



The Analysis of the Relationship Between ESG and Profitability of Stocks by Linear Regression

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Abstract

ESG (Environment, social and governance) nowadays becomes an important indicator for investors to consider those investing decisions. This passage will use a linear regression model to show whether ESG factor will influence companies' profitability positively. The author sampled 100 companies from Nasdaq randomly. And to measure the profitability, I choose Net Profit Margin as the dependent variable for our linear regression model. Since the Net profit margin is a ratio of profitability, the control variables will not use profitability ratios, and the author chooses four control variables from valuation and liquidity aspects. Through the research, the author finds out that ESG performs positively and significantly on the net profit margin standing for profitability.

Keywords- *ESG performance; Nasdaq; Linear regression model; Profitability*

1. INTRODUCTION

ESG represents the environment, social and governance. In other words, ESG can show a company's inner value. Nowadays, investors pay much more attention than before to ESG in order to make the securest investing decision. This is because if something bad happens to a company, the investors will face great potential loss. Hence it is rational to use ESG to prevent potential dangers such as the moral hazard of a firm. Like a person, no matter how much profit a company can make now, only its intrinsic value can determine how far it can go.

This passage will use a linear regression model to show whether ESG factor will influence companies' profitability positively. The passage chooses companies from Nasdaq. And the ESG data is from Sustainalytics (a company that rates the sustainability of listed companies based on their environmental, social and corporate governance(ESG) performance), and the basic financial data is from Morningstar and Yahoo Finance.

2. LITERATURE REVIEW

In 1934, Benjamin Graham and David Dodd wrote the book *Security Analysis*. This book was recognized as the origin of value investing [1]. This book proposed that when investors make investment decisions, they should focus on the fundamental analysis, valuation analysis and

the consideration related to investing safety. Also, there are many empirical studies that have analyzed the link between ESG and financial performance[2].

In 1938, John Burr Williams proposed the DCF model (Discounted cash flow model). This model assumes that the stock price should equal the sum of the present value of cash flows that a company can obtain in the course of future operations. But for investors, the operation exists great uncertainty, it is hard to predict the long-term cash flow data by using the DCF model [3]. In 1952, economist Henry Markowitz established the mean-variance model through the quantitative analysis of risk and profitability. This is the first time for researchers to quantify the risk and profitability [4]. Robin W. Roberts empirically tests the ability of stakeholder theory to explain one specific corporate social responsibility activity — social responsibility disclosure, finding that measures of stakeholder power, strategic posture, and economic performance are significantly related to levels of corporate social disclosure [5]. And Stakeholder theory The stakeholder theory is a theory of organizational management and business ethics that accounts for multiple constituencies impacted by business entities like employees, suppliers, local communities, creditors, and others. It addresses morals and values in managing an organization, such as CSR and social contract theory [6].

In 2008, Bert Scholtens used two test methods: OLS and Granger causation, finding out that direction of the

‘causation’ predominantly runs from financial to social performance although the specific interaction patterns might vary with different dimensions [7].

In 2017, Patrick Velte did a correlation and regression analysis that was carried out to evaluate possible links between ESGP and market-based measures of FINP (Return on Assets [ROA] and Tobin’s Q). And find out that ESGP has a positive impact on ROA but no impact on Tobin’s Q[8].

In 2020, Ziheng Liu established the Logistics probability model and multiple regression model, finding out that ESG score can influence the probability and scale of the selection of an investor. Also, the ESG score is less significant than the market value of stock[9].

In 2021, Zhongbao Zhou, Lipei Zhang and Helu Xiao established quadratic and cubic DEA model, to identify the interaction between E, S and G, and this passage suggests that the SRI (Social Responsible Investing) investing portfolio is better than traditional investing strategies in many aspects [10].

In 2021. Shanshan Song used the XGBoost model and Multi-factor model, this passage suggests that the ESG is effective in selecting stocks, and stocks with higher ESG scores perform better. Also, ESG performs differently in a bear market and bull market [11].

Also, under the influence of COVID-19, researchers made a research on ESG. Albuquerque and partners find out that under the recessive stock market caused by coronavirus, the stocks with higher ESG score performs better, with higher return rate, higher profitability and lower return volatility in the first quarter in 2020[12].

3. DATA AND METHODOLOGY

3.1. Sample selection

About the sample selection, the researcher chooses 100 companies from Nasdaq as the sample for the analysis. This group of stocks does not include financial companies due to their specific regulations in comparison to other sectors and companies. By removing the companies lacking data, we left 95 pieces of stocks in the table.

3.2. Variable selection

All the data of ESG performance and financial ratios are hand collected.

About the dependent variables, to measure the profitability of stock, the author chooses net profit margin as the dependent variable after excluding many other options. The reasons contain the lack of data and the unavailable data.

About the independent variables, ESG data are collected from Sustainalytics , a company that rates the sustainability of listed companies based on their environmental, social and corporate governance(ESG) performance, leading in developing high-quality, innovative solutions to meet the evolving needs of global investors.

And combined with ESG, there are several control variables. The author chooses Receivable Turnover Ratio, Inventory Turnover and Fixed Asset Turnover ratio from the Liquidity aspect, EPS(Earnings per share) from the valuation aspect. To prevent strong correlation, the author does not choose ratios related to profitability as our independent variables. And all the financial data are collected from Morningstar and Yahoo Finance.

The Receivable Turnover Ratio measures the efficiency a firm collecting on its payment due. The Inventory Turnover is a ratio showing how many times a company has sold and replaced inventory during a certain period. The Fixed Asset turnover ratio reveals how efficient a company is at generating sales from its existing fixed assets. And the EPS indicates how much money a company makes for each share of its stock and is a widely used metric for estimating corporate value.

All the financial data are collected in Trailing Twelve Months(TTM). And the Sustainalytics update their ESG data month round. But the inner value of a company tends to be changed slowly. Unless major negative incidents happened recently, the ESG will not change obviously.

The author hypothesizes that ESG score does have a positive influence on the profitability of a certain company, measured by net profit margin in this passage.

Hence the hypothesis 1 is: ESG has positive influence on the Profitability.

There is a summary of the respected variables is included in Table 1.

TABLE 1. VARIABLES AND EXPLANATIONS

Dependent Variables	Explanation $\frac{R^A - COGS^A - E^A - I^A - T^A}{R} \times 100$
Net Profit Margin	$= \frac{\text{Net Income}}{R} \times 100$
Independent Variables	The Environment, Social and Governance score from Sustainalytics
ESG	$\frac{\text{Net income} - \text{Preferred Dividends}}{\text{End of period Common Shares Outstanding}}$
Control Variables	$\frac{\text{Net Credit Sales}}{\text{Average Accounts Receivable}}$
EPS	$\frac{\text{COGS}}{\text{Average Value of Inventory}}$
Receivable Turnover Ratio	$\frac{\text{Net Sales}}{\text{Average Fixed Assets}^A}$

Inventory turnover	
Fixed Asset Turnover	

\hat{R} =Revenue

\hat{COGS} =Cost of Goods sold

\hat{I} =Interest

\hat{T} =Taxes

\hat{T} The Total Revenue is the revenue over the past 12 months.

$$\frac{\hat{Average} \quad \text{Fixed} \quad \text{Asset}}{\frac{\text{Net Fixed Assets' begin ing balance}-\text{Ending Balance}}{2}}$$

3.3. The methodology of ESG of Sustainalitics

In this passage, we choose the rating agency Sustainalitics which have their own scoring framework [13].

Based on their quantitative scores, companies are grouped into one of five risk categories (negligible, low, medium, high, severe). These risk categories are absolute, meaning that a ‘high risk’ assessment reflects a comparable degree of unmanaged ESG risk across all subindustries covered.

The ESG Risk Ratings are composed of three building blocks, including Corporate Governance, material ESG issues (MEIs), and idiosyncratic ESG issues.

And the ESG Risk Ratings using two-dimensional architecture: Exposure and Management. Below the Exposure part, there are subindustry exposure assessment, beta assessment and manageable risk factors.

The subindustry exposure assessment develops through the quant view (e.g GHG emissions, water use), corporate view (GRI G4 materiality matrices) and expert view (industry expertise and SASB insights). Betas reflect the degree to which a company’s exposure to a material ESG issues deviates from the average exposure to that issue within its subindustry. MRFs range from 30% to 100% and represent the share of exposure to a material ESG issue that that is deemed theoretically to be manageable by the company.

About the Management part, it can be considered as a set of company commitments, actions and outcomes that demonstrate how well a company is managing the ESG risks it is exposed to.

The calculation of ESG

The final ESG Risk Ratings scores are a measure of unmanaged risk. It includes two types of risk: unmanageable risk and the management gap.

The ESG Risk Ratings scoring system for a company is thought of as occurring in three stages. The starting point is determining exposure. The second stage is assessing management and the degree to which risk is managed, and the final stage is calculating unmanaged risk.

TABLE 2. THE CALCULATION OF ESG SCORE

Company Exposure	= Subindustry Exposure	*	Issue Beta
Manageable Risk	= Company Exposure	*	MRF
Managed Risk	= Manageable Risk	*	Management Score(as%)
Unmanaged Risk	= Company Exposure	*	Managed Risk

The final ESG Risk Ratings score is calculated as the sum of the individual material ESG issues’ unmanaged risk scores. It is the overall unmanaged risk of a company.

3.4. Regression Model

The study focus on whether ESG has influence on the Profitability of a stock. The author applied statistics in SPSS. And the author uses the stepwise regression involving the selection of independent variables to be used in a final model to help adding or removing potential explanatory variables in succession and testing for statistical significance after each iteration. And hypothesis test with significance level of 5%.

Here is the regression model:

$$\text{Net Profit Margin} = \alpha + \beta_1 \text{ESG} + \beta_2 \text{RTR} + \beta_3 \text{IT} + \beta_4 \text{EPS} + \epsilon$$

4. RESEARCH RESULTS

TABLE 3. Stepwise Regression Result--Coefficient^a

	Unstandardized coefficient		Standard coefficient	Significance	Colinearity	
	beta	SD	beta		VIF	tolerance
Constant	29.063	4.338		<.001		

Receivable Turnover Ratio	-.120	.036	-.349	.001	1.005	.995
Inventory Turnover	-.022	.010	.229	.030	1.003	.997
EPS	.189	.086	.226	.032	1.001	.999
ESG Score	-.389	.193	-.209	.048	1.009	.992

a. Dependent Variable: Net Profit Margin

From the result of the multiple linear regression above (Table 3), people can know that SPSS remove the variable Fixed Asset Turnover Ratio because of it is not significant. And the significance of other variables are all smaller than 0.05, which means they are significant. Most importantly, with a unit of decrement of ESG score, the Net Profit Margin will increase by 0.389 units under the unqualified data. Since in Sustainability, smaller ESG score means lower risks, hence researchers can conclude that ESG performs positively on the profitability of a company.

Multi-collinearity can be seen on tolerance and variance inflation factor (VIF). If the VIF is smaller than 10, better with 5, and the tolerance is greater than 0.1, the model is well established without multicollinearity.

The multicollinearity test results can be seen in Table 3. It shows that the value of variance inflation factor (VIF) is smaller than 10, around 1. In addition, the tolerance value is all greater than 0.9. Therefore, it can be concluded that there is no high correlation deviation of independent variables or multicollinearity.

TABLE 4. STEPWISE REGRESSION RESULT--DESCRIPTIVE STATISTICS

	Min	Mean	Max
ESG score	9.1	21.1176	44.66
EPS	-1.57	7.85940	92.190
Receivable Turnover Ratio	.72	21.5833	250.86
Inventory Turnover	.31	31.5895	933.48

TABLE 5. STEPWISE REGRESSION RESULT--MODEL SUMMARY

	R	R Square	Durbin-Watson
Model^b	.498*	.248	2.082

b. Predictors: constant, Receivable turnover ratio, Inventory Turnover, EPS, ESG Score

Autocorrelation was detected using the Durbin-Watson test (DW Test). The Durbin-Watson value between 1.7 and 2.3 means there is no autocorrelation in the model. Based on Table 4, the Durbin-Watson value is 2.082. This means no positive and negative autocorrelation.

5. CONCLUSION

From the results of the multivariate regression analysis. People can know that both the ESG score and the three components Receivable turnover ratio, Inventory turnover and Earnings per share are positively and significantly related to Net profit margin. With a unit of decrement of ESG score, the Net Profit Margin will increase by 0.389 units under the unqualified data, that is because lower the ESG score, lower risk and better performance of a stock. Also, with one unit increase of EPS, Inventory turnover and Receivable Turnover ratio, the net profit margin will increase by 0.189, -0.022 and -0.120 respectively.

About the limitations, first, the author only chooses the data for a short period of time. Hence the research can only show the result for a short period of time. Second, because of the lack of access to data for me, the author could only use the data that is public. So the selection of data has limitations. Third, there are only 95 companies in the sample, the sample groups are not large enough. Those things may possibly lead to some deviant and non-ideal results.

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