Explore Correlation Between ESG and Finance Performance of S&P 500 Companies.

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1. Introduction

ESG is abbreviate of the environment, social responsibility, and corporate governance. When value a company, finance analysts are paying more attention to a company's intangible assets, besides traditional financial statement figures. From the companies' perspective, managers are eager to know if it is profitable to assume more social responsibilities, to purchase environment-friendly but expensive assets or to share more benefits of the company with employees. In addition, investors doubt whether to invest in a company who have high ESG rank will be profitable because a company has limited resources. So, this report will investigate the correlation between S&P 500 companies' ESG and their performance from a quantitative perspective. We select S&P 500 as our research target because this index consists of tycoons in each industry in the United States and they have a significant influence on the whole economy. We apply Bloomberg Excel API to acquire historical data from the Bloomberg terminal and conduct descriptive and predictive analysis using BI tool, and statistical model. Our grand conclusion is ESG has a positive correlation with a company's operating performance, but ESG has little correlation with a company's market performance.

2. Methodology

In descriptive analysis part, we use Tableau to draw charts, including bar charts, pie charts, combined charts and so on. The descriptive analysis could give us a straightforward image of the correlation between variables.

In predictive analysis part, statistical models are applied. Only when model assumptions are satisfied, this model can be used to predict values effectively. We find multiple linear regression model satisfies most of the assumptions, except that distribution of residuals is heavy trailed and some influential outliers bias model accuracy, so we build a multiple linear regression model after removing outliers.

In this report, we provide an innovative view to predicting net income of listed companies.

3. Data description

We apply Bloomberg Excel API to acquire data. Our dataset includes 4 years of data, from 2014 to 2017. We select net income, sales, and free cash flow as the dependent variable, and select company name, year, industry sector and state as control variables. Because we want to analyze correlation before ESG and company performance, so we only choose ESG data as independent variables. We choose social responsibility rank, corporate governance rank and environment rank to stand for E, S, and G.

The amount of our dataset is 20 variables*1847 rows (including 4 years) = 36,940

Data source: Bloomberg API

Dependent Variable	Independent Variable	Control Variable
NET_INCOME	TOT_STK_AWARDS_GIVEN_TO_EXECS	Ticker
SALES_REV_TURN	TOT_TOP_3_HIGHEST_STK_AW_AMT	Year
CF_FREE_CASH_FLOW	2ND_HIGHEST_STK_AWARDS_AMT	GICS Sector
ROA	2ND_HIGHEST_ALL_OTH_COMP_AMT_AW	State
ROE	3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	

WACC	2ND_HIGHEST_TOT_COMP_AMT_AW	
TOBIN_Q_RATIO	SUSTAINALYTICS_SOCIAL_PERCENTILE	
	SUSTAINALYTICS_ENVIRONMENT_PCT	
	SUSTAINALYTICS_GOVERNANCE_PCT	
	TOTAL_ASSET	

Table1. Variables

Variables	**Explanation**
SALES_REV_TURN	Amount of sales generated by a company after the deduction of sales returns, allowances, discounts, and sales-based taxes.
CF_FREE_CASH_FLOW	A measure of financial performance calculated as operating cash flow minus capital expenditures.
TOT_STK_AWARDS_GIVEN_TO_EXECS	The total amount of stock the company awarded to the executives.
TOT_TOP_3_HIGHEST_STK_AW_AMT	Represents the top three highest stock awards amounts paid by the company to an executive.
2ND_HIGHEST_STK_AWARDS_AMT	Represents the second highest stock awards amount paid by the company to an executive.
2ND_HIGHEST_ALL_OTH_COMP_AMT_AW	Represents the second highest all other compensation amount paid by the company to an executive.
3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	Represents the third highest all other compensation amount paid by the company to an executive.
2ND_HIGHEST_TOT_COMP_AMT_AW	Second Highest Total Compensation Amount Paid.
SUSTAINALYTICS_SOCIAL_PERCENTILE	Industry percentile rank for the company's management of its social impact.
SUSTAINALYTICS_ENVIRONMENT_PCT	Industry percentile rank for the company's management of its environmental record.
ROE	Return On Equity
WACC	Calculation of a firm's cost of capital in which each category of capital is proportionately weighted.
ROA	Return On Assets
TOBIN_Q_RATIO	Tobin's Q Ratio
SUSTAINALYTICS_GOVERNANCE_PCT	Industry percentile rank for the company's management of its governance activities.
TOTAL ASSET	Total asset

Table 2. Variables Explanation

Calculation of WACC:

$$WACC = \frac{E}{V} * Re + \frac{D}{V} * Rd * (1 - Tc)$$

Where: Re = cost of equity; Rd = cost of debt; E = market value of the firm's equity; D = market value of the firm's debt; V = E + D = total market value of the firm's financing (equity and debt); E/V = percentage of financing that is equity; D/V = percentage of financing that is debt; Tc = corporate tax rate.

	NET_INCOME	SALES_REV_TURN	CF_FREE_CASH_FLOW	TOT_STK_AWARDS_GIVEN_TO_EXECS	TOT_TOP_3_HIGHEST_STK_AW_AMT	2ND_HIGHEST_STK_AWARDS_AMT
count	1847	1847	1847	1847	1847	1847
mean	488.5	5529.0	550.4	15738243.0	12359897.0	3146868.0
std	1047.99	9958.12	1369.16	17057380.0	14562615.0	3752389.0
min	-4336.2	132.8	-3927.4	0	0	0
0.250	104.0	1145.9	87.7	7499861.0	5948024.0	1266628.0
0.500	206.4	2388.5	219.9	12150000.0	9550106.0	2239971.0
0.750	502.2	4964.9	529.1	19345822.0	15052347.0	3992986.0
max	13683.2	123753.0	20442.4	274002428.0	264324332.0	62748196

Table 3a. Descriptive statistics

	2ND_HIGHEST_ALL_OTH_COMP_AMT_AW	3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	2ND_HIGHEST_TOT_COMP_AMT_AW	SUSTAINALYTICS_SOCIAL_PERCENTILE	SUSTAINALYTICS_GOVERNANCE_PCT	SUSTAINALYTICS_ENVIRONMENT_PCT
count	1847	1847	1847	1847	1847	1847
mean	6006383.0	4321024.0	7033092.00	48.83	56.54	48.36
std	5230115.0	3673138.0	5809250.0	26.95	24.32	28.07
min	558440.0	362814.0	969895.0	0.0	0.0	0.0
0.250	3112046.0	2314966.0	3773609.0	25.54	38.20	24.85
0.500	4657439.0	3431055.0	5486590.0	50.06	58.07	49.28
0.750	7264818.0	5115606.0	8272532.0	71.61	76.30	72.32
max	63548629.0	52293670.0	69871129.0	100.0	100.0	100.0

Table 3b. Descriptive statistics

	ROE	WACC	ROA	TOBIN_Q_RATIO	TOTAL ASSET
count	1847	1847	1847	1847	1847
mean	22.01	7.87	6.24	2.25	67150.30
std	522.62	1.78	529.62	1.47	214560
min	-127.70	2.20	-43.20	0.70	905.80
0.250	8.63	6.66	2.67	1.35	8330.70

0.500	14.53	7.91	5.555	1.82	18719.40
0.750	23.55	9.09	9.228	2.62	45275.20
max	1741.64	13.82	42.46	20.53	2539422.0

Table 3c. Descriptive statistics

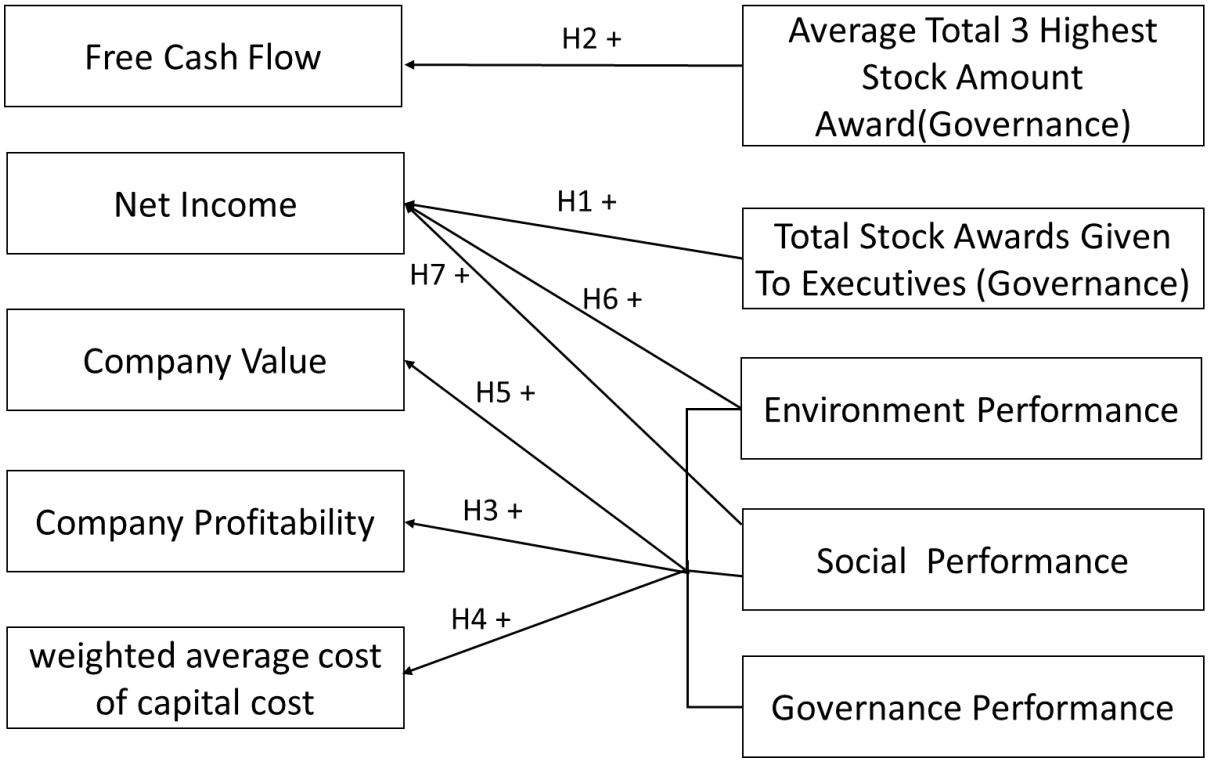

Figure 1. Research Model

4. Hypothesis

H1: There is a positive correlation between net income and total stock awards given to executives.

H2: There is a positive correlation between free cash flow and average total 3 highest stock amount award.

H3: There is a positive correlation between ESG scores and company profitability;

H4: There is a positive correlation between ESG scores and company value;

H5: There is a positive correlation between ESG scores and company weighted average cost of capital cost.

H6: There is a positive correlation between net income and S&P 500 companies' environment performance

H7: There is a positive correlation between net income and S&P 500 companies' social responsibility performance

5. Descriptive analysis

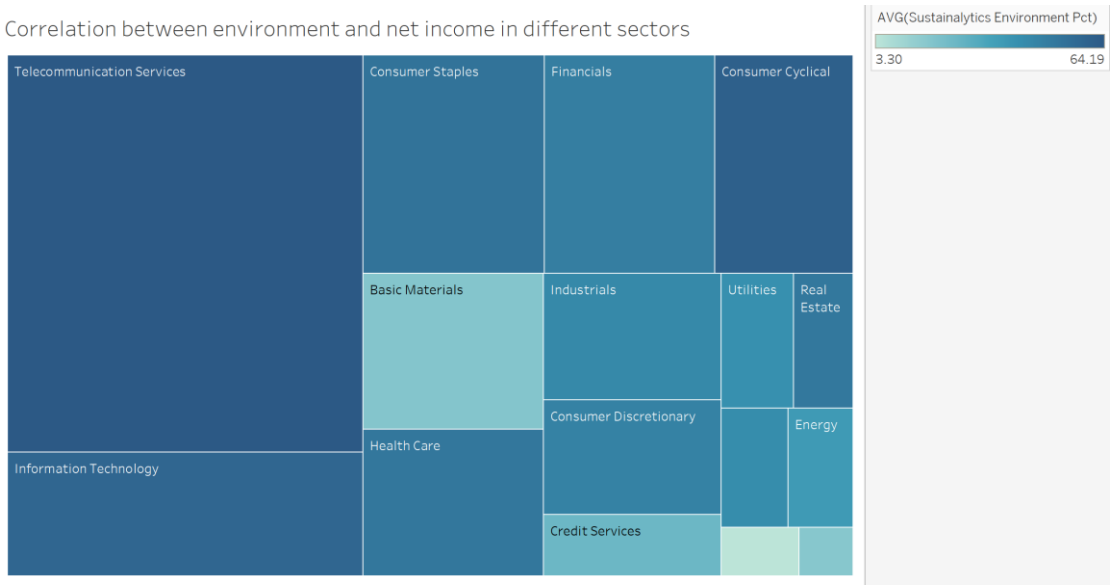

Chart 1. Correlation between environment and net income in different sectors

Chart 1 shows the correlation between environment parameter and net income in different sectors. The size of different sectors reveals the average net income in a different industry and the depth of color stands for the average environment performance of each sector. It clearly indicates companies from telecommunication services have the highest average net income as well as environmental performance. Telecommunication services companies need to build base stations and lay cables to

complete companies' operation. Under this circumstance, they probably spend a huge amount of money to protect the environment.

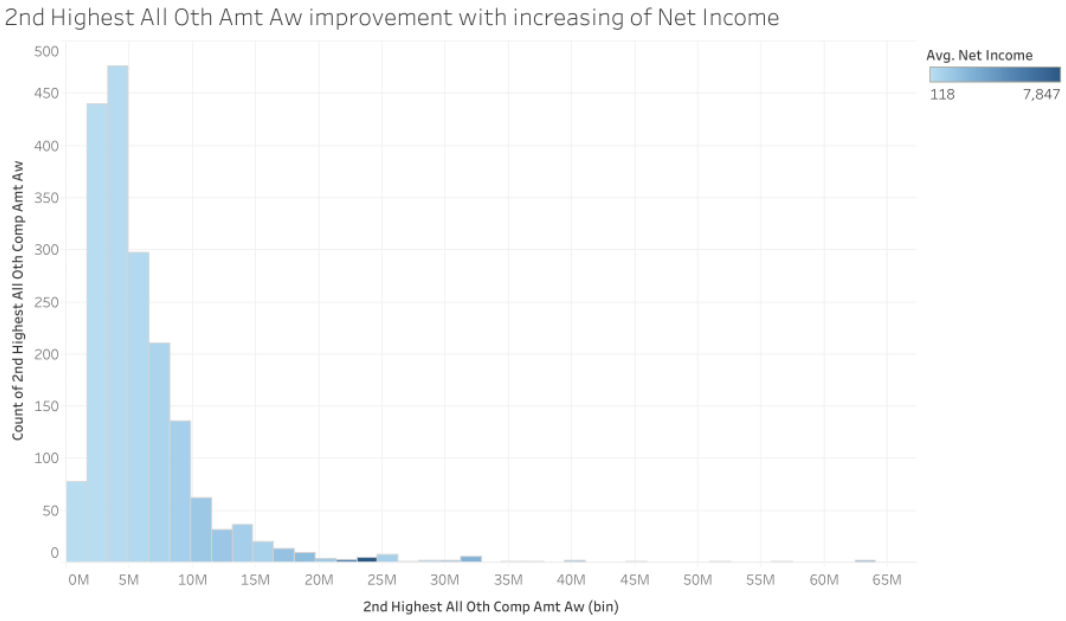

Chart 2. Correlation between 2nd highest all other compensation amount award and net income

Chart 2 shows the 2nd highest all other compensation amount awards are around 5 million in most companies. In general, the 2nd highest all other compensation amount awards raised with the improvement of net income.

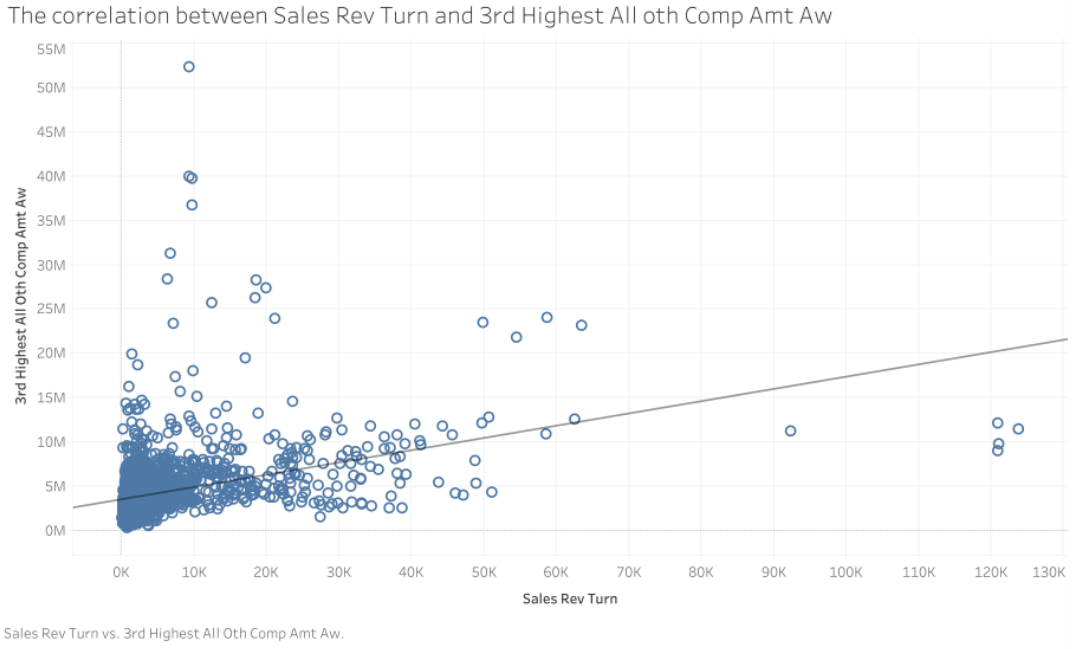

Chart 3 Correlation between Sales Rev Turn and 3rd Highest All Other Company Amount Award

Chart 3 points out a distinct positive trend line between revenue and 3rd highest all other compensation amount award. Combining this with chart 2, it's true that companies are likely to compensate their executives higher when they are earning more profit.

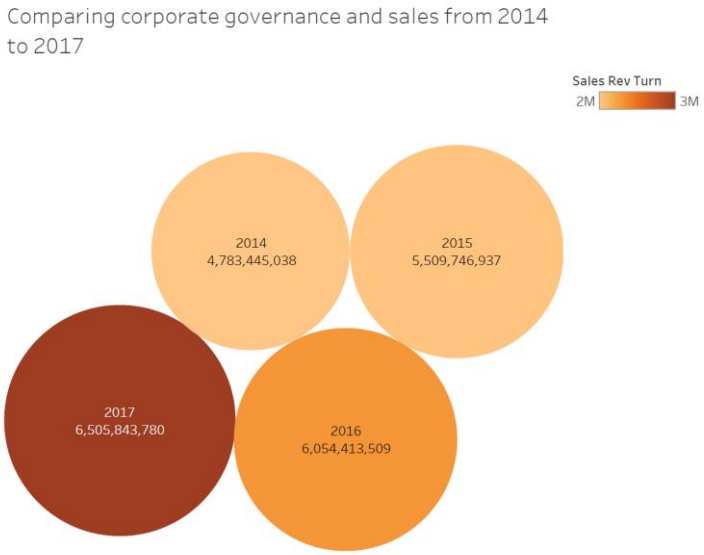

Chart 4 Comparing corporate governance and sales from 2014 to 2017

This bubble charts show the overall sales of S&P 500 companies increased over the last four years. In the meantime, the total stock award is given to executives also increased. This is evidence of their corporate governance. Their strategy of combining stock incentives with company revenue is effective.

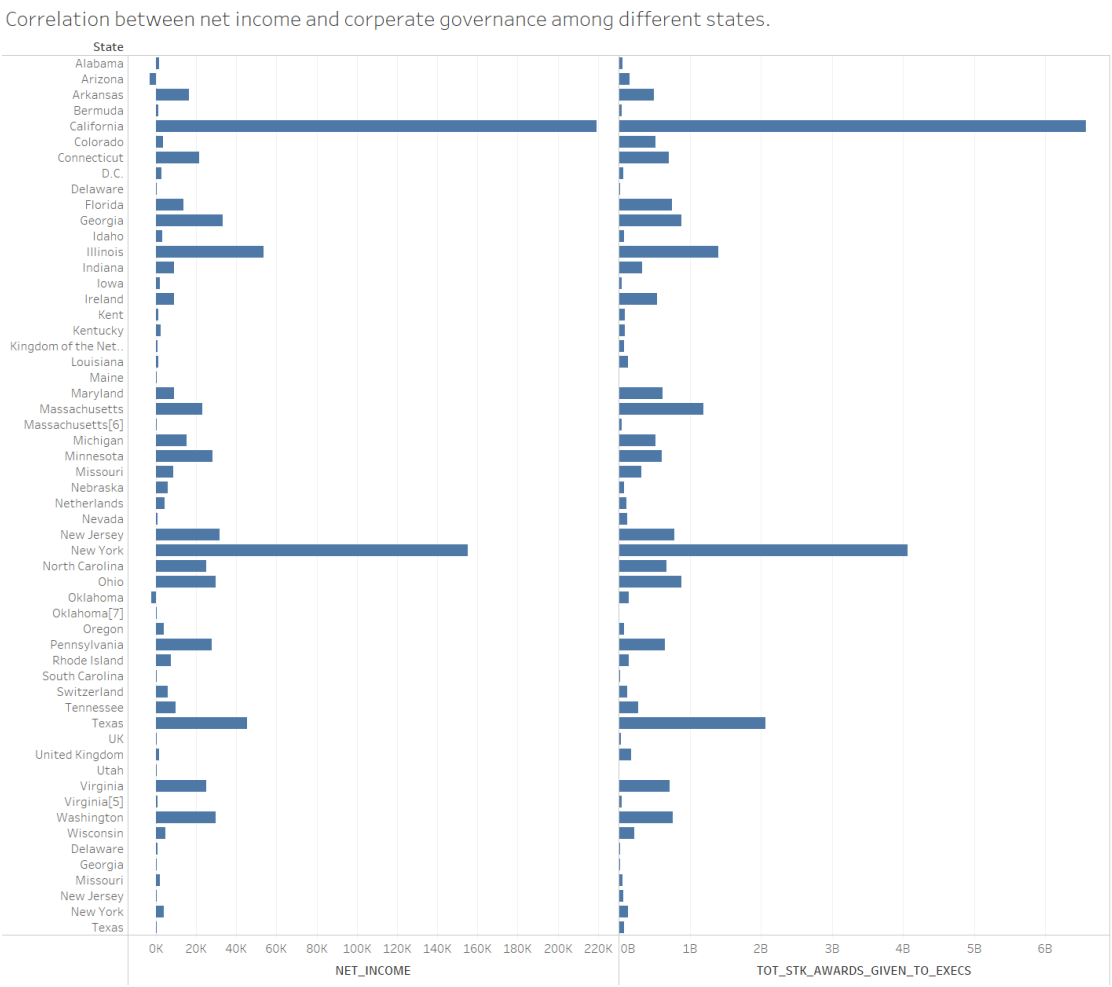

Chart 5 Correlation between net income and corporate governance among different states

To test H1, we built this bar chart that shows net income and corporate governance among different states. Look at this with chart 1, New York and California are striking in all. Comparing the bar chart on the left and right, the amount of net income and stock are consistent which means there is a positive correlation between net income and total stock awards given to executives in most states.

Therefore, H1 was supported.

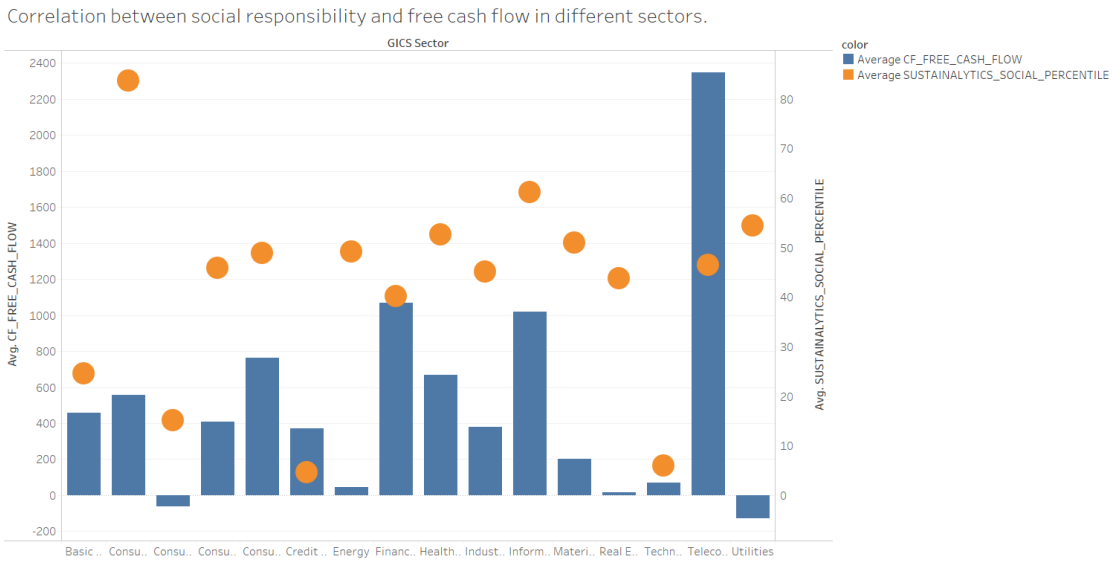

Chart 6 Correlation between social responsibility and free cash flow in different sectors

Chart 6 shows the performance of social responsibility and free cash flow in different sectors. Companies from telecommunication services have the highest free cash flow, and consumer discretionary companies have better social responsibility performance compared with other factors.

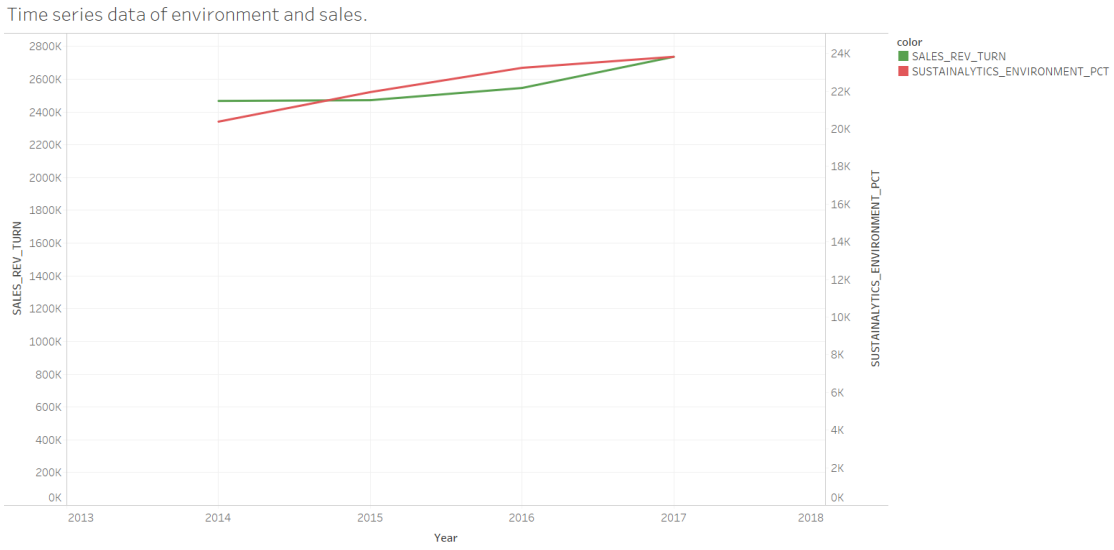

Chart 7 Changes of environmental performance and sales from 2014 to 2017

From 2014 to 2017, sales and environmental performance for all S&P 500 companies increased slightly. As companies take the impact of environmental performance more seriously, their sales and environment contribution will help still

consistent raise in a long-term.

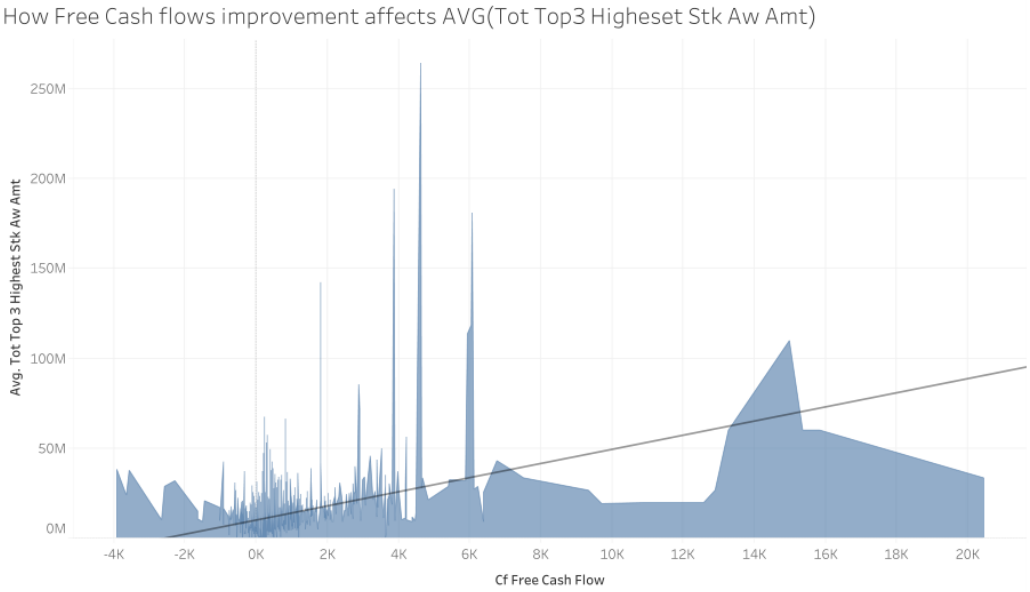

Chart 8 Correlation between top 3 Highest Stk Aw Amt and Free Cashflow

To test H2 by using chart 8. The trend line shows there is a positive correlation between free cash flow and the average total 3 highest stock amount award. It indirectly manifests the effectiveness of corporate governance.

Therefore, H2 was supported.

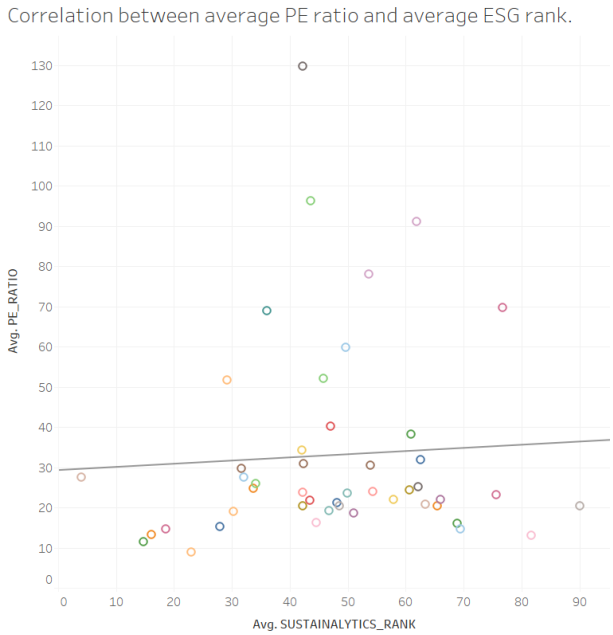

Chart 9 Correlation between average PE ratio and ESG performance

Chart 9 indicates the correlation between average PE ratio and ESG performance. This plot chart shows a slightly positive trend between companies average PE ratio and ESG performance. A company has good ESG performance has better chance to get a higher PE ratio.

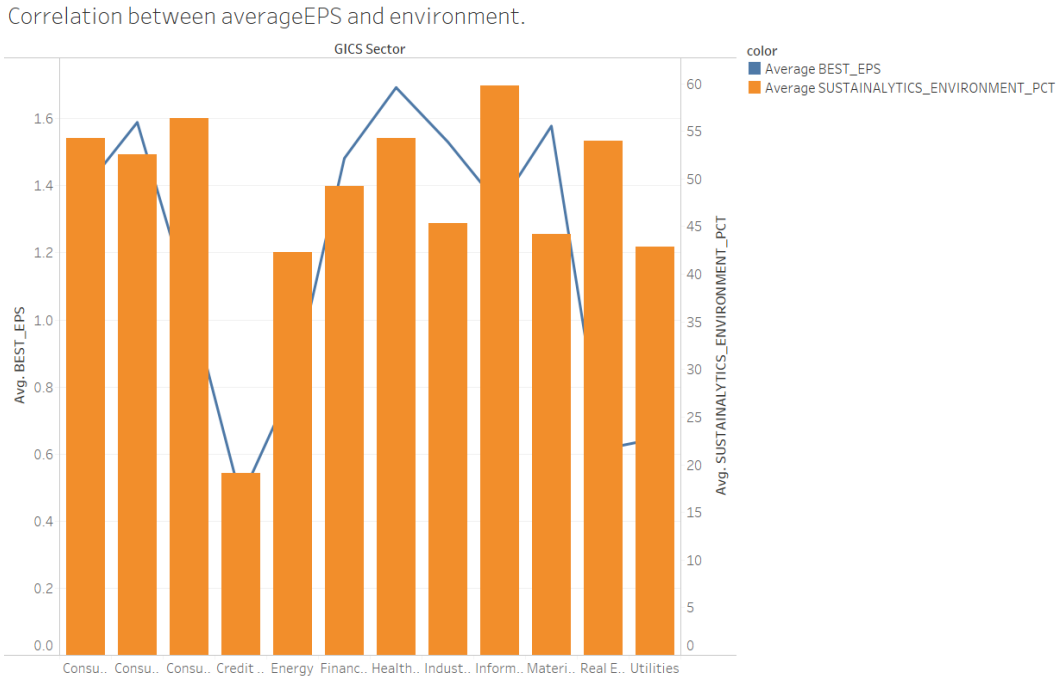

Chart 10 Correlation between average EPS and environmental performance in different sectors

This bar chart and line chart indicates environment performance and EPS of different sectors separately. It shows a positive correlation between average EPS and environmental performance. Companies from credit services have the lowest EPS and environmental performance. On the contrary, healthcare companies and information technology companies have good performance on both.

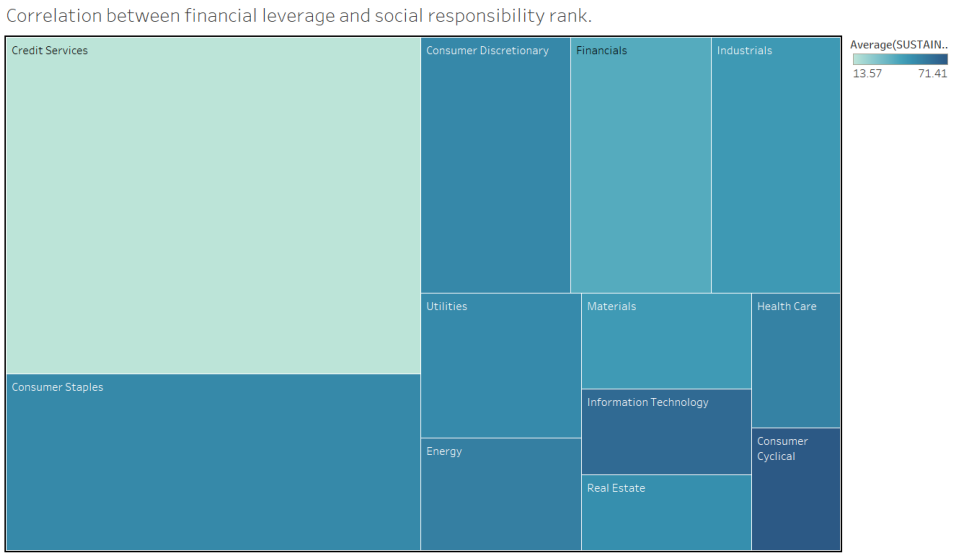

Chart 11 Correlation between Financial leverage and social responsibility rank

This treemap chart displays the correlation between financial leverage and social responsibility rank by sectors. It is obvious that financial leverage is negatively associated with social responsibility rank. For example, credit services and consumer staples sectors have highest financial leverage, and they have least social responsibility rank. On the contrary, financial leverage of information technology and cyclical consumer sectors are very low, and these two sectors have highest social responsibility rank. If a company relies on financing with debt, it is unwilling to assume more social responsibility.

Chart 12 Correlation between return on capital and ESG rank

This heat map chart displays the correlation between return on capital and ESG rank. The area of square indicates the return on capital and color of square indicates ESG rank. Some large squares have deep color, while the color of some small squares is light. The correlation between return on capital and ESG rank is not obvious.

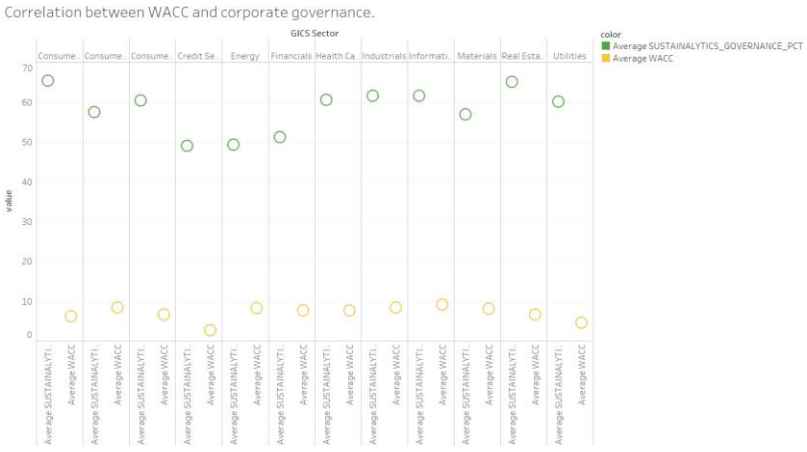

Chart 13 Correlation between WACC and corporate governance

The above chart compares corporate governance performance and weighted average cost of capital. WACC of the different sector remains stable, while corporate governance performance of different sectors fluctuates. The correlation between WACC and corporate governance performance is not obvious.

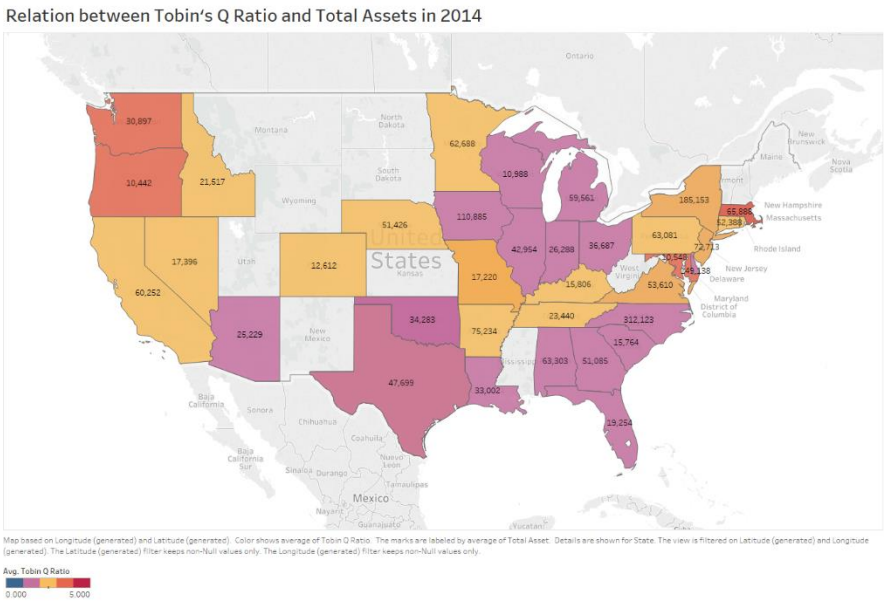

Chart 14a Relation between Tobin's Q Ratio and Total Assets in 2014

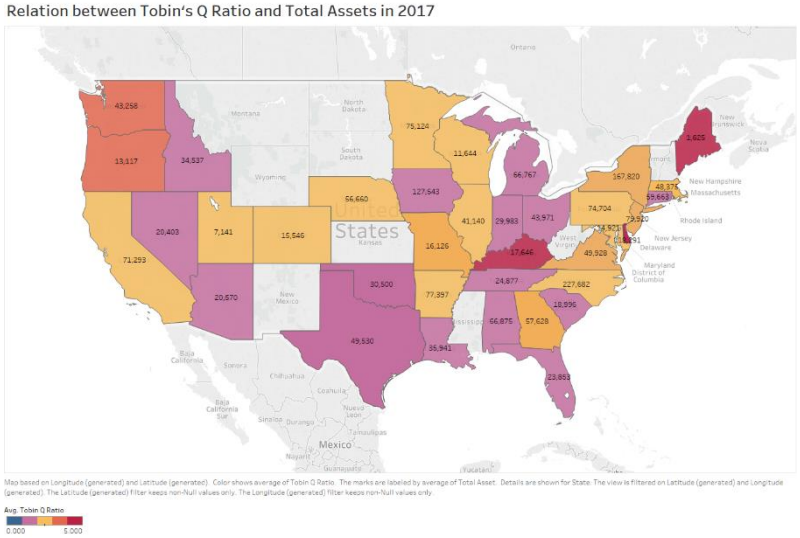

Chart 14b Relation between Tobin's Q Ratio and Total Assets in 2017

From chart 14a and chart 14b, almost all the companies have a Tobin's Q ratio greater than 1, which means the market value is greater than the value of the company's recorded assets. From 2014 to 2017, companies in east coast states have growth to higher level in 4 years, and the assets of companies in the south and west states were lower down a little bit.

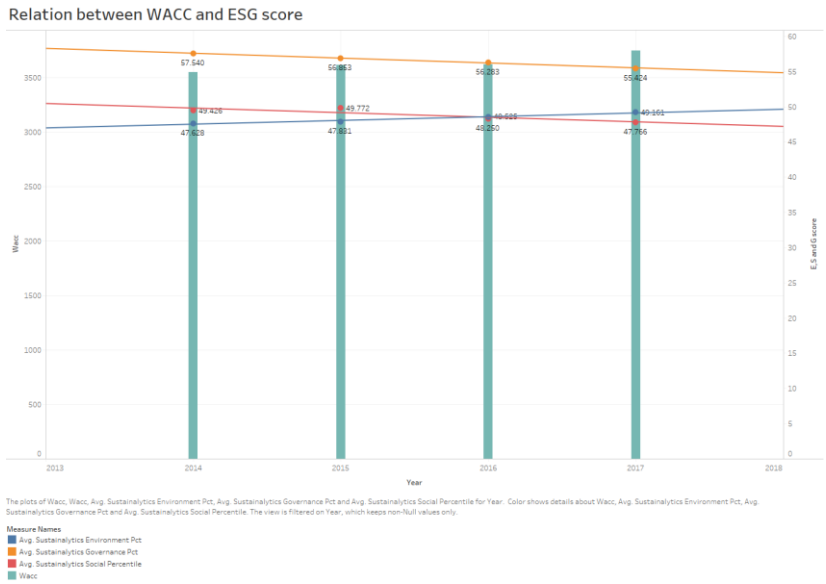

Chart 15 Relation between WACC and ESG score

From chart 15, the environment score has positive relation with the cost of the company (WACC), while the governance score and the social score have negative relation with the cost of company. From 2014 to 2017, the costs of companies have increased, which means the interests companies owe for each dollar they finance have increased.

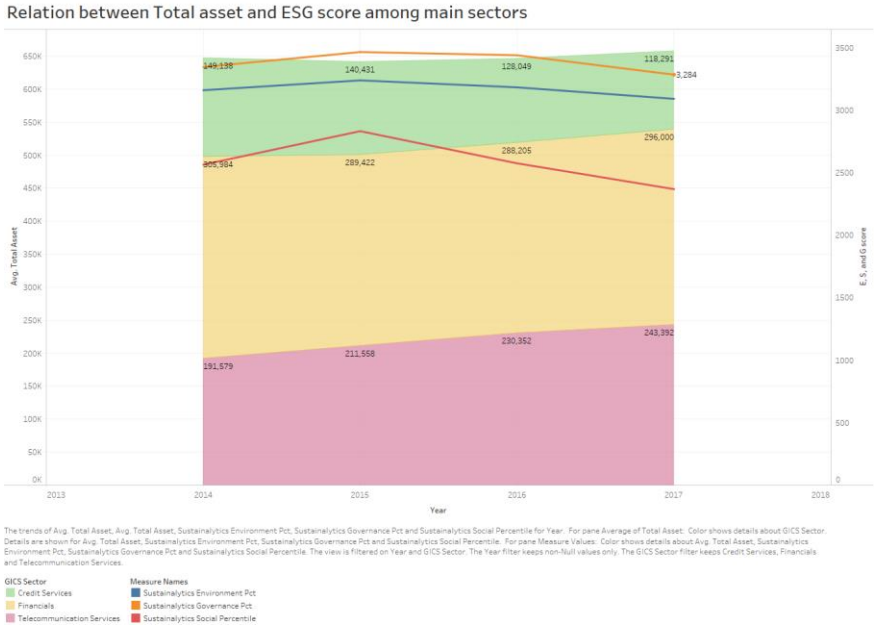

Chart 16 Relation between Total asset and ESG score among main sectors

This chart shows three main areas, Financials, Credit Services and

Telecommunication Services. From 2014 to 2017, the assets of Telecommunication Services Companies have a growth on every year, while Financials and Credit Services Companies almost the same every year. The average ESG score has a trend to reduce to a lower level. In 2015 all three scores (E, S, and G) reached highest level among four years.

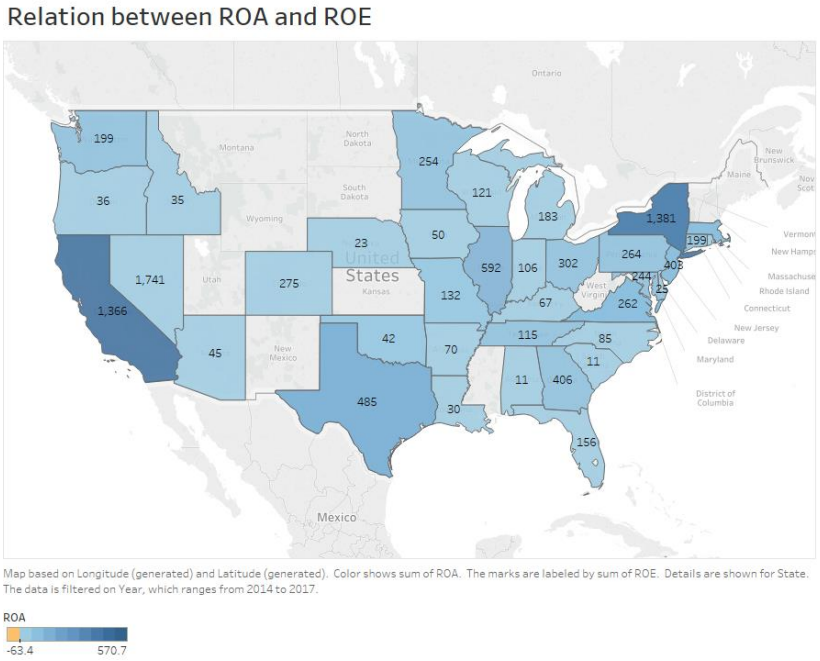

Chart 17 Relation between ROA and ROE in 2014

This chart represents the profitability of companies. Northeast and southwest of the country have higher ability of profitability. Where return on assets (ROA) is high, the return on equity is also very high.

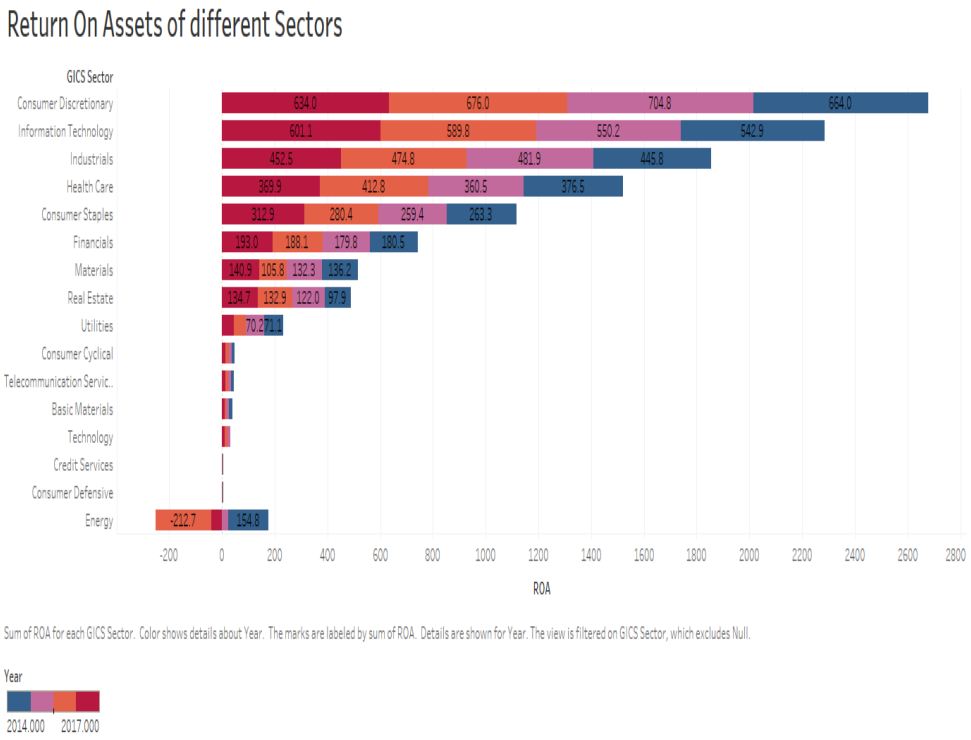

Chart 18 Return on Assets of different Sectors

From this chart, the consumer discretionary, information technology and industrials are the top three of the return on assets rate. However, although information technology is the second place of the rating, the return on assets has a negative relation with year.

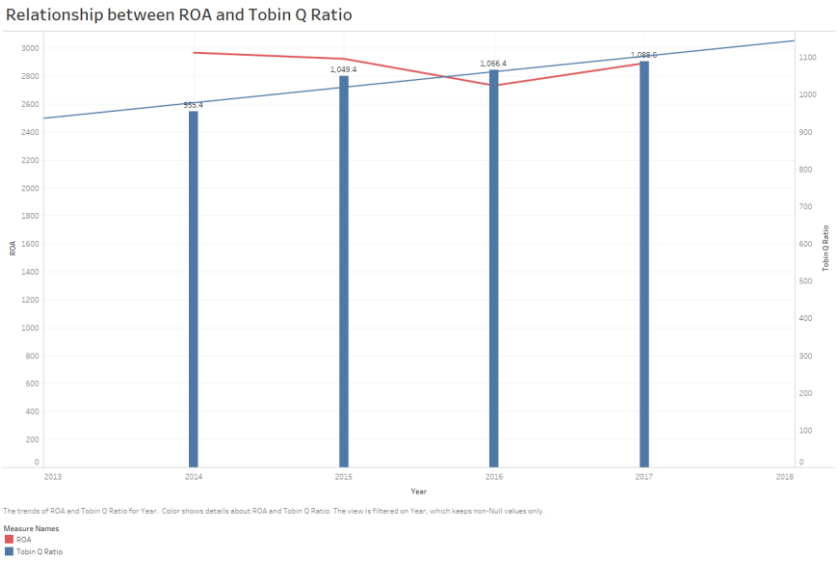

Chart 19 Relationship between ROA and Tobin Q Ratio

This chart shows us the relation between return on assets and Tobin's Q ratio.

The Tobin's Q has positive relation with year, while ROA reached the lowest point in 2016. After 2016 the ROA had a trend to increase.

6. Statistical model

In this part, we build statistical models to conduct the predictive analysis. We predict net income of S&P 500 companies by using ESG data. Our conclusion is that there is a positive correlation between net income and S&P 500 companies' environment performance and the correlation between net income and social responsibility performance is negative.

	NET_INCOME	ARDS_GIVI	HIGHEST_S	ST_STK_AV	ALL_OTH_C	LL_OTH_CT	TOT_CO	ICS_SOCIA	ICS_ENVIR
NET_INCOME	1								
TOT_STK_AWARDS_GIVEN_TO_EXECS	0.527003166	1							
TOT_TOP_3_HIGHEST_STK_AW_AMT	0.4639305	0.983256	1						
2ND_HIGHEST_STK_AWARDS_AMT	0.482036168	0.897409	0.869338	1					
2ND_HIGHEST_ALL_OTH_COMP_AMT_AW	0.429082023	0.682045	0.659339	0.769617	1				
3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	0.490393496	0.622594	0.554879	0.663683	0.876447	1			
2ND_HIGHEST_TOT_COMP_AMT_AW	0.450471574	0.683595	0.659814	0.770231	0.980346	0.854929	1		
SUSTAINALYTICS_SOCIAL_PERCENTILE	0.111895115	0.159225	0.129142	0.145538	0.111681	0.14768	0.108903	1	
SUSTAINALYTICS_ENVIRONMENT_PCT	0.25220684	0.260742	0.223574	0.216965	0.161443	0.220758	0.174492	0.6364	1

Table 4. Correlation matrix

Table 4 shows correlation among all numeric variables. It is obvious that net income has a positive correlation with independent variables, especially with corporate governance data. Independent variables also positively correlated with each other. It is worth noticing that social responsibility ranks strongly associated with environment rank. Companies who are undertaking social responsibility also focusing on environmental protection.

To test H6 and H7, we built multiple linear regression models.

First, we test multicollinearity by using VIF.

Variables	VIF
TOT_STK_AWARDS_GIVEN_TO_EXECS	61.993081
TOT_TOP_3_HIGHEST_STK_AW_AMT	47.841666
2ND_HIGHEST_STK_AWARDS_AMT	7.477162
2ND_HIGHEST_ALL_OTH_COMP_AMT_AW	33.758509
3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	6.76367
2ND_HIGHEST_TOT_COMP_AMT_AW	26.541663
SUSTAINALYTICS_SOCIAL_PERCENTILE	1.696896
SUSTAINALYTICS_ENVIRONMENT_PCT	1.81559

Table5. VIF of Independent Variables

Table 5 shows VIF result of independent variables. We see from the table that VIF of most of the corporate governance variables such as TOT_STK_AWARDS_GIVEN_TO_EXECS are larger than 10, which means the dataset suffers from multicollinearity.

Variables	VIF
TOT_TOP_3_HIGHEST_STK_AW_AMT	4.148041
2ND_HIGHEST_STK_AWARDS_AMT	5.721959
3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	3.80809
2ND_HIGHEST_TOT_COMP_AMT_AW	5.164314
SUSTAINALYTICS_SOCIAL_PERCENTILE	1.68648
SUSTAINALYTICS_ENVIRONMENT_PCT	1.758789

Table 6. VIF of Independent Variables after dropping variables

After we dropped variables with the highest VIF one by one, VIF of all the remaining variables are less than 10. These variables can be used to build a model.

Multiple Linear Regression Model				
Coefficients:	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	-259.2	48.92	-5.299	0.000000131***
TOT_TOP_3_HIGHEST_STK_AW_AMT	0.00001356	0.000002824	4.802	0.00000169***
2ND_HIGHEST_STK_AWARDS_AMT	0.00003847	0.00001287	2.989	0.002836**
3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	0.0001045	0.00001073	9.737	< 2e-16***
2ND_HIGHEST_TOT_COMP_AMT_AW	-0.00002056	0.000007899	-2.603	0.009323**
SUSTAINALYTICS_SOCIAL_PERCENTILE	-3.271	0.9731	-3.361	0.000793***
SUSTAINALYTICS_ENVIRONMENT_PCT	6.45	0.954	6.761	0.0000000000183***
Adj. R-Squared:	0.314			
F-statistic:	142	p-value:	< 2.2e-16	

Table 7. Multiple linear regression model 1

Table 7 displays the result of the multiple linear regression model. Adjusted R-squared of this model is about 0.314, which means 31.4% of net income variance can be explained by this model. Consider we only have ESG data in the model, this R-squared makes sense. P values of F-test and t-test are lower than 0.05. As a result, all independent variables are statistically significant. This model does not suffer from multicollinearity. In terms of coefficients, corporate governance indicators have small coefficients, while society and environment rank have large coefficients.

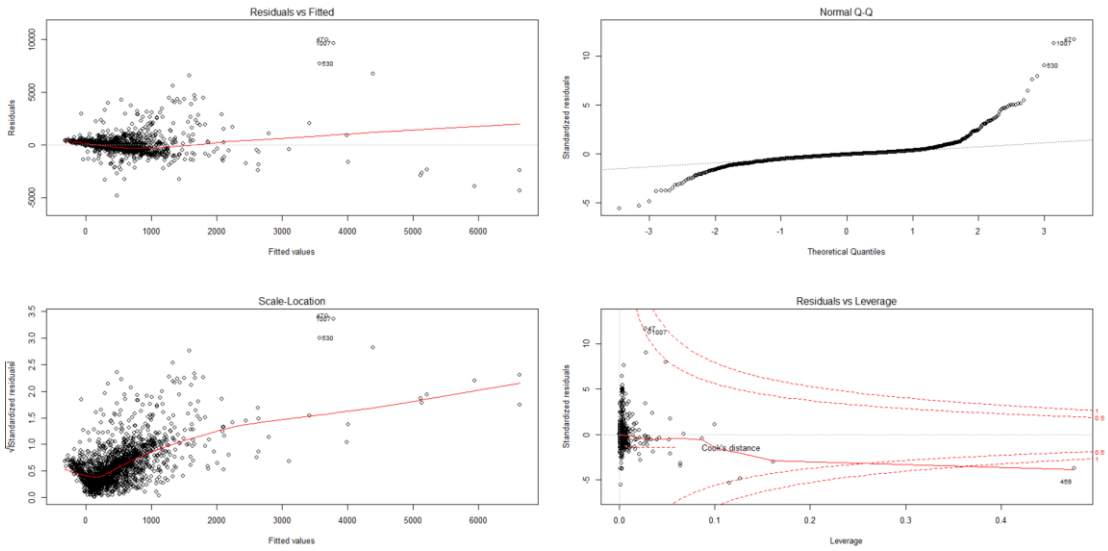

Chart 21. Model assumptions

The points in Residuals vs. Fitted chart are spread out evenly around 0, we can assume constant variance, and the points show no real pattern or trend, sticking close to 0, we can assume linearity. The line in Normal Q-Q chart shows the distribution of residuals is heavy-tailed. In the residuals vs. Leverage chart, we can see that the dataset has some influential outliers, for example, Cook's distance of observation 459 is very large.

Multiple Linear Regression Model				
Coefficients:	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	-274.3	48.91	-5.609	0.0000000234***
TOT_TOP_3_HIGHEST_STK_AW_AMT	0.00002353	0.000003864	6.091	0.00000000136***
2ND_HIGHEST_STK_AWARDS_AMT	0.000006222	0.00001542	0.403	0.686678
3RD_HIGHEST_ALL_OTH_COMP_AMT_AW	0.000106	0.0000107	9.91	< 2e-16***
2ND_HIGHEST_TOT_COMP_AMT_AW	-0.00002063	0.000007871	-2.621	0.008827**
SUSTAINALYTICS_SOCIAL_PERCENTILE	-3.483	0.9713	-3.586	0.000344***
SUSTAINALYTICS_ENVIRONMENT_PCT	6.45	0.9506	6.785	0.0000000000156***
Adj. R-Squared:	0.3173			
F-statistic:	144.1	p-value:	< 2.2e-16	

Table 8. Multiple linear regression model 2

We rebuilt a model after deleting observation 459, and Adjusted R-squared of model 2 increased to 0.3173 from 0.314

	Durbin-Watson Test
DW	2.1274
p-value	0.9968

Table 9. Durbin-Watson test

According to D-W test, this model does not suffer from residual autocorrelation.

Therefore, H6 was supported. However, the result is totally on the opposite of H7. There is a significant negative correlation between net income and company's social responsibility performance. One possible reason is that amount of money companies spend on social responsibility won't bring them matching benefits.

Before putting more variables in the further regression models, we ran correlation tests (Table 10) and VIF tests (Table 11). The correlation coefficients were very low, and variance inflation factors (VIF) for all variables were also very low. Therefore, there was no indication of multicollinearity and these variables can be used to build more multiple linear regression models.

Table 10. Correlations among Variables

	SUSTAINALYTICS_S	SUSTAINALYTICS_E	ROE	WACC	ROA	TOBIN_Q_RATIO	SUSTAINALYTICS_G

	OCIAL_PERCENTILE	NVIRONMENT_PCT					OVERNANCE_PCT
SUSTAINALYTICS_SOCIAL_PERCENTILE	1.00	0.64	0.02	0.01	0.08	-0.01	0.48
SUSTAINALYTICS_ENVIRONMENT_PCT		1.00	0.05	-0.03	0.07	-0.03	0.42
ROE			1.00	0.03	0.28	0.15	0.06
WACC				1.00	0.27	0.33	-0.08
ROA					1.00	0.49	0.09
TOBIN_Q_RATIO						1.00	-0.04
SUSTAINALYTICS_GOVERNANCE_PCT							1.00

Table 11. VIF

SUSTAINALYTICS_ENVIRONMENT_PCT	SUSTAINALYTICS_SOCIAL_PERCENTILE	SUSTAINALYTICS_GOVERNANCE_PCT	ROA	ROE	WACC	TOBIN_Q_RATIO
1.73	1.86	1.36	1.45	1.09	1.16	1.40

To test hypothesis H3, H4, and H5, this study relies on regression models. There are four models to estimate the hypotheses – model ROE and model ROA test H3; model WACC tests H5, and model TOBIN_Q test H4. The models are shown in the following:

$$\mathrm{ROE} = \beta_0 + \beta_1 \mathrm{E\_s} + \beta_2 S\_s + \beta_3 \mathrm{G\_s} + \beta_4 \mathrm{T\_A} \quad (1)$$

$$\mathrm{ROA} = \beta_0 + \beta_1 \mathrm{E\_s} + \beta_2 S\_s + \beta_3 \mathrm{G\_s} + \beta_4 \mathrm{T\_A} \quad (2)$$

$$\mathrm{WACC} = \beta_0 + \beta_1 \mathrm{E\_s} + \beta_2 S\_s + \beta_3 \mathrm{G\_s} + \beta_4 \mathrm{T\_A} \quad (3)$$

$$\mathrm{T\_Q\_R} = \beta_0 + \beta_1 \mathrm{E\_s} + \beta_2 S\_s + \beta_3 \mathrm{G\_s} + \beta_4 \mathrm{T\_A} \quad (4)$$

Where: ROE = return on equity for companies; ROA = return on asset for companies; WACC = calculation of a firm's cost of capital in which each category of capital is proportionately weighted; T_Q_R = Tobin's Q ratio for companies; E_s = environment score for companies; S_s = social score for companies; G_s = governance score for companies; T_A = total assets for companies.

	Model ROE		**Model ROA**	
Sample Size	1847*20		1847*20	
	Coefficients	**Pr(>|t|)**	**Coefficients**	**Pr(>|t|)**
(Intercept)	1.27E+01	0.00127 **	4.73E+00	< 2e-16 ***
SUSTAINALYTICS_ENVIRONMENT_PCT	1.54E-01	0.02703 *	1.60E-02	0.0205 *
SUSTAINALYTICS_SOCIAL_PERCENTILE	-1.10E-01	0.13507	3.18E-03	0.663
SUSTAINALYTICS_GOVERNANCE_PCT	1.46E-01	0.03568 *	1.66E-02	0.0159 *
TOTAL_ASSET	-1.47E-05	0.03446 *	-5.14E-06	1.09e-13 ***
Multiple R-squared	0.008063		0.03995	
Adjusted R-squared	0.005909		0.03786	
p-value	0.004871		1.87E-15	

Table 12. Model ROE and Model ROA

In Table 12, the p-value of E, S, and G scores are not very low (for model ROE, the p-values are 0.027 < 0.05(E), 0.135 < 1(S), 0.03568 < 0.05(G); for model ROA, the p-values are 0.0205 < 0.05(E), 0.663 < 1(S), 0.0159 < 0.05(G)), so E, S, and G scores are insignificant in influencing the ROE and ROA, which means companies with ESG information do not perform any better than companies with less ESG info. Since ROA and ROE represent the profitability of companies, companies with ESG information do

not profit any better than companies with less ESG info. This suggests that there isn't a significant positive relationship between ESG scores and profitability;

Therefore, H3 was not supported.

	Model WACC		**Model TOBIN_Q**	
Sample Size	1847*20		1847*20	
	Coefficients	**Pr(>|t|)**	**Coefficients**	**Pr(>|t|)**
(Intercept)	8.20E+00	< 2e-16 ***	2.44E+00	< 2e-16 ***
SUSTAINALYTICS_ENVIRONMENT_PCT	1.22E-03	0.5252	1.21E-03	0.4501
SUSTAINALYTICS_SOCIAL_PERCENTILE	4.14E-03	0.0411 *	5.93E-04	0.7277
SUSTAINALYTICS_GOVERNANCE_PCT	-8.11E-03	0.0000218 ***	-3.29E-03	0.0397 *
TOTAL_ASSET	-1.96E-06	< 2e-16 ***	-1.26E-06	4.88e-15 ***
Multiple R-squared	0.06343		0.03508	
Adjusted R-squared	0.06139		0.03299	
p-value	<2.2e-16		1.73E-13	

Table 13. Model WACC and Model TOBIN_Q

In Table 13, the p-value of E, and S scores are not very low, while p-value of G score is very low in model TOBIN_Q (for model TOBIN_Q, the p-values are 0.4501 < 0.5(E), 0.7277 < 1(S), 0.0397 < 0.05(G)), so the p-value of E, S and G scores are insignificant in influencing the Tobin's Q ratio. Since Tobin's Q calculate the value of companies, ESG is not helping in increasing companies' value. This suggests that there isn't any significant positive relationship between ESG scores and companies value.

Therefore, H4 was not supported.

In Table 10, the p-value of E, and S scores are not very low (the p-values are 0.5252 < 1(E), 0.0411 < 0.5(S)), so E and S scores are insignificant in influencing the cost of capital of companies (WACC). However, the p-value of G score is very low, so G score

does show significantly in influencing the WACC (the p-value is 0.0000218 < 0.001(G)), which means companies with ESG information do perform better than companies with less ESG info. This suggests that there is a significant positive relationship between ESG scores and the cost.

Therefore, H4 was supported.

7. Grand Conclusions & Future Research

H1 was supported.

H2 was supported.

H3 was not supported.

H4 was not supported.

H5 was supported.

H6 was supported.

H7 was not supported, the correlation between net income and social responsibility performance is significant negative.

8. Scope & Limitations

We only use companies from the S&P 500 index which on behalf of large companies. The conclusion could be more stable with more companies involved in the data set.

ESG is a new concept; many companies don't have detailed data which is hard to

generate a detailed conclusion.

9. Grand Policy & Managerial Implications

To improve net income, companies should take the environment, social responsibility, and corporate governance seriously.

Companies should develop their own corporate governance policy as well as decide how much they should expend on the environment and social responsibility, based on the sector they belong to.

Corporate governance policy such as incentive stock to executives has been proved to be a good way to improve companies' performance.

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