Assignment 7: Predicting Operational Risk Using NLP

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Analysis

Justification for Choosing Option 1 (Cybersecurity Risk Ratio)

- The cybersecurity risk ratio focuses on the relative importance of cybersecurity within each company's risk assessment. By using a ratio instead of a raw count, we can compare the emphasis on cybersecurity risk across firms, regardless of how much they write about risks overall. This makes it easier to compare cybersecurity risk across firms of different sizes or with varying levels of overall risk disclosure.

Observation on Cybersecurity Risk for All the Years Across Different Industry

- Finance, Insurance and Real Estate has the highest mean cybersecurity risk (0.020273), significantly higher than other sectors, with a high variability (standard deviation of 0.022927). This indicates that this sector faces the greatest exposure to cyber threats, likely due to its handling of sensitive financial data and strict regulatory requirements.
- Wholesale Trade demonstrates the second highest mean risk (0.013640), accompanied by relatively high variability (standard deviation of 0.016582). This suggests notable variation in cybersecurity risk exposure across companies in this sector.
- Agriculture, Forestry and Fishing has a relatively low mean risk (0.010314) and the lowest kurtosis (0.182918), suggesting a more uniform and generally lower perception of cybersecurity risks across companies in this sector.
- Manufacturing shows the lowest mean risk (0.007050) among all sectors but has a high kurtosis (3.741473), implying that while most companies in this sector report low cybersecurity risks, there are some significant outliers.
- Retail Trade exhibits interesting characteristics with a negative skewness (0.894671), suggesting a more uniform distribution of cybersecurity risks across companies in this sector, with fewer extreme outliers compared to others.
- Mining has the highest kurtosis (7.524308), reflecting extreme variation in cybersecurity risks, with certain companies reporting risks significantly higher than the sector average of 0.007442.
- Services shows a moderate mean risk (0.011581) and kurtosis (2.688571), indicating a balanced risk perception with some variability.
- Transportation and Other Utilities has a comparable mean risk (0.011583) and a standard deviation of 0.014042, reflecting moderate variability in cybersecurity risk across this industry.
- Construction reports a slightly higher mean risk (0.010290) than Agriculture, with a standard deviation of 0.011761 and a relatively high skewness (1.377157), indicating a heavier tail toward higher risks.
- Public Administration reports a mean risk of 0.012126 with moderate variability (standard deviation of 0.012076) and a balanced kurtosis (0.993258), reflecting relatively uniform risk perception within the industry.

Observation on Mean and Standard Deviation of Cybersecurity Risk for Each Industry for Each Year

- Finance, Insurance, and Real Estate demonstrates the most dramatic increase in cybersecurity risk, with the mean peaking at 0.053129 in 2020 and the standard deviation reaching its highest at 0.041241 in 2016. The sector has consistently shown elevated risk levels from 2016 to 2022, reflecting its exposure to cyber threats due to the sensitive nature of financial data and stringent regulatory compliance requirements.
- Services and Wholesale Trade exhibit significant risk growth after 2015. Services reached its highest mean of 0.038632 in 2022, with a notable increase in variability (standard deviation 0.016065) during its rise. Wholesale Trade peaked with a mean of 0.033379 in 2018, maintaining higher variability (standard deviation 0.021437) across companies, highlighting diverse risk exposures.
- Construction shows a steady upward trajectory, starting from near-zero levels in the 2005-2008 period and reaching its highest mean of 0.029413 in 2022. Its standard deviation remained relatively stable, reflecting a uniform increase in risk across the sector, possibly driven by the adoption of new technologies and infrastructure digitization.
- Agriculture, Forestry, and Fishing exhibits a more moderate but consistent increase in cybersecurity risk, with its mean rising from 0.000708 in 2006 to 0.018156 in 2021. Interestingly, this sector's standard deviation decreased over time (from 0.016709 in 2013 to 0.008591 in 2022), indicating more uniformity in perceived risk among companies.
- Mining shows volatile growth, with sharp jumps in mean risk post-2015, peaking at 0.027204 in 2022. The high variability (standard deviation frequently exceeding the mean) underscores the uneven distribution of risk across the sector, likely driven by varying levels of technological maturity and exposure to cyber threats.
- Public Administration demonstrates the most stable pattern among all sectors, with moderate risk growth over time. Its mean rose from 0.002591 in 2006 to 0.016899 in 2022, with standard deviations remaining relatively low and consistent, reflecting standardized cybersecurity practices and uniformity across organizations.
- Manufacturing shows slower growth in cybersecurity risk compared to other industries, with the mean increasing from 0.003038 in 2006 to 0.028401 in 2022. The sector has maintained a high standard deviation, indicating the presence of significant outliers, likely reflecting uneven adoption of cybersecurity measures.

Equal-Weighted Portfolio Comment and Discussion

- The returns for both high cybersecurity risk (Quintile 5) and low cybersecurity risk (Quintile 1) portfolios exhibit significant volatility, particularly during the early 2000s and 2003-2004. In 2003-2004, Quintile 5 displayed its highest return spike, exceeding 2.0, reflecting heightened sensitivity to market dynamics.
- Notable periods of divergence between high-risk and low-risk portfolios include:
  - Early 2000s, marked by a sharp reversal from high-risk underperformance to significant outperformance.
  - 2003-2004, showing the largest return spread between high and low-risk portfolios.
  - 2009-2010, with another phase of pronounced outperformance by high-risk portfolios, driven by recovery trends post-2008 financial crisis.
- The High Risk-Low Risk return spread (green line) remains volatile across the sample period, oscillating between positive and negative values. This highlights the instability of the relationship between cybersecurity risk and returns, with market conditions playing a significant role.
- Post-2015, the return differences between high and low-risk portfolios diminish noticeably, with the spread stabilizing around zero. Possible explanations include:
  - Improved efficiency in market pricing of cybersecurity risks.
  - More robust risk management frameworks adopted across industries.

- Increasing standardization of cybersecurity measures and disclosures.
- The recent period (2018-2022) exhibits relatively subdued fluctuations in both portfolio returns and their differences, suggesting maturation in how markets perceive and price cybersecurity risks, along with potentially reduced uncertainty regarding the economic impact of such risks.

Value-Weighted Portfolio Comment and Discussion

- The value-weighted portfolios show pronounced volatility, highlighted by two extreme events:
  - 2003-2004, with a sharp positive spike where both Quintile 5 and the High Risk-Low Risk return peaked near 2.0, indicating strong performance by high-risk, high-cap companies.
  - 2010, marked by a dramatic negative spike where the High Risk-Low Risk return fell to approximately -1.2, driven by significant outperformance of low-risk companies during economic stabilization.

- The relationship between high and low cybersecurity risk portfolios evolves through three distinct phases:
  - 2000-2003, characterized by relatively stable fluctuations with no pronounced divergence.
  - 2003-2010, a period of heightened volatility with extreme swings in return spreads, reflecting market turbulence and differential risk perceptions.
  - Post-2010, characterized by more subdued fluctuations and narrower return differentials, indicating convergence in risk management practices among larger firms.

- The most recent period (2015-2022) reflects the smallest return differentials, with the High Risk-Low Risk return line remaining close to zero. This indicates alignment in market capitalization-weighted returns for high and low cybersecurity risk companies, suggesting reduced differentiation in risk premiums.

- Unlike earlier periods, recent years demonstrate muted reactions to market stress events, indicating a more sophisticated and nuanced market approach to assessing cybersecurity risks among large-cap firms.

Descriptive Analysis

1. Compute the descriptive stats

	count	mean	std	min	max	skew	kurtosis	1%	5%	25%	50%	75%	95%	99%
industry														
Agriculture, Forestry and Fishing	144	0.010314	0.012193	0.0	0.044444	1.018134	0.182918	0.0	0.0	0.000000	0.005962	0.018966	0.034454	0.0444
Construction	172	0.010290	0.011761	0.0	0.058394	1.371757	1.989498	0.0	0.0	0.000000	0.006730	0.017033	0.031111	0.0505
Finance, Insurance and Real Estate	200	0.020273	0.022927	0.0	0.142857	1.779232	4.446305	0.0	0.0	0.000000	0.015244	0.028479	0.061169	0.0912
Manufacturing	269	0.007050	0.011229	0.0	0.060606	1.918140	3.741473	0.0	0.0	0.000000	0.000000	0.010989	0.031548	0.0414
Mining	186	0.007442	0.012125	0.0	0.067873	2.579830	7.524308	0.0	0.0	0.000000	0.002366	0.010194	0.035885	0.0569
Public Administration	155	0.012126	0.012076	0.0	0.055838	1.159158	0.993258	0.0	0.0	0.002444	0.008798	0.018512	0.035009	0.0474
Retail Trade	209	0.012711	0.013196	0.0	0.053571	0.894671	-0.010900	0.0	0.0	0.000000	0.010417	0.021127	0.038860	0.0474
Services	235	0.011581	0.014293	0.0	0.074689	1.537934	2.688571	0.0	0.0	0.000000	0.006757	0.020529	0.038795	0.0608
Transportation and other Utilities	191	0.011583	0.014042	0.0	0.068182	1.266751	1.056648	0.0	0.0	0.000000	0.006623	0.020036	0.039709	0.0503
Wholesale Trade	190	0.013640	0.016582	0.0	0.076923	1.541294	2.349952	0.0	0.0	0.000000	0.008753	0.021520	0.044679	0.0709

2. Compute the mean and standard deviation for each industry each year

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Industry: Agriculture, Forestry and Fishing
                        industry  year      mean       std
0   Agriculture, Forestry and Fishing  2006  0.000708  0.002123
1   Agriculture, Forestry and Fishing  2007  0.001724  0.003220
2   Agriculture, Forestry and Fishing  2008  0.001227  0.002359
3   Agriculture, Forestry and Fishing  2009  0.001733  0.002327
4   Agriculture, Forestry and Fishing  2010  0.002784  0.004360
5   Agriculture, Forestry and Fishing  2011  0.003048  0.006541
6   Agriculture, Forestry and Fishing  2012  0.008742  0.015898
7   Agriculture, Forestry and Fishing  2013  0.010061  0.016709
8   Agriculture, Forestry and Fishing  2014  0.011957  0.015451
9   Agriculture, Forestry and Fishing  2015  0.016098  0.017545
10  Agriculture, Forestry and Fishing  2016  0.014394  0.015862
11  Agriculture, Forestry and Fishing  2017  0.019522  0.013353
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12  Agriculture, Forestry and Fishing  2018  0.016560  0.008096
13  Agriculture, Forestry and Fishing  2019  0.017963  0.009455
14  Agriculture, Forestry and Fishing  2020  0.018491  0.007950
15  Agriculture, Forestry and Fishing  2021  0.018156  0.008252
16  Agriculture, Forestry and Fishing  2022  0.017289  0.008591


Industry: Construction
       industry  year      mean       std
17  Construction  2005  0.000000  0.000000
18  Construction  2006  0.000552  0.001747
19  Construction  2007  0.000524  0.001656
20  Construction  2008  0.000000  0.000000
21  Construction  2009  0.004518  0.007190
22  Construction  2010  0.003256  0.004898
23  Construction  2011  0.003181  0.005250
24  Construction  2012  0.004010  0.008345
25  Construction  2013  0.004733  0.006433
26  Construction  2014  0.007467  0.007135
27  Construction  2015  0.014646  0.009085
28  Construction  2016  0.013081  0.008189
29  Construction  2017  0.014984  0.008342
30  Construction  2018  0.012340  0.007890
31  Construction  2019  0.020244  0.010143
32  Construction  2020  0.019679  0.007993
33  Construction  2021  0.024355  0.012600
34  Construction  2022  0.029413  0.016416


Industry: Finance, Insurance and Real Estate
                               industry  year      mean       std
35  Finance, Insurance and Real Estate  1997  0.000000       NaN
36  Finance, Insurance and Real Estate  2000  0.000000  0.000000
37  Finance, Insurance and Real Estate  2001  0.000000       NaN
38  Finance, Insurance and Real Estate  2002  0.000000       NaN
39  Finance, Insurance and Real Estate  2003  0.000000  0.000000
40  Finance, Insurance and Real Estate  2004  0.000000  0.000000
41  Finance, Insurance and Real Estate  2005  0.004482  0.010391
42  Finance, Insurance and Real Estate  2006  0.014305  0.019463
43  Finance, Insurance and Real Estate  2007  0.014361  0.014544
44  Finance, Insurance and Real Estate  2008  0.004375  0.009669
45  Finance, Insurance and Real Estate  2009  0.009719  0.010733
46  Finance, Insurance and Real Estate  2010  0.011774  0.015431
47  Finance, Insurance and Real Estate  2011  0.009881  0.007710
48  Finance, Insurance and Real Estate  2012  0.019342  0.013179
49  Finance, Insurance and Real Estate  2013  0.011072  0.013920
50  Finance, Insurance and Real Estate  2014  0.014941  0.010711
51  Finance, Insurance and Real Estate  2015  0.021247  0.007220
52  Finance, Insurance and Real Estate  2016  0.030726  0.041241
53  Finance, Insurance and Real Estate  2017  0.031435  0.018436
54  Finance, Insurance and Real Estate  2018  0.039211  0.025305
55  Finance, Insurance and Real Estate  2019  0.024441  0.013881
56  Finance, Insurance and Real Estate  2020  0.053129  0.026964
57  Finance, Insurance and Real Estate  2021  0.044253  0.019310
58  Finance, Insurance and Real Estate  2022  0.046766  0.024764


Industry: Manufacturing
       industry  year      mean       std
59  Manufacturing  1996  0.000000  0.000000
60  Manufacturing  1997  0.000000  0.000000
61  Manufacturing  1998  0.000000  0.000000
62  Manufacturing  1999  0.000513  0.001622
63  Manufacturing  2000  0.000000  0.000000
64  Manufacturing  2001  0.000000  0.000000
65  Manufacturing  2002  0.000000  0.000000
66  Manufacturing  2003  0.000000  0.000000
67  Manufacturing  2004  0.000769  0.002433
68  Manufacturing  2005  0.004938  0.006773
69  Manufacturing  2006  0.003038  0.004628
70  Manufacturing  2007  0.001512  0.003194
71  Manufacturing  2008  0.001050  0.001727
72  Manufacturing  2009  0.000248  0.000783
73  Manufacturing  2010  0.002408  0.005316
74  Manufacturing  2011  0.004300  0.006361
75  Manufacturing  2012  0.010261  0.014752
76  Manufacturing  2013  0.009141  0.013965
77  Manufacturing  2014  0.010788  0.009198
78  Manufacturing  2015  0.016952  0.017275
79  Manufacturing  2016  0.008462  0.008801
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80   Manufacturing  2017  0.012437  0.012240
81   Manufacturing  2018  0.018322  0.013526
82   Manufacturing  2019  0.017342  0.007058
83   Manufacturing  2020  0.018185  0.006853
84   Manufacturing  2021  0.020579  0.012352
85   Manufacturing  2022  0.028401  0.014373

Industry: Mining
      industry  year      mean       std
86      Mining  1996  0.000000  0.000000
87      Mining  1997  0.000000       NaN
88      Mining  1998  0.000000       NaN
89      Mining  1999  0.000000       NaN
90      Mining  2000  0.000000       NaN
91      Mining  2001  0.000000       NaN
92      Mining  2002  0.000000  0.000000
93      Mining  2003  0.000000       NaN
94      Mining  2004  0.000000       NaN
95      Mining  2005  0.000000  0.000000
96      Mining  2006  0.000606  0.001917
97      Mining  2007  0.002001  0.002751
98      Mining  2008  0.000000  0.000000
99      Mining  2009  0.000265  0.000837
100     Mining  2010  0.001659  0.002808
101     Mining  2011  0.000916  0.002079
102     Mining  2012  0.003843  0.007017
103     Mining  2013  0.003812  0.004157
104     Mining  2014  0.003895  0.003867
105     Mining  2015  0.005977  0.006241
106     Mining  2016  0.010393  0.010741
107     Mining  2017  0.009495  0.010510
108     Mining  2018  0.015909  0.019313
109     Mining  2019  0.019857  0.010624
110     Mining  2020  0.014025  0.014165
111     Mining  2021  0.018564  0.018845
112     Mining  2022  0.027204  0.017123

Industry: Public Administration
                   industry  year      mean       std
113  Public Administration  2006  0.002591  0.005181
114  Public Administration  2007  0.002933  0.005079
115  Public Administration  2008  0.007573  0.009339
116  Public Administration  2009  0.004755  0.008420
117  Public Administration  2010  0.008170  0.010261
118  Public Administration  2011  0.008436  0.010118
119  Public Administration  2012  0.018901  0.014773
120  Public Administration  2013  0.012210  0.009546
121  Public Administration  2014  0.007475  0.008782
122  Public Administration  2015  0.010956  0.013165
123  Public Administration  2016  0.014073  0.009592
124  Public Administration  2017  0.013734  0.011426
125  Public Administration  2018  0.011637  0.012193
126  Public Administration  2019  0.014549  0.015550
127  Public Administration  2020  0.017828  0.012161
128  Public Administration  2021  0.020353  0.017265
129  Public Administration  2022  0.016899  0.010421

Industry: Retail Trade
        industry  year      mean       std
130  Retail Trade  1996  0.000000       NaN
131  Retail Trade  1997  0.000000  0.000000
132  Retail Trade  1998  0.000000       NaN
133  Retail Trade  1999  0.000000  0.000000
134  Retail Trade  2000  0.004695  0.008132
135  Retail Trade  2001  0.002841  0.005682
136  Retail Trade  2002  0.000000  0.000000
137  Retail Trade  2003  0.002525  0.005051
138  Retail Trade  2004  0.001515  0.003711
139  Retail Trade  2005  0.001042  0.003294
140  Retail Trade  2006  0.002286  0.004828
141  Retail Trade  2007  0.007857  0.010454
142  Retail Trade  2008  0.007575  0.009942
143  Retail Trade  2009  0.004925  0.004528
144  Retail Trade  2010  0.008998  0.009404
145  Retail Trade  2011  0.009575  0.011835
146  Retail Trade  2012  0.009664  0.008791
147  Retail Trade  2013  0.018412  0.010625
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148  Retail Trade  2014  0.012798  0.012198
149  Retail Trade  2015  0.026208  0.007977
150  Retail Trade  2016  0.015468  0.008258
151  Retail Trade  2017  0.023938  0.013057
152  Retail Trade  2018  0.022460  0.013950
153  Retail Trade  2019  0.023414  0.014184
154  Retail Trade  2020  0.024240  0.014097
155  Retail Trade  2021  0.027216  0.014891
156  Retail Trade  2022  0.015118  0.013594

Industry: Services
     industry  year      mean       std
157  Services  1996  0.000000  0.000000
158  Services  1997  0.000000  0.000000
159  Services  1998  0.000000  0.000000
160  Services  1999  0.000412  0.001008
161  Services  2000  0.002331  0.002740
162  Services  2001  0.003126  0.006723
163  Services  2002  0.003208  0.006169
164  Services  2003  0.000751  0.002252
165  Services  2004  0.001563  0.003494
166  Services  2005  0.003217  0.004532
167  Services  2006  0.008513  0.008801
168  Services  2007  0.002406  0.004676
169  Services  2008  0.013659  0.014343
170  Services  2009  0.005792  0.007275
171  Services  2010  0.005872  0.007086
172  Services  2011  0.006901  0.010274
173  Services  2012  0.011882  0.015856
174  Services  2013  0.010207  0.011211
175  Services  2014  0.016559  0.011903
176  Services  2015  0.015091  0.013893
177  Services  2016  0.013639  0.007619
178  Services  2017  0.014825  0.013855
179  Services  2018  0.023081  0.013106
180  Services  2019  0.023930  0.019725
181  Services  2020  0.027661  0.017360
182  Services  2021  0.022566  0.008944
183  Services  2022  0.038632  0.016065

Industry: Transportation and other Utilities
                              industry  year      mean       std
184  Transportation and other Utilities  1996  0.000000       NaN
185  Transportation and other Utilities  1997  0.000000  0.000000
186  Transportation and other Utilities  1998  0.000000  0.000000
187  Transportation and other Utilities  1999  0.000000  0.000000
188  Transportation and other Utilities  2000  0.000000       NaN
189  Transportation and other Utilities  2001  0.000000  0.000000
190  Transportation and other Utilities  2003  0.000000       NaN
191  Transportation and other Utilities  2004  0.000000  0.000000
192  Transportation and other Utilities  2005  0.000000  0.000000
193  Transportation and other Utilities  2006  0.004066  0.005970
194  Transportation and other Utilities  2007  0.000844  0.002669
195  Transportation and other Utilities  2008  0.005187  0.007860
196  Transportation and other Utilities  2009  0.000932  0.002946
197  Transportation and other Utilities  2010  0.001920  0.002561
198  Transportation and other Utilities  2011  0.002794  0.003670
199  Transportation and other Utilities  2012  0.014354  0.012041
200  Transportation and other Utilities  2013  0.007276  0.010210
201  Transportation and other Utilities  2014  0.009559  0.012613
202  Transportation and other Utilities  2015  0.018396  0.017476
203  Transportation and other Utilities  2016  0.013374  0.012235
204  Transportation and other Utilities  2017  0.023583  0.016474
205  Transportation and other Utilities  2018  0.015569  0.009442
206  Transportation and other Utilities  2019  0.023456  0.012044
207  Transportation and other Utilities  2020  0.019032  0.010139
208  Transportation and other Utilities  2021  0.027407  0.012984
209  Transportation and other Utilities  2022  0.033481  0.015104

Industry: Wholesale Trade
            industry  year      mean       std
210  Wholesale Trade  1996  0.000000  0.000000
211  Wholesale Trade  1997  0.000000  0.000000
212  Wholesale Trade  1998  0.000000       NaN
213  Wholesale Trade  1999  0.000000  0.000000
214  Wholesale Trade  2000  0.000000       NaN
215  Wholesale Trade  2002  0.000000       NaN
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216  Wholesale Trade  2003  0.000000  0.000000
217  Wholesale Trade  2004  0.000000  0.000000
218  Wholesale Trade  2005  0.000942  0.002306
219  Wholesale Trade  2006  0.001861  0.004042
220  Wholesale Trade  2007  0.004135  0.005950
221  Wholesale Trade  2008  0.002848  0.006886
222  Wholesale Trade  2009  0.004006  0.007281
223  Wholesale Trade  2010  0.002676  0.004369
224  Wholesale Trade  2011  0.002861  0.006078
225  Wholesale Trade  2012  0.011114  0.010499
226  Wholesale Trade  2013  0.015301  0.012807
227  Wholesale Trade  2014  0.012869  0.015002
228  Wholesale Trade  2015  0.019032  0.013077
229  Wholesale Trade  2016  0.032402  0.020405
230  Wholesale Trade  2017  0.018934  0.022014
231  Wholesale Trade  2018  0.033379  0.021437
232  Wholesale Trade  2019  0.024924  0.013170
233  Wholesale Trade  2020  0.021115  0.011319
234  Wholesale Trade  2021  0.027793  0.018070
235  Wholesale Trade  2022  0.023338  0.018133
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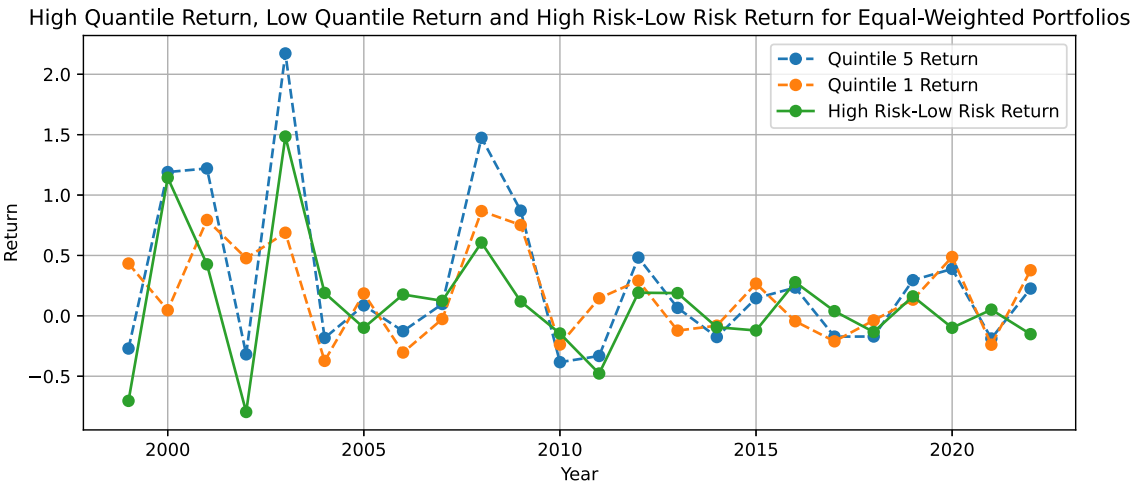

Industry Mean and Std over Years
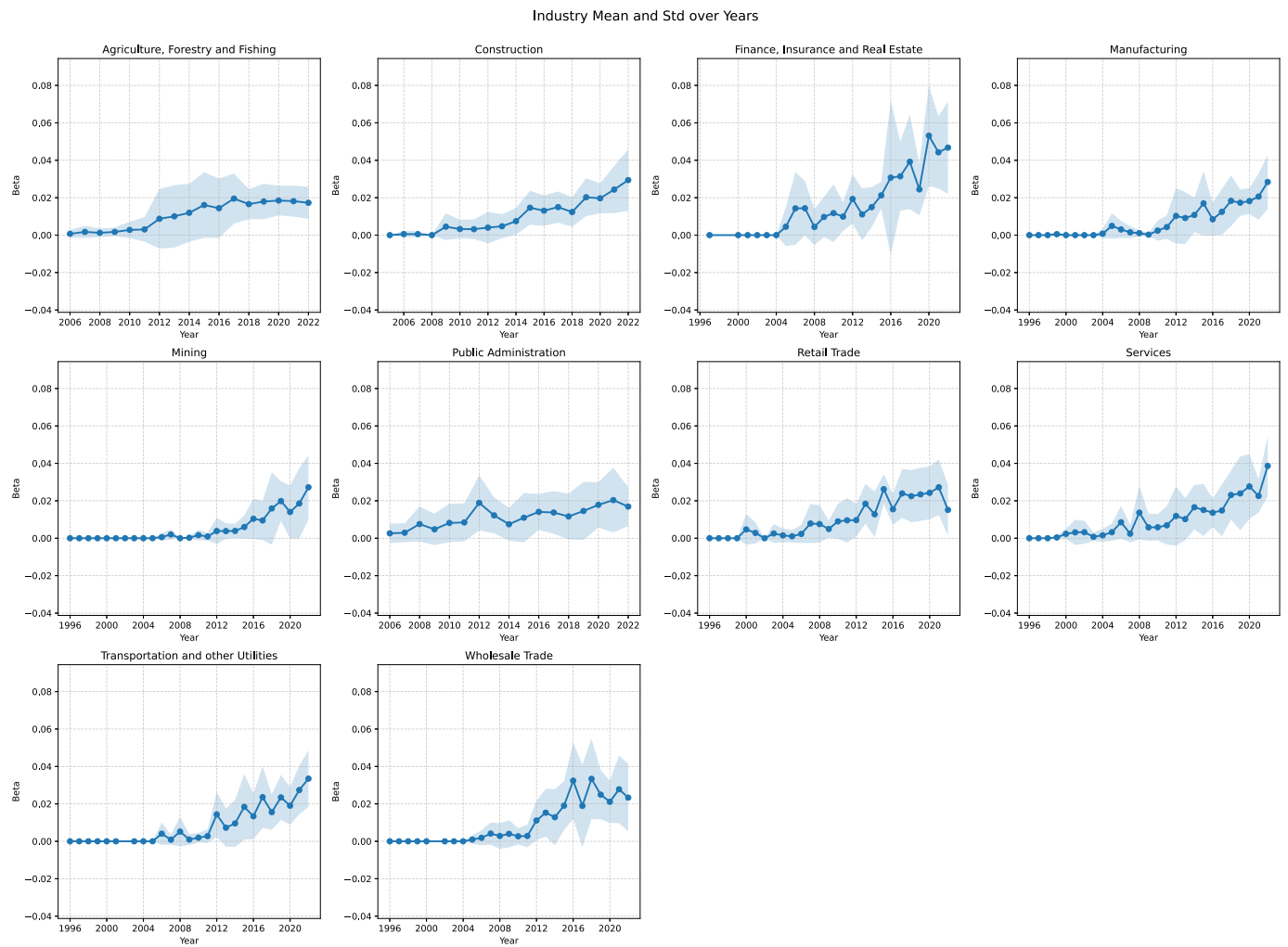
Step 5: Portfolio Analysis

- As all the companies in year 1996-1998 has 0 cybersecurity risk, it's not meaningful to cut portfolio into five quantile based on all 0 cybersecurity risk and make comparison in return for different quantile portfolio. Therefore, year 1996-1998 is dropped.
- For 1999-2010, given that over 80% of companies report zero cybersecurity risk, I use a binary classification: Quintile 1 for zero-risk companies and Quintile 5 for those with any non-zero risk.
- After 2010, as cybersecurity risk ratios become more diverse, I divide companies into five quintiles based on their cybersecurity risk levels and make comparison on equal-weighted and value-weighted return accordingly.

1. Form equal weighted portfolios

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Average return for quintile 5 across all years: 0.2761
Average return for quintile 1 across all years: 0.1778



Equal-weighted return difference (High Risk-Low Risk) for each year:
Year 1999: -0.7040
Year 2000: 1.1437
Year 2001: 0.4266
Year 2002: -0.7960
Year 2003: 1.4844
Year 2004: 0.1896
Year 2005: -0.0986
Year 2006: 0.1765
Year 2007: 0.1244
Year 2008: 0.6064
Year 2009: 0.1190
Year 2010: -0.1459
Year 2011: -0.4776
Year 2012: 0.1915
Year 2013: 0.1883
Year 2014: -0.0941
Year 2015: -0.1211
Year 2016: 0.2786
Year 2017: 0.0388
Year 2018: -0.1336
Year 2019: 0.1612
Year 2020: -0.0989
Year 2021: 0.0513
Year 2022: -0.1518
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High Quantile Return, Low Quantile Return and High Risk-Low Risk Return for Equal-Weighted Portfolios

2. Form value-weighted portfolio

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Value-weighted return for quintile 5 across all years: 0.0323
Value-weighted return for quintile 1 across all years: 0.0205



Value-weighted return difference (High Risk-Low Risk) for each year:
Year 1999: 0.0203
Year 2000: 0.0755
Year 2001: 0.2246
Year 2002: -0.2862
Year 2003: 1.7670
Year 2004: 0.0097
Year 2005: 0.0777
Year 2006: 0.2337
Year 2007: 0.0702
Year 2008: -0.0433
Year 2009: -1.2910
Year 2010: -0.2469
Year 2011: 0.0043
Year 2012: -0.1513
```

```
Year 2013: 0.0805
Year 2014: -0.1539
Year 2015: -0.1190
Year 2016: 0.1235
Year 2017: 0.0772
Year 2018: -0.0133
Year 2019: -0.2872
Year 2020: 0.0101
Year 2021: 0.1621
Year 2022: -0.0615
```

High Quantile Return, Low Quantile Return and High Risk-Low Risk Return for Value-Weighted Portfolios