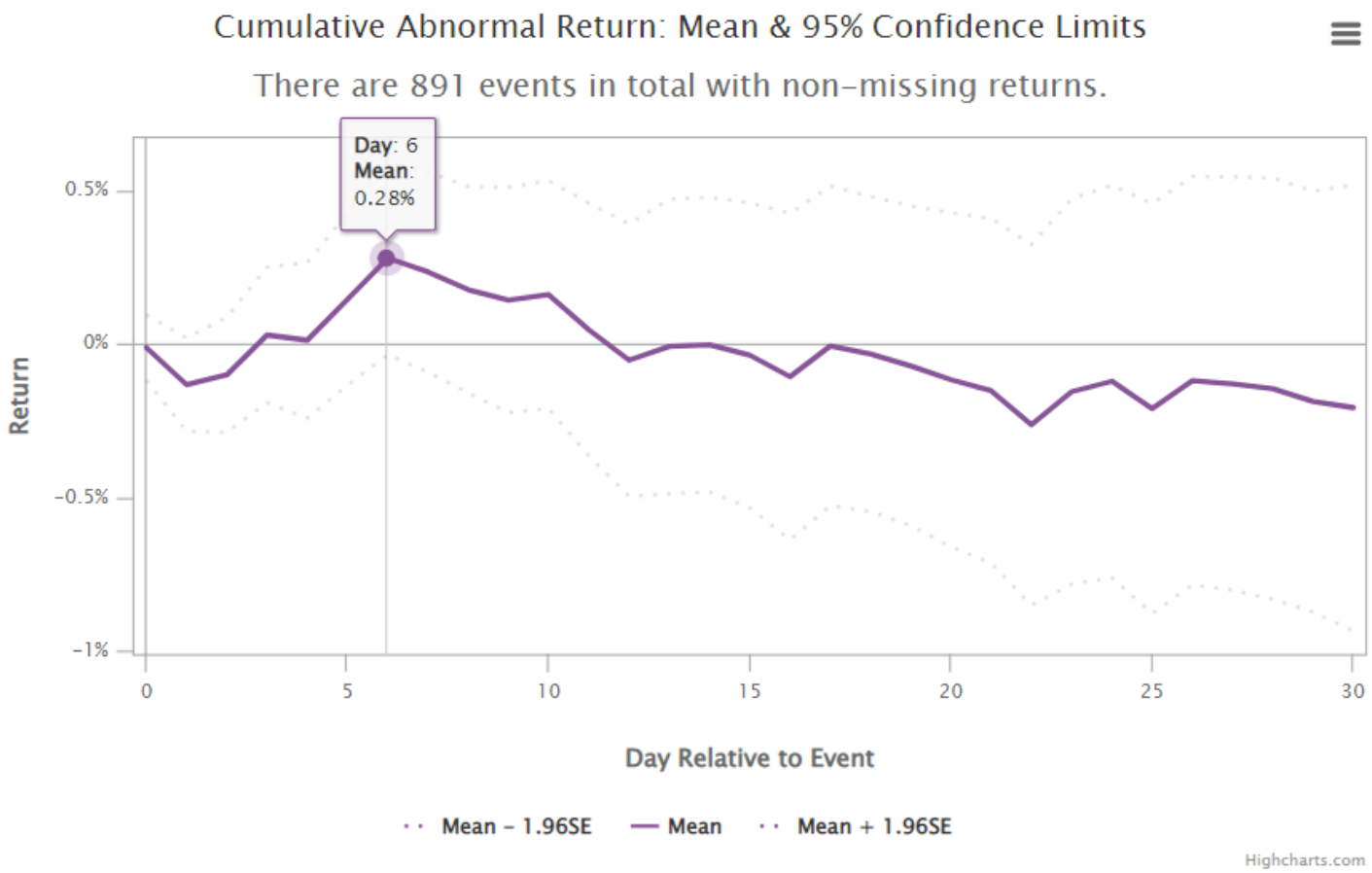
- where:
  - R_f = risk free rate of return
  - R_m = total market portfolio return
  - $R_m - R_f$ = excess return on the market portfolio (index)
  - SMB = size premium (small minus big)
  - HML = value premium (high minus low)
  - $\beta_{1,2,3}$ = factor coefficients

OUTPUT & T-STATISTIC

		Cumulative Abnormal Return		Abnormal Return	
Credit Rating		**CAR (%)**	***t*-statistic**	**AR (%)**	***t*-statistic**
All	5-day	0.1462%	1.0223	0.1336%	2.2694
	10-day	0.1620%	0.8545	0.0178%	0.3189
	30-day	-0.2075%	-0.5589	-0.0202%	-0.2784
AAA	5-day	-2.0600%	-2.8973	-0.5486%	-1.8228
	10-day	-2.2947%	-3.1793	-0.3021%	-1.3697
	30-day	-0.9347%	-0.2572	0.0365%	0.1671
AA	5-day	-0.3411%	-1.4454	-0.0484%	-0.4186
	10-day	-0.2623%	-0.6197	-0.1317%	-0.8129
	30-day	0.2823%	0.3406	0.2768%	1.9221
BB	5-day	0.9980%	2.2393	0.3872%	1.9940
	10-day	0.8158%	1.3053	0.0322%	0.1347
	30-day	0.0343%	0.0263	-0.3616%	-0.9634
B	5-day	1.3374%	0.8801	1.3699%	2.5629
	10-day	2.0157%	1.1339	-0.2686%	-0.3477
	30-day	6.4025%	1.4986	1.1371%	2.1311

> 10 ESG RISK INCREASE

ALL RATINGS



5-day CAR: 0.15%

10-day CAR: 0.16%

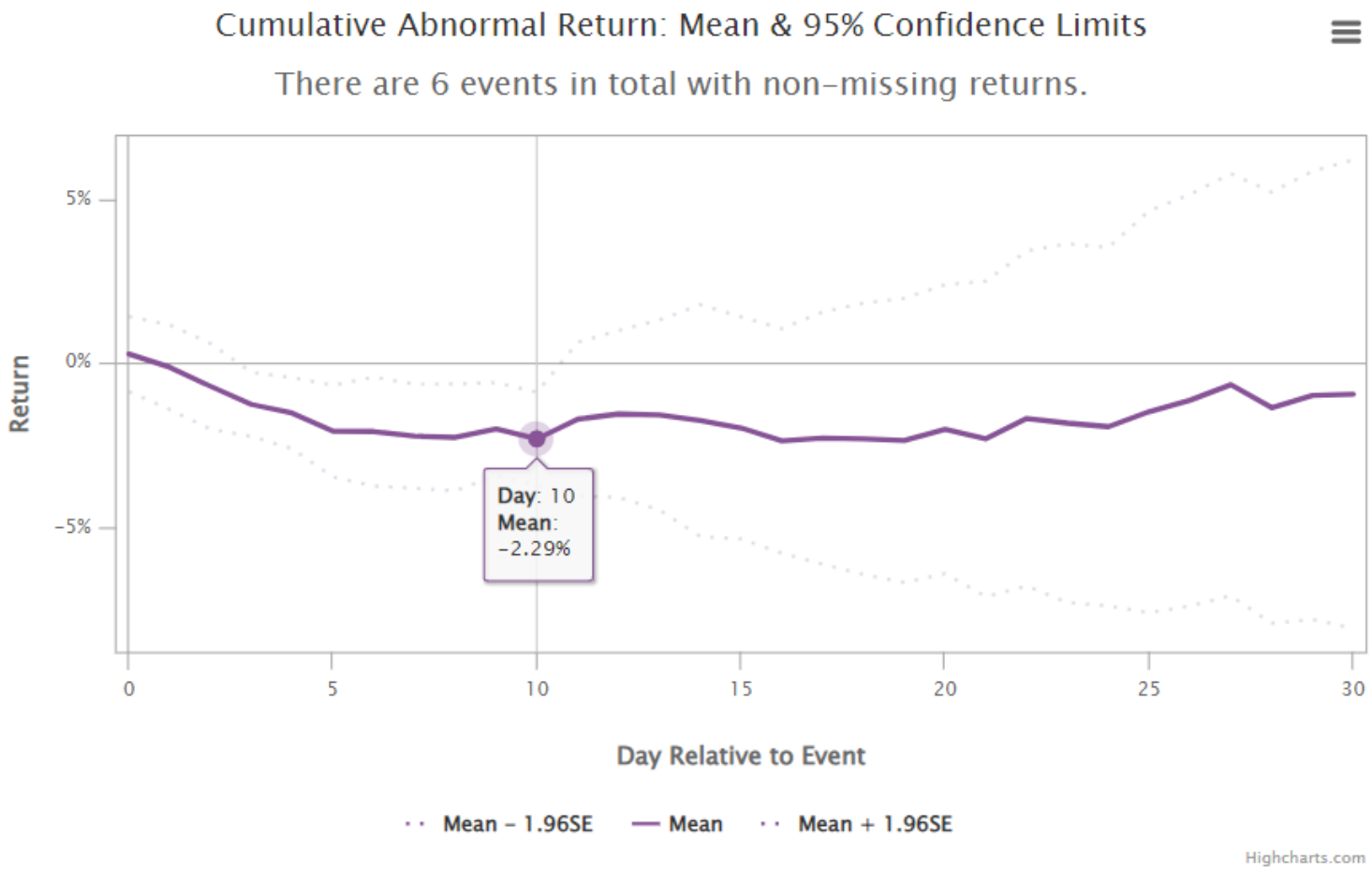
30-day CAR: -0.21%

Overall Trend:

- Increase during 6-day window
- Decrease during 6 to 30-day window

> 10 ESG RISK INCREASE

CREDIT RATING AAA



5-day CAR: -2.06%

10-day CAR: -2.29%

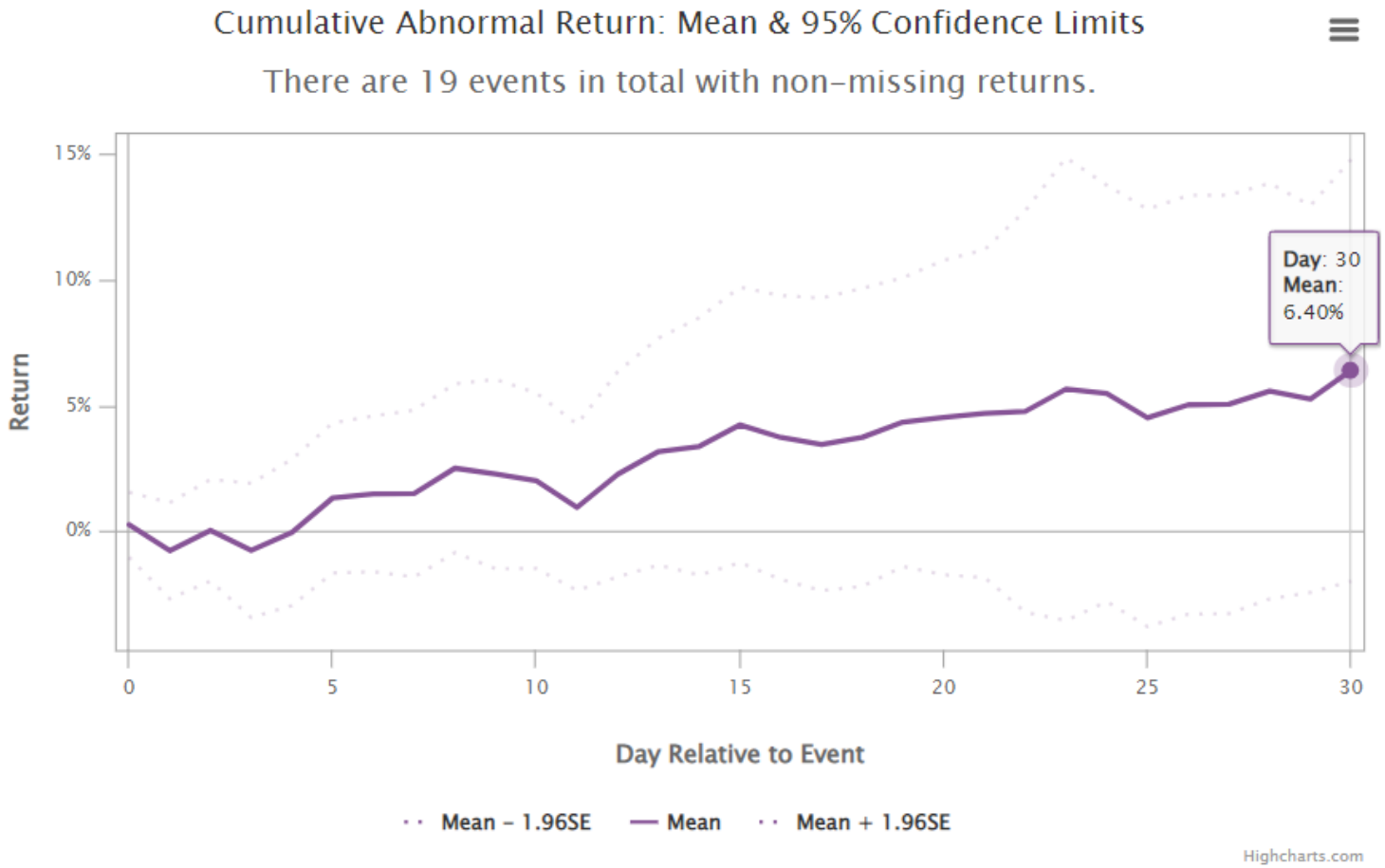
30-day CAR: -0.94%

<u>Major risk includes:</u>

- Human rights abuses and corporate complicity
- Violation of legislation
- Local pollution

> 10 ESG RISK INCREASE

CREDIT RATING B



5-day CAR: 1.34%

10-day CAR: 2.02%

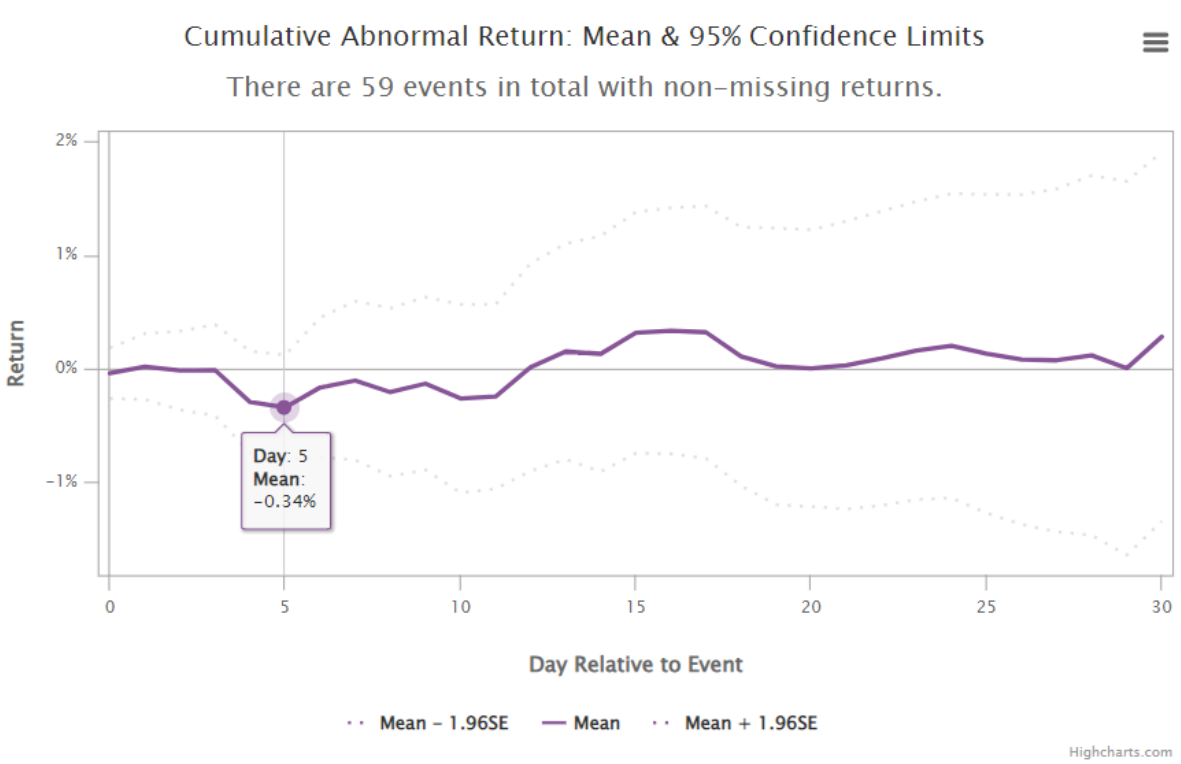
30-day CAR: 6.40%

<u>Major risk includes:</u>

- Fraud
- Controversial products and services
- Occupational health and safety issues

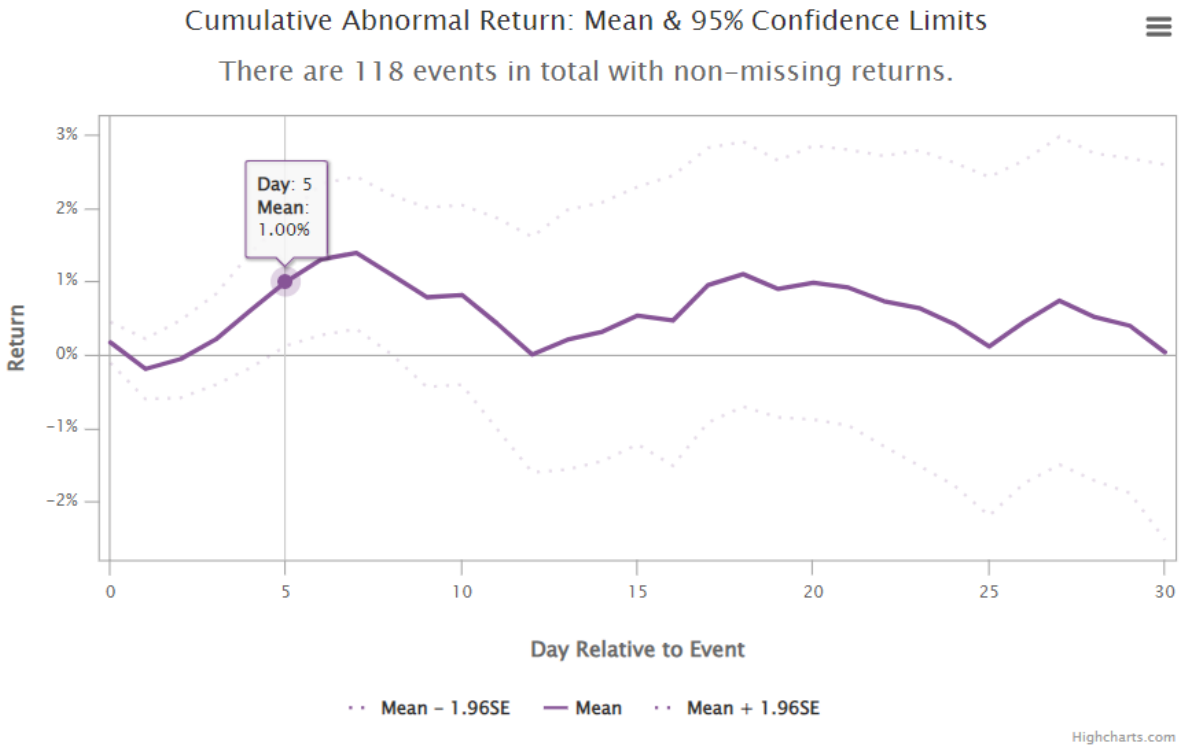
> 10 ESG RISK INCREASE

CREDIT RATING AA



CAR 5-day: -0.34%; 10-day: -0.26%; 30-day: 0.28%

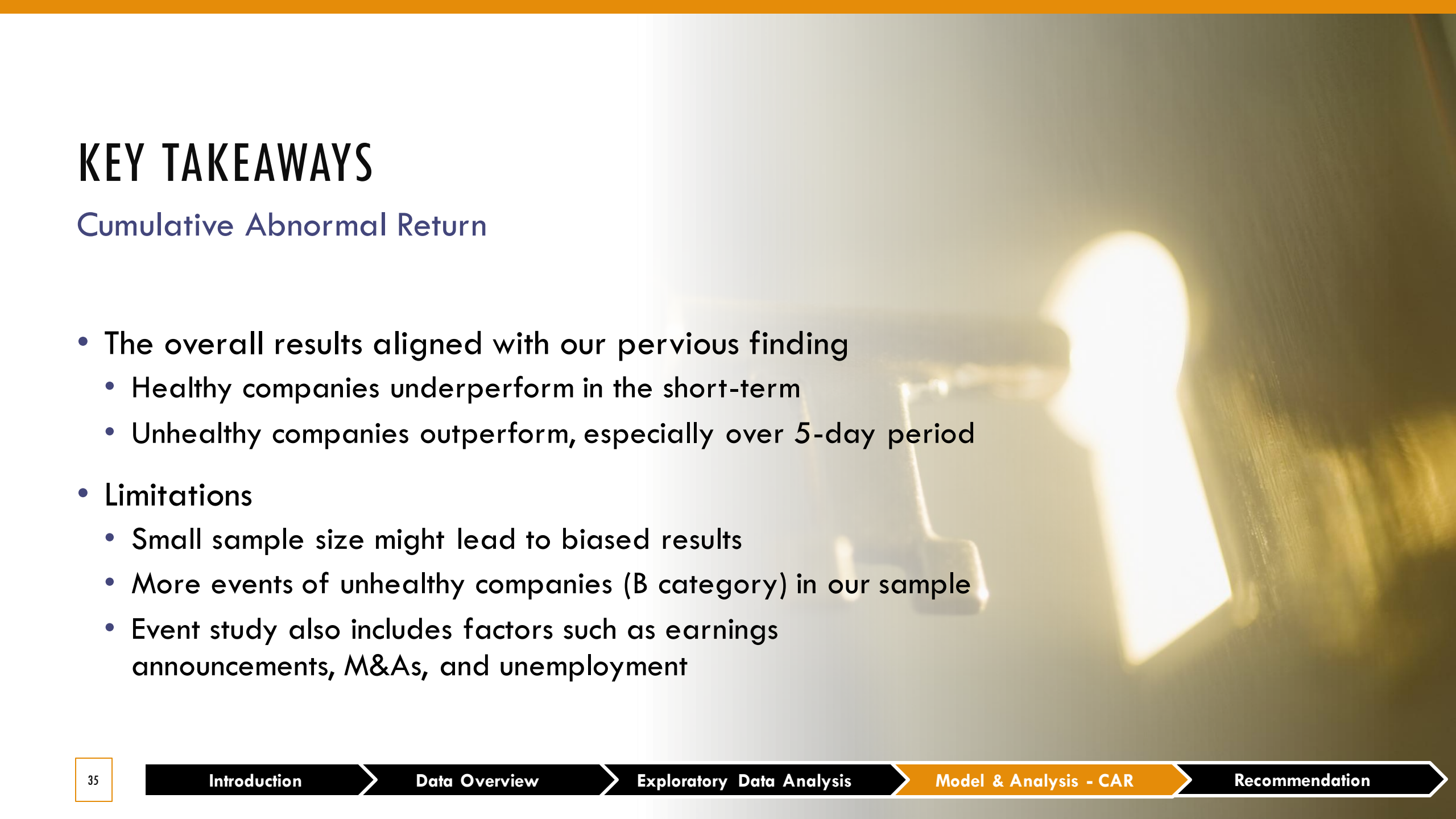
CREDIT RATING BB



CAR 5-day: 1.00%; 10-day: 0.82%; 30-day: 0.03%

KEY TAKEAWAYS

Cumulative Abnormal Return



- The overall results aligned with our pervious finding
  - Healthy companies underperform in the short-term
  - Unhealthy companies outperform, especially over 5-day period
- Limitations
  - Small sample size might lead to biased results
  - More events of unhealthy companies (B category) in our sample
  - Event study also includes factors such as earnings announcements, M&As, and unemployment

How does significant exposure to ESG risks affect short-term stock returns for companies of different health levels?

Healthy Companies:

Major exposures to ESG risks will decrease returns on stocks in the short term. ESG issues matter for healthy companies in terms of the market returns.

Unhealthy Companies:

Major exposures to ESG risks will increase returns on stocks in the short term. Investors care less about how these companies are coping with ESG-related issues.

RECOMMENDATION

If you are the management of a healthy company, investors will react strongly to ESG issues, and it is reasonable to take actions to prevent exposure to those risks.

For unhealthy companies, investors care less about how these companies are coping with ESG-related issues compared to healthy companies.

FURTHER RESEARCH

1. Expand the S&P 500 to Russell 2000 and beyond
2. Further Dissect Credit Ratings
    - Rating type
    - Annual to monthly or daily
3. Expand Date Pool
4. Segment Events
    - ESG sections individually
    - Further Dissect E, S, and G

THANK YOU

APPENDIX

SAMPLE MASTER TABLE, SECTION 1

	ticker	date_mut	permno	RepRisk_ID	name	date	current_RRI	RRI_trend	peak_RRI	peak_RRI_da	RepRisk_rati	country_sect	sectors	headquarter_	environment	social_perce	governance_	V1
1	A	1/29/16	87432	1795	Agilent Tech	1/31/16	15	-2	20	20140131	AA	24	Electronic an	US	0%	0%	0%	727069
2	A	2/29/16	87432	1795	Agilent Tech	2/29/16	14	-1	20	20151005	AA	24	Electronic an	US	0%	0%	0%	727089
3	A	3/31/16	87432	1795	Agilent Tech	3/31/16	13	-1	20	20151005	AA	24	Electronic an	US	0%	0%	0%	727111
4	A	4/29/16	87432	1795	Agilent Tech	4/30/16	11	-2	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727132
5	A	5/31/16	87432	1795	Agilent Tech	5/31/16	10	-1	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727153
6	A	6/30/16	87432	1795	Agilent Tech	6/30/16	8	-2	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727175
7	A	7/29/16	87432	1795	Agilent Tech	7/31/16	7	-1	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727195
8	A	8/31/16	87432	1795	Agilent Tech	8/31/16	6	-1	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727218
9	A	9/30/16	87432	1795	Agilent Tech	9/30/16	4	-2	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727239
10	A	10/31/16	87432	1795	Agilent Tech	10/31/16	3	-1	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727260
11	A	11/30/16	87432	1795	Agilent Tech	11/30/16	1	-2	20	20151005	AA	21	Electronic an	US	0%	0%	0%	727281
12	A	12/30/16	87432	1795	Agilent Tech	12/31/16	0	-1	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727302
13	A	1/31/17	87432	1795	Agilent Tech	1/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727322
14	A	2/28/17	87432	1795	Agilent Tech	2/28/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727341
15	A	3/31/17	87432	1795	Agilent Tech	3/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727364
16	A	4/28/17	87432	1795	Agilent Tech	4/30/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727383
17	A	5/31/17	87432	1795	Agilent Tech	5/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727405
18	A	6/30/17	87432	1795	Agilent Tech	6/30/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727427
19	A	7/31/17	87432	1795	Agilent Tech	7/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727447
20	A	8/31/17	87432	1795	Agilent Tech	8/31/17	0	0	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727470

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SAMPLE MASTER TABLE, SECTION 2

	ticker	date_mut	permno	RepRisk_ID	name	date	current_RRI	RRI_trend	peak_RRI	peak_RRI_da	RepRisk_rati	country_sect	sectors	headquarter_	environment	social_perce	governance_	V1
1	A	1/29/16	87432	1795	Agilent Tech	1/31/16	15	-2	20	20140131	AA	24	Electronic an	US	0%	0%	0%	727069
2	A	2/29/16	87432	1795	Agilent Tech	2/29/16	14	-1	20	20151005	AA	24	Electronic an	US	0%	0%	0%	727089
3	A	3/31/16	87432	1795	Agilent Tech	3/31/16	13	-1	20	20151005	AA	24	Electronic an	US	0%	0%	0%	727111
4	A	4/29/16	87432	1795	Agilent Tech	4/30/16	11	-2	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727132
5	A	5/31/16	87432	1795	Agilent Tech	5/31/16	10	-1	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727153
6	A	6/30/16	87432	1795	Agilent Tech	6/30/16	8	-2	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727175
7	A	7/29/16	87432	1795	Agilent Tech	7/31/16	7	-1	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727195
8	A	8/31/16	87432	1795	Agilent Tech	8/31/16	6	-1	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727218
9	A	9/30/16	87432	1795	Agilent Tech	9/30/16	4	-2	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727239
10	A	10/31/16	87432	1795	Agilent Tech	10/31/16	3	-1	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727260
11	A	11/30/16	87432	1795	Agilent Tech	11/30/16	1	-2	20	20151005	AA	21	Electronic an	US	0%	0%	0%	727281
12	A	12/30/16	87432	1795	Agilent Tech	12/31/16	0	-1	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727302
13	A	1/31/17	87432	1795	Agilent Tech	1/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727322
14	A	2/28/17	87432	1795	Agilent Tech	2/28/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727341
15	A	3/31/17	87432	1795	Agilent Tech	3/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727364
16	A	4/28/17	87432	1795	Agilent Tech	4/30/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727383
17	A	5/31/17	87432	1795	Agilent Tech	5/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727405
18	A	6/30/17	87432	1795	Agilent Tech	6/30/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727427
19	A	7/31/17	87432	1795	Agilent Tech	7/31/17	0	0	20	20151005	AA	22	Electronic an	US	0%	0%	0%	727447
20	A	8/31/17	87432	1795	Agilent Tech	8/31/17	0	0	20	20151005	AA	23	Electronic an	US	0%	0%	0%	727470

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SAMPLE MASTER TABLE, SECTION 3 & 4

symbol	adjusted	5_day_spy_r	10_day_spy_	30_day_ret
SPY	173.034439	-0.0109436	-0.05606	0.0466655
SPY	172.891602	0.03549231	0.04753022	0.05947616
SPY	184.521286	0.00437897	0.01206678	0.00476821
SPY	185.24852	-0.0065916	0.0011147	0.01812627
SPY	188.399902	0.00719569	-0.0066242	0.02967869
SPY	189.054718	0.00023875	0.03169754	0.04377529
SPY	195.949814	-0.0032703	0.00704685	-0.017686
SPY	196.184464	0.00749809	-0.0194593	-0.0119168
SPY	196.195847	-0.0024042	-0.0152104	0.00286641
SPY	192.794388	-0.0188191	0.01820748	0.06445562
SPY	199.896591	0.00598966	0.0334877	0.03396501
SPY	203.948883	0.0164632	0.01574743	0.04133692
SPY	207.598495	0.00615303	0.02303006	0.04118124
SPY	215.755341	0.00524387	0.00566672	-0.0004489
SPY	216.02504	-0.0012726	-0.0137017	0.01374396
SPY	218.169342	0.00285629	0.0054603	0.02238741
SPY	221.248337	0.00733089	0.0128812	0.01557312
SPY	222.658768	0.00128212	0.01555019	0.00959467
SPY	227.235321	0.00259373	-0.0107387	0.00988793
SPY	227.898361	-0.0025052	0.01050541	0.03399621

m2016	m2017	m2018	m2019	m2020	ratings
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB
BBB	BBB	BBB	BBB	BBB	BBB

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AVG. 5/10/30-DAY EXCESS RETURNS FOR >5 & >20 ESG RISK INCREASES

For >5 Risk Increases

	5-day Excess Return	10-day Excess Return	30-day Excess Return
AAA	-0.509	-0.396	0.054
AA	-0.075	-0.066	-0.046
A	-0.006	0.009	-0.038
BBB	-0.055	-0.021	-0.024
BB	0.022	0.011	0.019
B	0.229	0.511	0.611

For >20 Risk Increases

	5-day Excess Return	10-day Excess Return	30-day Excess Return
AAA	NA	NA	NA
AA	-0.338	-0.298	0.264
A	-0.321	-0.133	-0.074
BBB	0.250	0.190	0.132
BB	0.053	0.039	0.130
B	-0.460	-0.123	-0.326

* All returns are annualized

Similar findings in the >5 case:

- Healthier companies have below-market returns in 5/10-day periods; unhealthy companies have higher returns in 30-day periods

For >20 risk increases:

- Negative impact for companies that sit at two extremes of the spectrum (but relatively low t-scores for 5/10-day periods)
- Not so much impact for companies in the middle

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AVG. 5/10/30-DAY EXCESS RETURNS FOR >5 & >20 ESG RISK INCREASES T STATISTICS

For >5 Risk Increases

	5-day Excess Return	10-day Excess Return	30-day Excess Return
AAA	-3.560	-3.483	0.416
AA	-0.803	-0.866	-1.067
A	-0.099	0.200	-1.500
BBB	-0.856	-0.435	-0.841
BB	0.164	0.104	0.341
B	0.365	0.849	1.484

For >20 Risk Increases

	5-day Excess Return	10-day Excess Return	30-day Excess Return
AAA	NA	NA	NA
AA	-1.179	-0.891	1.062
A	-2.532	-1.165	-0.983
BBB	1.123	1.160	1.346
BB	0.219	0.219	1.039
B	-0.346	-0.115	-2.040

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ALPHAS AND BETAS

- Extended case : 5/10/30-day returns after > 5 risk increases

	30 Day Returns	10 Day Returns	5 Day Returns
Alpha	-0.007725	-0.0007927	-0.0008952
Beta	1.242157	1.1237408	1.0604646

- Extended case : 5/10/30-day returns after > 20 risk increases

	30 Day Returns	10 Day Returns	5 Day Returns
Alpha	0.002924	0.0002404	-0.0005842
Beta	1.183780	1.1648104	1.0482205

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