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EVA: An Indicator of Corporate Bankruptcy?

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EVA: An Indicator of Corporate Bankruptcy?

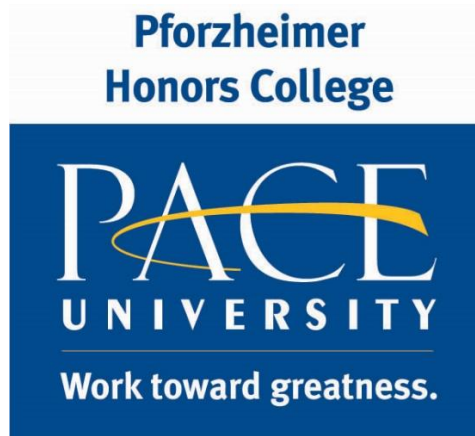
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Abstract

Economic value added (EVA) analysis is one of the most common methods to evaluate company's performance in terms of value creation, which involves ROIC (Return on Invested Capital) and WACC (Weighted Average Cost of Capital) as key drivers. Past studies evaluate the superiority of EVA over other measures of performance and relationship between EVA and stock returns. This paper analyzes the relationship between EVA and bankruptcy on 373 public traded companies in U.S. of which 178 companies filed for bankruptcy between the year of 2015 to October 2017. We present descriptive statistics, conduct univariate grouping tests and correlation between ROIC, WACC, NOPAT, and EVA, and logistic regression analysis for each sector. The results show that non-bankrupt firms tend to have higher WACC (compared to relative very low and negative WACC of bankrupt companies), higher NOPAT, and higher ROIC. EVA has correlation with bankruptcy but its significant level varies across sectors. The findings also suggest that WACC is another good indicator of bankruptcy.

Keywords: EVA, Bankruptcy

1. Introduction

Traditional performance measures are frequently used in evaluating companies' performance. Those measures include but not limited to ratios such as EPS, ROA, ROE, gross margin. Although companies appear profitable by looking at those traditional measures, it does not necessarily mean that they are creating incremental value to company or more importantly to shareholders.

The concept of Economic Value Added (EVA) is initially brought up by a business consulting firm Stern Stewart & Co. and it published a book, *The Quest of Value* (Stewart, 1991). EVA is viewed as a better performance measure than traditional accounting measures in evaluating corporate performance because it takes into account of cost of capital and measures value creation on a continuous basis (Stewart, 1994).

Prior research on is broadly conducted on the topic of EVA. The studies can be categorized into several categories such as EVA's relationship to shareholder's wealth in relation to stock returns, relationship between EVA and MVA, EVA as a performance measurement tool, and EVA's relationship with executive compensation. These studies suggest the superiority of EVA over other traditional performance measures, however, some argue that EVA is not better than the traditional performance measures.

One of the hottest research topic related to EVA and its relationship to stock returns. Kumar, Katepogu Kiran and Subramanyam (2017) evaluate the stock performance of 20 companies in cement industry in India over the period of 2005 - 2006 and 2014 - 2015. They use multiple regression with step-wise method to test the superiority of EVA and MVA in relation to stock returns. Their results reveal that both EVA and MVA are significant

in financial performance, however, EVA is a superior measure for creating value to shareholders in terms stock returns.

Nakhaei and Hamid (2013) study on 87 non-financial companies listed in TSE (Tehran Stock Exchange) over the period of 2004 – 2008 testing relative explanatory power of EVA versus operational profit and net profit in describing share market value (MV). They use Pearson correlation coefficient and regression method. Their results show that net profit and operational profit has more explanatory power than EVA although EVA does have a significant correlation with share market value. Of the two measures, net profit and operational profit, net profit has the most significant relationship with MV.

Samadiyan, Pooryeganeh, Ebrahimi, and Ghanbari (2013) also research on 120 companies that are listed on TSE (Tehran Stock Exchange) during the period of 2003 and 2010 to test its hypothesis of whether EVA, NOPAT, and operational cash flow has meaningful relationship with stock return besides whether EVA or operational cash flows has more data content than NOPAT in describing stock return behavior and whether EVA has more differential (increasing) data content than the other measures. They use panel regression to test the relative and differential data content of EVA and two other traditional measures, NOPAT and operational cash flows. Their results show that all three measures have meaningful relationship with stock returns in general. However, NOPAT is better in explaining the traits of stock returns than EVA and operational cash flow has more important differential (increasing) data content than EVA. They conclude that their findings do not support the superiority of EVA in describing stock return behavior.

Similarly, Eswara and Venkat (2016) do not support the superiority of EVA over traditional measures such as ROE, ROA, ROCE (Return On Capital Employed), ROS (Return

On Sales), and EPS in their research on 12 Indian companies between 2010 and 2014, which are also traded on NSE (National Stock Exchange of India). Of the 12 companies, 50% are from cement industry while the rest from FMGG (Fast-Moving Consumer Goods) industry. Although the data sample seems quite small, Eswara and Venkat suggest a combination of traditional measures and adjusted EVA together be used in better evaluating financial performance. They conclude that EVA is not found superior in shareholder wealth in terms of stock returns as a result of correlation and linear regression tests.

Corresponding to an increasing interest in shareholder value management by companies stemming from Stern Steward's EVA concept another popular research area is on analyzing relationship between EVA and MVA (market value added). He states that EVA is best reflects the success of companies adding value to their shareholders. Stewart (1991) also brings up the concept of EVA as a proxy for MVA.

Fernandez (2015) analyzes 582 companies in the U.S. using data provided in Stern Stewart's publication that includes EVA, MVA, NOPAT, and WACC (Weighted Average Cost of Capital). Fernandez calculates 10-year correlation between change in MVA versus EVA, NOPAT, and WACC each year. The results show that in 50% of the companies the correlation between change in MVA and NOPAT is greater than change in MVA and EVA, suggesting NOPAT is more correlated to MVA than EVA. It also shows that about 210 companies have a negative relationship between EVA and MVA.

Yahyazadehfar, Shams, and Larimi (2010) also explores whether ROE, ROA, EPS versus EVA has significant relationship on MVA. They focus on companies listed in TSE over the

period between 1379 -1385. Their results indicate that ROE and EVA both have significant relationship with MVA while ROA and EPS both do not have relationship with MVA. The

As the ultimate goal of a company is to maximize shareholders' wealth, some studies in the past explore the area of whether EVA is a good performance measure of shareholder wealth creation. Panigrahi (2017) investigates on shareholder's wealth creation comparing EVA and traditional accounting measures in the context of 280 public traded companies in Malaysia over the period of 2003 and 2012. Panigrahi use panel data analysis techniques that include Error Correction Model and Ordinary Least Squares regression to test the hypothesis of whether EPS (Earnings Per Shares), ROA (Return on Assets), ROE (Return on Equity), ROCE (Return On Capital Employed), NOPAT (Net Operating Profit After Tax), DPR (Dividend Payout Ratio), EVA, and MVA (Market Value Added), is an important performance measure for creating shareholder's wealth. The results suggest that EPS, EVA, and DPR has significant positive relationship with shareholder wealth creation while MVA has a negative relationship with CSV (Created Shareholder Value), which supports the neo-classical theory that says value maximization and market efficiency fail to provide an explanation of crucial aspects of organizational development. Panigrahi also suggests managers can ensure their decisions can create value if using EPS, EVA, and DPR as performance measurement tools.

The comparison of EVA and traditional measures in describing financial performance such as profitability is another popular research area.

Reddy, Narayan, and Poornima (2015) examine the relationship between EVA and other traditional measures such as EPS, ROIC, RONW (Return On Net Worth). Their research on 50 companies listed on Nifty 50 Index of National Stock Exchange in India over

the two periods between 2009 – 2010 and 2013 – 2014. They first rank the companies based on average of EVA performance and select the top 10 companies to be used in their methods. They use Pearson's correlation matrix and regression methods to test two hypotheses that whether there exists significant difference between the mean values of the variables and whether there exists no significant impact of EPS, ROIC, and RONW on EVACE (EVA Capital Employed). Their finds indicate that there exists significant difference in mean values of variables. Of the three variables, ROIC has significant influence on EVACE.

Chen, Wang, and Qiao (2014) incorporate ABC (Activity Based Costing) and EVA to improve the DuPont Model. They find that EVA brings the advantage on performance evaluation and BAC's advantage of tracing costs to products by activities consumed. They conclude that the improved model provides useful information that helps improve activities management and resources optimization and correctly evaluates the product's profitability as costs are accurately reflected. EVA-ABC based DuPont profitability analysis also reflects the goal of maximizing shareholder value. They also point out the limitation of the model as they find WACC difficult to define and EVA too complex for adjustments besides lack of sufficient cost management data in cost calculation of ABC method.

Other than researching on the relationship between EVA and profitability, Ivanov, Leong and Zaima (2014) study the performance of only negative EVA firms using Stern Stewart Company database that composes of 1000 market value added firms. They identified total 623 negative EVA firms as of 2003 year-end of which they further break down into 4 quartiles by EVA ranking from most to least negative. The 4 portfolios' performance are then evaluated from 2004 to 2009. They use univariate and multivariate analysis to test correlation between performance and four traditional measures ROA, MTB

(Market-to-Book ratio), leverage, and size is examined. Their finds indicate that NOPAT, MTB, and size are not good indicators of performance for firms that experience negative EVA. Among 4 traditional measures, leverage correlates to firm performance. They find that negative EVA firms that have lower leverage generally have higher possibility of turning around. Firms with the least negative EVA experience higher returns, suggesting investors who consider investing in negative EVA firms should invest in near-zero EVA ones with lower leverage because these firms tend to earn abnormal returns.

Makhele (2013) explore post-acquisition performance using EVA on 336 acquired companies listed in South Africa from 2000 to 2011. Makhele uses paired sample t-test to examine the level of significance between EVA and traditional measures, EPS, ROA, ROE, and ROC (Return On Capital). The results indicate that acquiring firms experience significantly deteriorating EVA post-acquisition while tend to have slightly improvement on operating performance if using traditional measures but these measures are not significant in influencing performance. However, the improved performance is offset by the large premiums paid in acquisition, creating no real economic gains. Thus, Makhele concludes that acquisitions are zero NPV (Net Present Value) investments for acquiring firms.

Holian and Reza conducts research on evaluating how much better EVA can explain the firm and industry fixed-effect model than simple accounting measures of profit. Holian and Reza explore the relative importance of firm versus industry effects in explaining firm performance (2011) using ROA and EVA as dependent variables on U.S large corporations. They find that EVA contributes to greater explanatory power of the model than ROA as EVA can explain over 50% of the variation in firm profitability.

Interest alignment between managers and owners of a firm can be strengthened by adopting EVA in performance management. EVA based remuneration gains popularity in prior research studies. Sloof and Randolph (2014) test whether residual income based performance measure, EVA is manipulative by managers. They compare 67 firms listed on NYSE (New York Stock Exchange) that adopted EVA in executive remuneration contracts and a matched sample of non-adopter companies using difference-in-differences approach. The results suggest that EVA is a distorted performance measure as it can be manipulated easily. They come up with a hypothesis that managers may increase short term EVA at the cost of future EVA and managers may try to avoid negative EVA projects even if they are profitable in the long run. However, they also conclude that their finds do not infer EVA is a poor performance measure.

De Wet (2012) research on South African companies during the period 2006-2010 to test the relationship between executive compensation and EVA, MVA, ROA, and ROE. De Wet uses regression and robustness test and the results indicate that the relationships between compensation and ROA and ROE measures are stronger compared to relationships between compensation and EVA and MVA. Of EVA and MVA measures, EVA is has stronger relationship with executive compensation than MVA. De Wet also concludes that companies with high EVA have significant relationship between MVA and executive compensation while low-EVA companies there is no relationship between compensation with either MVA or EVA. De Wet also mentions that South African companies seem to rely more on ROA and ROE in valuing compensation unlike American companies, which tend to reply more EVA and MVA.

In United States, there are public and private companies filing bankruptcy every

year. Bankrupt companies are across different industries. As of early October 2017 year end, 40.26% of bankrupt companies come from consumer discretionary and consumer staples industries followed by 23.38% from energy industry. For example, the household toy brand store, Toys R US Inc. filed Chapter 11 bankruptcy in September 2017. The frequent occurrence of bankruptcy draws the interest in raising a question of whether there exists some relationship between bankruptcy and indicative measures that show correlation with bankruptcy.

Despite prior research has demonstrated correlated relationship between EVA and stock returns and MVA besides the benefits to companies who adopt EVA as part of performance management, the exploration on the connection between EVA and bankruptcy remains open. Recent research study concentrates on EVA as a tool in performance management and consequences of bad financial performance can lead to corporate bankruptcy in which companies file Chapter 11 (Reorganization) or Chapter 7 (Liquidation) bankruptcy. EVA tells whether economic profit is generated to the company after counting for cost of capital, thus it will be also interesting to know whether economic profit can be a good indicator of bankruptcy as prior research show different aspects on how EVA can be a good indicator of financial performance.

This paper will further analyze performance in terms of bankruptcy rather than profitability, which prior research is already being conducted on. To conduct this research, a sample of 373 U.S. public traded companies is formed. The sample list of companies contains 178 companies that have filed for bankruptcy during the period of 2015 to October 2017 across multiple sectors including Consumer, Energy, Financials, Health Care, Industrials, Materials, Technology, and Utilities. The rest of the sample are non-bankruptcy

public companies that are peers to the bankruptcy companies randomly chosen across all the industries bankruptcy companies are in.

This rest of the paper is organized in following way: Section 2 presents the hypothesis that are being tested on. Section 3 shows how data is gathered (details can be found in Appendix) and descriptive statistics for each sector based on bankrupt and non-bankrupt group to compare the average financial performance between bankrupt and non-bankrupt group in each sector. Section 4 presents univariate grouping tests that helps to find out the distribution of bankruptcy in different sector. Section 5 shows correlation between ROIC, WACC, EVA, and NOPAT variables by entire sample, bankrupt sample, and non-bankrupt sample. Section 6 displays logistic regression analysis for each sector, which will help discover the significance of EVA in each sector. Section 7 shows conclusions after presenting the results and implication of this research study. Reference and Appendix are also included at the end.

2. Research question

This research intends to ask the question of whether there exists relationship between EVA and bankruptcy.

Hypothesis: There exists significant relationship between EVA and bankruptcy across sectors.

3. Data and sampling method

Bloomberg is used as a secondary data source for the sample list of companies in this research. As there is tremendous amount of public and private companies that filed for bankruptcy including Chapter 11 and Chapter 7, the sample list of companies only focus on public traded companies as their financial statements are available to the public compared to private companies of which financials are not released in the public. The period of bankruptcy

filing traced back from 2015 to October 2017, which is about two calendar years.

The entire sample contain 178 bankruptcy filing companies and the other non-bankrupt 195 companies are peers to the 178 companies across different sectors. The peer companies are picked based on the sectors and randomly chosen to form this entire sample. (See Appendix for more details). Composition of the sample include companies' tickers, bankruptcy announcement date, WACC, ROIC, total invested capital, adjusted NOPAT, EVA, financial leverage, net liability, and BICS sector. These financials are all derived from Bloomberg using the most recent quarter's financials. For bankruptcy filing companies, their financials are only up to the most recent quarter when their business was still active.

3.1 Descriptive statistics by entire sample

The entire sample consists a lot of data points and below is a table that presents the variables that the in interest of exploration. From Table 1, the range of each variable and their mean, median, and standard deviation are shown. Some variables such as WACC, ROIC, and financial leverage are interpreted in percentage while others such as NOPAT, total invested capital, EVA, and net liability are presented in dollar sign. As the entire sample covers 373 companies, the range of each variable is quite broad. WACC is ranged from negative about 3363% to positive 26.14% with the median being 7.46%. A negative WACC indicates a negative equity, meaning a company has accumulated equity loss. Similar to WACC, ROIC is ranged from negative 2,522% to positive 20,013%, showing that some companies suffer from a huge loss while some can earn a positive return. Financial leverage is ranged from 0.21% to 209.80%, showing that some companies carry very low leverage while some carry high leverage. Net liability is the difference between total assets and total liabilities. When there are more liabilities than assets, net liability will be negative. A positive net liability means that more assets than liabilities. Adjusted

NOPAT, total invested capital, and EVA are also ranged from negative to positive.

Table 1

Entire Sample					
	Min	Max	Mean	Median	Std. Deviation
WACC	-3362.85%	26.14%	-2.19%	7.46%	1.75
ROIC	-2521.05%	20012.50%	28.71%	3.77%	10.66
NOPAT_adj	-\$7,590	\$20,555	\$702	\$35	2543.25
Total_Inv_Cap	-\$2,685	\$144,404	\$9,840	\$1,980	15496.62
EVA	-\$21,860	\$29,865	-\$181	-\$16	2690.69
Financial_Leverage	0.21%	209.80%	6.26%	2.94%	0.15
Net_Liability	-\$10,900	\$173,830	\$5,856	\$837	18319.09

This table shows min, max, mean, median, and standard deviation of important variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for entire sample of 373 companies.

Of the 373 companies, energy companies occupies large portion of the entire sample followed by consumer discretionary with and quantity of 80 and 65 respectively as can be seen in Table 1.2. The size of Health Care, Financials, and Industrials companies is similar to each other. Materias, Communications, Consumer Staples, and Technology companies also have similar size in the sample with Utilities companies having the least amount. There are 59 companies filing bankruptcy in 2015 compared to 79 in 2016. As of the end of October 2017, there are about 40 companies that filed bankruptcy. Non-bankruptcy companies are chosen as benchmark, which has about 195 companies, which are also included in Table 1.2.

Table 1.2

BICS Sector	# of Companies
Energy	80
Consumer Discretionary	65
Health Care	35
Financials	34
Industrials	34
Materials	29
Communications	24
Consumer Staples	25
Technology	27
Utilities	19
Unclassifiable	1

Table 1.3

Filing Year	Bankruptcy Filing
2015	59
2016	79
2017	40
non-bankrupt	195

Table 1.2 shows 10 sectors that 373 companies fall in. BICS stand for Bloomberg Industry Classification Systems. There is also 1 unclassifiable companies as the BICS sector does not include. It is in the aerospace and defense sector, which will not be covered in the rest of the paper. Table 1.3 summarizes the amount of bankruptcy filing by year with the bottom showing the number of non-bankruptcy companies in the entire sample.

From looking at the statistics of the entire sample, it will also be interested to know

whether there will be more negative data points leaning toward the bankruptcy companies

as these companies generally do not perform well financially speaking. Compare Table 2

with Table 1, we can find that the minimum of WACC, ROIC, total invested capital, financial leverage, and net liability belongs to the bankruptcy sample with only two variables,

adjusted NOPAT and EVA coming from the non-bankruptcy sample. It is also surprising to

find that the most negative EVA and adjusted NOPAT come from non-bankrupt companies

sample, meaning that there are companies that have very low EVA and NOPAT can still

survive and have not yet went bankrupt.

Table 2

Bankrupt Companies					
	Min	Max	Mean	Median	Std. Deviation
WACC	-3362.85%	26.14%	-13.69%	6.13%	2.53
ROIC	-2521.05%	20012.50%	60.25%	-9.27%	15.42
NOPAT_adj	-\$4,407	\$705	-\$132	-\$7	527.03
Total_Inv_Cap	-\$2,685	\$16,245	\$572	\$77	1743.51
EVA	-\$4,598	\$29,865	\$8	-\$15	2310.68
FinancialLeverage	0.21%	209.80%	10.44%	3.68%	0.25
Net_Liability	-\$2,928	\$1,798	\$43	\$7	614.20

Table 3

Non-Bankrupt Companies					
	Min	Max	Mean	Median	Std. Deviation
WACC	3.94%	18.36%	8.31%	8.28%	0.02
ROIC	-893.02%	48.38%	-0.08%	7.22%	0.80
NOPAT_adj	-\$7,590	\$20,556	\$1,462	\$490	3306.06
Total_Inv_Cap	\$48	\$144,404	\$18,299	\$21,106	17520.79
EVA	-\$21,860	\$8,066	-\$354	-\$25	2991.36
FinancialLeverage	1.20%	43.66%	4.22%	2.82%	0.05
Net_Liability	-\$10,900	\$173,830	\$10,357	\$3,207	23448.60

Table 2 and 3 also show descriptive statistics for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability based on the sub-samples of bankrupt and non-bankrupt companies.

3.2 Descriptive statistics by sectors

After presenting descriptive statistics by entire, bankrupt, and non-bankrupt samples, we next present those statistics by sectors to see how the range of those statistics change by sectors. We want to know if some sectors might have better statistics than others and within a sector, if non-bankrupt companies have better statistics than bankrupt companies. From Table 4 to 23, we display statistics of companies by sectors based on bankrupt and non-bankrupt status.

Table 4 Consumer Staples-Bankrupt						Table 5 Consumer Staples-Non-Bankrupt					
	Min	Max	Mean	Median	Std. Deviation		Min	Max	Mean	Median	Std. Deviation
WACC	2.07%	8.13%	5.61%	5.74%	0.02	WACC	4.89%	8.21%	6.22%	6.04%	0.01
ROIC	-54.99%	69.46%	-6.38%	-10.62%	0.36	ROIC	1.92%	32.94%	12.54%	12.37%	0.08
NOPAT_adj	-\$634	\$61	-\$88	-\$11	225.18	NOPAT_adj	\$93	\$9,934	\$2,194	\$787	3133.14
Total_Inv_Cap	-\$913	\$1,763	\$279	\$154	757.82	Total_Inv_Cap	\$21,110	\$21,110	\$21,110	\$21,110	0.00
EVA	-\$615	\$0	-\$111	-\$47	206.40	EVA	-\$848	\$8,066	\$1,298	\$450	2507.19
Financial_Leverage	2.79%	2.79%	2.79%	2.79%	NA	Financial_Leverage	1.20%	6.27%	3.17%	2.80%	0.01
Net_Liability	-\$584	\$1	-\$132	-\$23	253.38	Net_Liability	-\$10,900	\$12,810	\$4,527	\$4,451	5543.58

Table 4 and Table 5 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Consumer Staples companies in bankrupt and non-bankrupt status respectively.

In Consumer Staples sector, WACC is positive for both bankrupt and non-bankrupt companies. The mean of WACC is 5.61% in bankrupt companies and 6.22% in non-bankrupt companies. The cost of capital in average is almost the same no matter if companies are bankrupt or non-bankrupt in the Consumer Staples sector. The mean of financial leverage for both bankrupt and non-bankrupt companies are also close to each other with 2.79% and 3.17% respectively. Other than two variables, there is a big difference in average value of ROIC, adjusted NOPAT, EVA, and net liability of bankrupt and non-bankrupt companies. The mean of ROIC, NOPAT, EVA, and net liability are all positive in non-bankrupt companies while the

mean of variables of bankrupt companies are negative except for financial leverage and invested capital, which is understandable because leverage and invested capital are always either equal or above zero for non-bankrupt and bankrupt companies. Thus, we tentatively think that in Consumer Staples sector, an average bankrupt company usually has negative ROIC, NOPAT, and EVA versus a positive ROIC, NOPAT, and EVA of non-bankrupt companies.

Table 6						Table 7					
Consumer Discretionary-Bankrupt						Consumer Discretionary-Non-Bankrupt					
	Min	Max	Mean	Median	Std. Deviation		Min	Max	Mean	Median	Std. Deviation
WACC	-5.92%	22.22%	6.45%	6.56%	0.02	WACC	5.26%	12.48%	8.75%	8.96%	0.02
ROIC	-1013.00%	99.77%	-62.60%	-2.02%	0.10	ROIC	-2.89%	36.89%	12.42%	11.98%	0.10
NOPAT_adj	-\$218	\$348	\$5	\$0	1281.16	NOPAT_adj	-\$318	\$5,900	\$845	\$541	1281.16
Total_Inv_Cap	-\$37	\$2,246	\$374	\$115	549.65	Total_Inv_Cap	\$21,110	\$21,110	\$21,110	\$21,110	0.00
EVA	-\$219	\$280	-\$18	-\$10	77.58	EVA	-\$5,116	\$3,719	-\$9	\$60	1381.48
FinancialLeverage	1.24%	60.11%	6.00%	2.60%	0.13	FinancialLeverage	1.30%	11.66%	3.58%	2.73%	0.03
Net_Liability	-\$290	\$1,780	\$161	\$22	393.60	Net_Liability	-\$5,656	\$22,600	\$3,853	\$1,909	6120.11

Table 6 and Table 7 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Consumer Discretionary companies in bankrupt and non-bankrupt status respectively.

In Consumer Discretionary sector, the mean of WACC of bankrupt companies is 6.45% compared with 8.75% in non-bankrupt companies. The bankrupt companies consist of negative WACC, which the non-bankrupt companies do not have. It suggests that bankrupt companies might tend to experience loss in equity as this is what drives WACC to be negative. ROIC of bankrupt companies is -62.60% compared to 12.42% in non-bankrupt companies. This suggests than an average non-bankrupt company in the Consumer Discretionary sector generally have a positive return on invested capital while negative for bankrupt companies. Non-bankrupt companies also have a higher NOPAT (\$845 vs \$5), EVA (-\$9 vs -\$18), total invested capital (\$21,110 vs \$374) and more assets (\$3853 vs \$161) in average than bankrupt companies. Average financial leverage of bankrupt companies (6%) is about 1.5 times bigger than than of non-bankrupt companies (3.58%), meaning bankrupt companies in average tend to have higher financial leverage than non-bankrupt companies. We think that in the Consumer Discretionary

sector, non-bankrupt companies in average tend to have a lower financial leverage and higher ROIC, NOPAT, EVA, total invested capital, and more assets than that of bankrupt companies.

Table 8

Energy-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	-3363.00%	26.14%	-52.86%	6.21%	4.46
ROIC	-797.00%	710.20%	-26.09%	-9.20%	1.71
NOPAT_adj	-\$4,407	\$705	-\$257	-\$44	713.93
Total_Inv_Cap	-\$2,685	\$16,240	\$952	\$403	2519.03
EVA	-\$4,598	\$29,870	\$218	-\$40	4062.81
FinancialLeverage	1.08%	209.80%	15.32%	5.40%	0.37
Net_Liability	-\$2,928	\$1,798	-\$17	\$19	943.22

Table 9

Energy-Non-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	5.53%	13.69%	8.90%	8.89%	0.02
ROIC	-10.97%	9.29%	0.15%	1.51%	0.06
NOPAT_adj	-\$2,077	\$3,848	\$272	\$135	1384.39
Total_Inv_Cap	\$21,110	\$21,110	\$21,110	\$21,110	0.00
EVA	-\$15,470	-\$107	-\$2,362	-\$1,263	3823.04
FinancialLeverage	1.32%	14.36%	2.76%	1.97%	0.03
Net_Liability	\$2,249	\$173,800	\$22,780	\$9,448	43997.48

Table 8 and Table 9 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Consumer Discretionary companies in bankrupt and non-bankrupt status respectively.

In Energy sector, bankrupt companies on average tend to experience a negative WACC (-52.86%) and ROIC (-26.09%) as non-bankrupt companies tend to have positive WACC (8.90%) and ROIC (0.15%). Surprisingly, the mean of EVA in bankrupt companies is positive (\$218) compared with -\$2362 in the non-bankrupt companies. Except for this, bankrupt companies on average have a higher NOPAT, more total invested capital, and more assets. Bankrupt companies on average has 5 times more financial leverage than non-bankrupt companies. From comparing the two tables, we can tell that non-bankrupt companies in the energy sector tend to have a positive and higher NOPAT, more total invested capital, less financial leverage, more assets but maybe a lower EVA than bankrupt companies.

Table 10

HealthCare-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	-169.20%	12.92%	-10.95%	4.34%	0.47
ROIC	-1113.00%	461.50%	-102.40%	-15.67%	4.11
NOPAT_adj	-\$89	\$15	-\$17	-\$10	24.97
Total_Inv_Cap	-\$5	\$532	\$64	\$9	141.47
EVA	-\$89	\$1	-\$23	-\$12	25.31
FinancialLeverage	1.72%	11.73%	5.50%	4.45%	0.04
Net_Liability	-\$87	\$150	\$10	\$0	50.27

Table 11

HealthCare-Non-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	6.67%	18.36%	9.66%	8.55%	0.03
ROIC	-25.50%	48.38%	8.74%	10.13%	0.16
NOPAT_adj	-\$291	\$14,620	\$2,174	\$348	3914.11
Total_Inv_Cap	\$336	\$144,400	\$19,880	\$2,214	34242.19
EVA	-\$5,578	\$4,347	\$316	\$52	2098.28
FinancialLeverage	1.23%	11.29%	3.22%	2.25%	0.02
Net_Liability	\$88	\$76,200	\$11,860	\$1,118	21044.80

Table 10 and Table 11 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net

liability for Health Care companies in bankrupt and non-bankrupt status respectively.

In Health Care sector, the average of mean of bankrupt companies is -10.95% compared to 9.66% of non-bankrupt companies. Similar to Consumer Discretionary sector, the average of ROIC (8.74%) of non-bankrupt companies is higher than that of bankrupt companies (-102.40%). Non-bankrupt companies also have a positive and higher NOPAT (\$2,174), total invested capital (\$19,880), EVA (\$316), and more assets (\$11,860) than that of bankrupt companies which on average have a negative ROIC, NOPAT, and EVA. Bankrupt companies on average has about 1.5 times financial leverage than that of bankrupt companies. Thus, on average non-bankrupt companies tend to have a positive and higher ROIC, NOPAT, EVA, and more assets than that of bankrupt companies in the Health Care sector.

Table 12

Financials Bankrupt					
	Min	Max	Mean	Median	Std. Deviation
WACC	0.18%	23.51%	7.47%	6.33%	0.06
ROIC	-62.23%	52.20%	-8.73%	-9.96%	0.29
NOPAT_adj	-\$254	\$441	\$19	-\$3	169.23
Total_Inv_Cap	-\$46	\$3,239	\$597	\$81	1053.76
EVA	-\$349	\$368	-\$10	-\$6	170.57
FinancialLeverage	1.23%	42.79%	10.82%	3.79%	0.14
Net_Liability	-\$134	\$835	\$190	\$19	341.45

Table 13

Financials Non-Bankrupt					
	Min	Max	Mean	Median	Std. Deviation
WACC	4.68%	11.91%	8.00%	7.83%	0.02
ROIC	-645.90%	10.16%	-22.73%	4.00%	1.33
NOPAT_adj	-\$7,590	\$9,508	\$1,290	\$391	3365.07
Total_Inv_Cap	\$21,110	\$21,110	\$21,110	\$21,110	0.00
EVA	-\$21,860	\$187	-\$2,592	-\$384	5295.31
FinancialLeverage	1.82%	18.28%	7.00%	6.15%	0.05
Net_Liability	\$817	\$77,180	\$10,540	\$3,851	17255.89

Table 12 and Table 13 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Financials companies in bankrupt and non-bankrupt status respectively.

In Financials sector, the mean of WACC is very similar between bankrupt and non-bankrupt companies at about 8%. It seems like both bankrupt and non-bankrupt companies on average have a negative ROIC, however, bankrupt companies this time has a higher ROIC (-8.73%) than that of non-bankrupt companies (-22.73%). Bankrupt companies in the Financials sector also have a higher EVA (-\$10) on average than that of non-bankrupt companies (-\$2,592). Non-bankrupt companies on average have a higher NOPAT, more invested capital and assets than bankrupt companies. Bankrupt companies has also about 1.5 times financial leverage than that of

non-bankrupt companies on average. Thus, it appears that in Financials sector, bankrupt companies on average have a higher EVA and ROIC than non-bankrupt companies but have lower NOPAT, invested capital and less assets.

Table 14

Industrials-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	-2.95%	9.32%	5.34%	5.61%	0.03
ROIC	-935.20%	180.70%	-58.01%	-1.41%	2.73
NOPAT_adj	-\$170	\$103	-\$7	-\$3	58.27
Total_Inv_Cap	-\$11	\$1,369	\$231	\$13	415.77
EVA	-\$180	\$101	-\$19	-\$4	62.47
FinancialLeverage	1.91%	4.82%	3.23%	3.25%	0.01
Net_Liability	-\$86	\$839	\$94	\$5	243.14

Table 15

Industrials-Non-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	6.78%	12.64%	9.51%	9.37%	0.02
ROIC	-5.31%	25.74%	9.85%	9.23%	0.07
NOPAT_adj	-\$650	\$4,526	\$1,145	\$344	1430.90
Total_Inv_Cap	\$1,050	\$38,840	\$11,660	\$5,277	11778.75
EVA	-\$1,728	\$1,690	\$131	\$5	729.87
FinancialLeverage	1.34%	7.71%	2.83%	2.75%	0.01
Net_Liability	\$550	\$19,550	\$5,602	\$1,851	5710.36

Table 14 and Table 15 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Industrials companies in bankrupt and non-bankrupt status respectively.

In Industrials sector, the mean of WACC for non-bankrupt companies (9.51%) is higher than that of bankrupt companies (5.34%) but non-bankrupt companies have a much higher and positive ROIC (9.85%) than bankrupt companies (-58.01%). Bankrupt companies has slightly higher financial leverage ratio than non-bankrupt companies at 3.25% and 2.83% respectively. On average, non-bankrupt companies have higher and positive NOPAT, total invested capital, EVA, and more assets.

Table 16

Materials-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	2.45%	17.52%	6.82%	5.85%	0.04
ROIC	-300.00%	1180.00%	48.39%	-30.07%	3.70
NOPAT_adj	-\$3,097	-\$1	-\$344	-\$9	890.38
Total_Inv_Cap	-\$2,400	\$1,458	\$131	\$20	969.74
EVA	-\$2,677	-\$4	-\$326	-\$26	767.49
FinancialLeverage	2.27%	69.37%	25.50%	10.61%	0.29
Net_Liability	-\$172	\$1,035	\$156	-\$1	390.95

Table 17

Materials-Non-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	6.18%	11.09%	8.14%	8.24%	0.01
ROIC	2.64%	24.60%	11.44%	10.61%	0.06
NOPAT_adj	\$157	\$4,000	\$1,128	\$731	1015.96
Total_Inv_Cap	\$2,869	\$20,810	\$9,314	\$7,003	5302.60
EVA	-\$934	\$2,536	\$362	\$162	801.37
FinancialLeverage	1.99%	43.66%	8.11%	3.67%	0.13
Net_Liability	\$363	\$10,390	\$3,332	\$2,889	2678.68

Table 16 and Table 17 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Materials companies in bankrupt and non-bankrupt status respectively.

In Materials sector, non-bankrupt companies have slightly higher WACC at 8.14% compared to 6.82% of bankrupt companies. In this sector, both bankrupt companies on average has much

higher financial leverage at 25.50% than non-bankrupt companies at 8.11%, although they are all higher than other sectors at around 3%-7%. Bankrupt companies on average have a higher ROIC at 48.39% compared to 11.44% of non-bankrupt companies. Other than this, non-bankrupt companies on average have a much higher and positive NOPAT, invested capital, EVA, and more assets than bankrupt companies.

Table 18

Communications Bankrupt					
	Min	Max	Mean	Median	Std. Deviation
WACC	1.61%	19.20%	7.15%	6.41%	0.05
ROIC	-381.20%	20010.00%	2147.00%	11.76%	63.06
NOPAT_adj	-\$1,466	\$129	-\$142	-\$7	467.48
Total_Inv_Cap	-\$18	\$9,139	\$1,074	\$7	2858.66
EVA	-\$1,613	\$100	-\$162	-\$10	511.26
FinancialLeverage	0.21%	21.04%	8.04%	5.46%	0.09
Net_Liability	-\$1,122	\$10	\$202	-\$3	410.02

Table 19

Communications Non-Bankrupt					
	Min	Max	Mean	Median	Std. Deviation
WACC	4.23%	12.64%	7.90%	7.27%	0.03
ROIC	-0.17%	33.78%	9.41%	7.47%	0.09
NOPAT_adj	-\$19	\$20,560	\$5,013	\$886	7586.26
Total_Inv_Cap	\$21,110	\$21,110	\$21,110	\$21,110	0.00
EVA	-\$830	\$4,894	\$1,059	\$200	1990.45
FinancialLeverage	1.21%	7.37%	3.71%	3.27%	0.02
Net_Liability	\$278	\$139,000	\$28,800	\$3,750	47139.14

Table 18 and Table 19 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Communications companies in bankrupt and non-bankrupt status respectively.

In Communications sector, the average value of WACC are similar to both bankrupt (7.15%) and non-bankrupt companies. (7.90%). Similar to Materials sector, bankrupt companies on average have a higher ROIC at 2147% than 9.41%. In addition, bankrupt companies (8.04%) on average has almost 3 times more financial leverage of non-bankrupt companies (3.71%). In other areas, non-bankrupt companies generally on average have higher and positive NOPAT, invested capital, EVA, and more assets than bankrupt companies in Communications sector.

Table 20

Technology Bankrupt					
	Min	Max	Mean	Median	Std. Deviation
WACC	0.47%	19.12%	10.18%	8.49%	0.07
ROIC	-1242.00%	541.20%	-243.70%	-184.50%	5.06
NOPAT_adj	-\$2,559	-\$1	-\$282	-\$25	800.50
Total_Inv_Cap	-\$13	\$206	\$31	\$5	64.36
EVA	-\$2,570	-\$1	-\$284	-\$28	803.50
FinancialLeverage	1.09%	8.78%	2.86%	1.42%	0.03
Net_Liability	-\$55	\$320	\$36	\$4	103.55

Table 21

Technology Non-Bankrupt					
	Min	Max	Mean	Median	Std. Deviation
WACC	6.73%	14.78%	10.14%	10.00%	0.02
ROIC	-893.00%	21.79%	-44.84%	6.90%	2.19
NOPAT_adj	-\$432	\$9,384	\$896	\$294	293.80
Total_Inv_Cap	\$48	\$143,000	\$12,080	\$2,870	33937.44
EVA	-\$3,740	\$1,050	-\$215	-\$58	989.81
FinancialLeverage	1.33%	24.71%	3.44%	1.90%	0.06
Net_Liability	\$48	\$66,140	\$5,837	\$1,678	15641.73

Table 20 and Table 21 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Technology companies in bankrupt and non-bankrupt status respectively.

In Technology sector, the mean of WACC for bankrupt and non-bankrupt companies are also similar at 10.18% and 10.14% respectively. Bankrupt and non-bankrupt companies also have similar financial leverage at 2.86% and 3.44% respectively. Non-bankrupt companies on average have a higher although negative ROIC than bankrupt companies. In this sector, both non-bankrupt and bankrupt companies experience negative EVA on average. In generally, a non-bankrupt company on average have a higher and positive NOPAT, invested capital, and more assets than bankrupt company in the Communications sector.

Table 22

Utilities-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	5.32%	12.94%	9.13%	9.13%	0.05
ROIC	3.16%	12.64%	7.90%	7.90%	0.07
NOPAT_adj	\$16	\$233	\$125	\$125	153.75
Total_Inv_Cap	\$126	\$7,383	\$3,755	\$3,755	5131.46
EVA	-\$159	\$0	-\$80	-\$80	112.18
FinancialLeverage	1.12%	1.12%	1.12%	1.12%	NA
Net_Liability	\$119	\$119	\$119	\$119	NA

Table 23

Utilities-Non-Bankrupt					
	Min	Max	Mean	Median	Std.Deviation
WACC	3.94%	6.64%	4.95%	4.74%	0.01
ROIC	-21.99%	15.45%	3.56%	5.90%	0.08
NOPAT_adj	-\$7,377	\$9,771	\$948	\$367	3322.53
Total_Inv_Cap	\$3,815	\$97,240	\$22,910	\$13,490	25345.44
EVA	-\$8,702	\$7,143	-\$59	\$92	2891.16
FinancialLeverage	2.64%	12.21%	4.30%	3.35%	0.02
Net_Liability	\$1,538	\$41,040	\$8,674	\$3,899	10573.24

Table 22 and Table 23 present min, max, mean, median, standard deviation for variables that include WACC, ROIC, adjusted NOPAT, total invested capital, EVA, financial leverage, and net liability for Utilities companies in bankrupt and non-bankrupt status respectively.

In the Utilities sector, the WACC of bankrupt companies (9.13%) on average is almost twice bigger than that of non-bankrupt companies (4.95%). Bankrupt companies (1.12%) has less financial leverage than that of non-bankrupt companies (3.35%) on average but a higher ROIC at 7.90% compared to 3.56% of non-bankrupt companies. Both bankrupt and non-bankrupt companies experience negative EVA on average with non-bankrupt companies on average have a higher EVA. Generally speaking, on average non-bankrupt companies have a higher and positive NOPAT, invested capital, and more assets than bankrupt companies in the Utilities sector.

4. Univariate grouping test

4.1 Grouping test by entire sample

The descriptive statistics in each sector generally give a sense of the trend of financial performance of bankrupt and non-bankrupt companies. We identify 4 variables that we believe are driving bankruptcy and will explore these four variables further in regression analysis in the next section. The 4 variables are WACC, ROIC, EVA, and NOPAT. In the entire sample, from Table 24, we can see that in the first five group, companies that have a higher WACC are usually non-bankrupt while as WACC can lower and even to negative, there are more bankrupt companies. In Table 25, ROIC also follows a similar patter. There are more non-bankrupt companies in first five groups and in the last five groups in which ROIC is at the lower bound, there are more bankrupt companies. In Table 26, the first three groups and last three groups consist of more non-bankrupt companies. There are more bankrupt companies and less non-bankrupt companies found in group 4-7. The pattern of EVA suggests that bankrupt companies occur when their EVA are around the middle portion of the sample. In table 27, the trend is more obvious as there are more non-bankrupt companies in the first five groups in which NOPAT is at the upper bound and in the last five groups in which is at lower bound, the occurrence of bankrupt companies is more frequent.

Table 24

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	14	23	3.75%	6.17%
Group 2	1	37	0.27%	9.92%
Group 3	23	15	6.17%	4.02%
Group 4	10	28	2.68%	7.51%
Group 5	18	20	4.83%	5.36%
Group 6	13	25	3.49%	6.70%
Group 7	17	21	4.56%	5.63%
Group 8	21	17	5.63%	4.56%
Group 9	29	9	7.77%	2.41%
Group 10	32	0	8.58%	0.00%

Table 25

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	24	13	6.43%	3.49%
Group 2	6	32	1.61%	8.58%
Group 3	6	32	1.61%	8.58%
Group 4	8	30	2.14%	8.04%
Group 5	8	30	2.14%	8.04%
Group 6	11	27	2.95%	7.24%
Group 7	20	18	5.36%	4.83%
Group 8	28	10	7.51%	2.68%
Group 9	37	1	9.92%	0.27%
Group 10	30	2	8.04%	0.54%

Table 26

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	1	36	0.27%	9.65%
Group 2	8	30	2.14%	8.04%
Group 3	11	27	2.95%	7.24%
Group 4	36	2	9.65%	0.54%
Group 5	37	1	9.92%	0.27%
Group 6	31	7	8.31%	1.88%
Group 7	22	16	5.90%	4.29%
Group 8	15	23	4.02%	6.17%
Group 9	9	29	2.41%	7.77%
Group 10	8	24	2.14%	6.43%

Table 27

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	37	0.00%	9.92%
Group 2	0	38	0.00%	10.19%
Group 3	3	35	0.80%	9.38%
Group 4	4	34	1.07%	9.12%
Group 5	18	20	4.83%	5.36%
Group 6	36	2	9.65%	0.54%
Group 7	37	1	9.92%	0.27%
Group 8	33	5	8.85%	1.34%
Group 9	29	9	7.77%	2.41%
Group 10	18	14	4.83%	3.75%

Table 24, 25, 26, and 27 display proportion of bankruptcy in the entire sample divided into 10 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

4.2 Grouping test by sectors

The results of grouping test by entire sample suggests that majority of bankrupt companies generally have a lower WACC, lower ROIC, and lower NOPAT than non-bankrupt companies with EVA falling neither higher or lower than that of non-bankrupt companies. Next, we perform the same tests by each sector and divide sector specific companies into 5 groups that rank WACC, ROIC, EVA, and NOPAT from highest to lowest.

Table 28 Consumer Staples

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	2	3	8.00%	12.00%
Group 2	2	3	8.00%	12.00%
Group 3	0	5	0.00%	20.00%
Group 4	1	4	4.00%	16.00%
Group 5	3	2	12.00%	8.00%

Table 29 Consumer Staples

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	1	4	4.00%	16.00%
Group 2	0	5	0.00%	20.00%
Group 3	0	5	0.00%	20.00%
Group 4	2	3	8.00%	12.00%
Group 5	5	0	20.00%	0.00%

Table 30 Consumer Staples

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	5	0.00%	20.00%
Group 2	0	5	0.00%	20.00%
Group 3	3	2	12.00%	8.00%
Group 4	3	2	12.00%	8.00%
Group 5	2	3	8.00%	12.00%

Table 31 Consumer Staples

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	5	0.00%	20.00%
Group 2	0	5	0.00%	20.00%
Group 3	0	5	0.00%	20.00%
Group 4	3	2	12.00%	8.00%
Group 5	5	0	20.00%	0.00%

Table 28, 29, 30, and 31 display proportion of bankruptcy in the Consumer Staples sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In Table 28, there are more bankrupt companies at the upper and lower bound of WACC as shown in group 1-2 and group 4-5. Generally speaking, more non-bankrupt companies occur at the upper bound of WACC, meaning higher WACC ratio. In Table 29, ROIC also follows

similar pattern in which there are more bankrupt companies that have either very high or low ROIC. In Table 30, non-bankrupt companies occur at the upper bound of EVA suggesting companies that have higher EVA tend to be non-bankrupt. In the last three groups where EVA are lowers, more bankrupt companies occur. In Table 31, distribution of bankruptcy by NOPAT is consistent with that of EVA. In the first three groups where NOPAT are higher than the last two groups, all belong to non-bankrupt companies. From these 4 tables, we can generally find out in the Consumer Staples sector, non-bankrupt companies tend to have higher EVA, ROIC, and NOPAT than bankrupt companies.

Table 32: Consumer Discretionary

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	5	8	7.69%	12.31%
Group 2	6	7	9.23%	10.77%
Group 3	7	6	10.77%	9.23%
Group 4	10	3	15.38%	4.62%
Group 5	13	0	20.00%	0.00%

Table 33: Consumer Discretionary

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	4	9	6.15%	13.85%
Group 2	6	7	9.23%	10.77%
Group 3	8	5	12.31%	7.69%
Group 4	10	3	15.38%	4.62%
Group 5	13	0	20.00%	0.00%

Table 34: Consumer Discretionary

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	2	11	3.08%	16.92%
Group 2	9	4	13.85%	6.15%
Group 3	12	1	18.46%	1.54%
Group 4	12	1	18.46%	1.54%
Group 5	6	7	9.23%	10.77%

Table 35: Consumer Discretionary

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	13	0.00%	20.00%
Group 2	5	8	7.69%	12.31%
Group 3	13	0	20.00%	0.00%
Group 4	12	1	18.46%	1.54%
Group 5	11	2	16.92%	3.08%

Table 32, 33, 34, and 35 display proportion of bankruptcy in the Consumer Discretionary sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In the Consumer Discretionary sector, looking at Table 32, in the last three groups in which WACC is at the lowest bound range, there are more bankrupt companies especially in the last group, all 13 companies are bankrupt companies. In Table 33, there are non-bankrupt companies in the first two groups. In group 5 where ROIC is also at the lowest bound range, all 13 companies are bankrupt. In Table 34, we can find that there are less bankrupt companies in first two groups in which EVA is at the upper bound range. When EVA decreases, we find more bankrupt companies in group 3-5. In Table 35, more non-bankrupt companies in first two groups but more bankrupt companies occur in last three groups in which NOPAT are smaller. From

these 4 tables, we can see that non-bankrupt companies generally have a higher WACC, ROIC, EVA and NOPAT than that of bankrupt companies in the Consumer Discretionary sector.

Table 36: Energy

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	5	11	6.25%	13.75%
Group 2	12	4	15.00%	5.00%
Group 3	10	6	12.50%	7.50%
Group 4	14	2	17.50%	2.50%
Group 5	16	0	20.00%	0.00%

Table 37: Energy

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	13	3	16.25%	3.75%
Group 2	7	9	8.75%	11.25%
Group 3	7	9	8.75%	11.25%
Group 4	14	2	17.50%	2.50%
Group 5	16	0	20.00%	0.00%

Table 38: Energy

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	16	0	20.00%	0.00%
Group 2	16	0	20.00%	0.00%
Group 3	11	5	13.75%	6.25%
Group 4	10	6	12.50%	7.50%
Group 5	4	12	5.00%	15.00%

Table 39: Energy

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	4	12	5.00%	15.00%
Group 2	16	0	20.00%	0.00%
Group 3	15	1	18.75%	1.25%
Group 4	13	3	16.25%	3.75%
Group 5	9	7	11.25%	8.75%

Table 36, 37, 38, and 39 display proportion of bankruptcy in the Energy sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In the Energy sector, when WACC decreases, the number of non-bankrupt companies generally decreases and that of bankrupt companies increases as seen from Table 36. In Table 37, There are more bankrupt companies occur in Group 1 and Group 4-5. In group 5 in which ROIC are at its lowest bound range, all 16 companies are bankrupt, which is the same as that in Table 36. In Table 38, there are more bankrupt companies in first 4 groups. When EVA decreases, the number of non-bankrupt companies increases, which is quite different that the traditional pattern where non-bankrupt companies generally take place at the upper bound of EVA instead of lower bound. In Table 39, there are more non-bankrupt companies in Group 1 but as NOPAT becomes smaller, there are more bankrupt companies and less non-bankrupt companies. These four tables together suggest that non-bankrupt companies generally have a higher WACC, lower EVA, and higher NOPAT than bankrupt companies in the Energy sector.

Table 40 Communications

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	2	3	8.33%	12.50%
Group 2	2	3	8.33%	12.50%
Group 3	1	4	4.17%	16.67%
Group 4	2	3	8.33%	12.50%
Group 5	3	1	12.50%	4.17%

Table 41 Communications

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	4	1	16.67%	4.17%
Group 2	1	4	4.17%	16.67%
Group 3	1	4	4.17%	16.67%
Group 4	0	5	0.00%	20.83%
Group 5	4	0	16.67%	0.00%

Table 42 Communications

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	5	0.00%	20.83%
Group 2	1	4	4.17%	16.67%
Group 3	5	0	20.83%	0.00%
Group 4	3	2	12.50%	8.33%
Group 5	1	3	4.17%	12.50%

Table 43 Communications

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	5	0.00%	20.83%
Group 2	0	5	0.00%	20.83%
Group 3	2	3	8.33%	12.50%
Group 4	5	0	20.83%	0.00%
Group 5	3	1	12.50%	4.17%

Table 40, 41, 42, and 43 display proportion of bankruptcy in the Communications sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In the Communications sector, there are more non-bankrupt companies at the upper bound of WACC as seen in Group 1-4 in Table 40. In Table 41, there are more bankrupt companies occur at the lower and upper bound of ROIC with more non-bankrupt companies occur group 2-4, suggesting in this sector, companies that have average ROIC are usually non-bankrupt companies. In Table 42, majority of non-bankrupt companies occur in Group 1-2 with a few that are in Group 4-5. In Group 1, there is no bankrupt companies as they mostly occur at the lower bound of EVA. In Table 43, we can see that there are no bankrupt companies in Group 1-2 but occur in Group 3-5. Non-bankrupt companies occur in the first 3 groups in which NOPAT are at the upper bound. From these 4 tables, we can find that non-bankrupt companies generally have a higher WACC, NOPAT. Bankrupt companies generally have a lower EVA but higher ROIC in the Communications sector.

Table 44 Financials

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	1	6	2.94%	17.65%
Group 2	3	4	8.82%	11.76%
Group 3	0	7	0.00%	20.59%
Group 4	2	5	5.88%	14.71%
Group 5	4	2	11.76%	5.88%

Table 45 Financials

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	1	6	2.94%	17.65%
Group 2	1	6	2.94%	17.65%
Group 3	0	7	0.00%	20.59%
Group 4	3	4	8.82%	11.76%
Group 5	5	1	14.71%	2.94%

Table 46 Financials

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	5	2	14.71%	5.88%
Group 2	4	3	11.76%	8.82%
Group 3	1	6	2.94%	17.65%
Group 4	0	7	0.00%	20.59%
Group 5	0	6	0.00%	17.65%

Table 47 Financials

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	7	0.00%	20.59%
Group 2	1	6	2.94%	17.65%
Group 3	0	7	0.00%	20.59%
Group 4	5	2	14.71%	5.88%
Group 5	4	2	11.76%	5.88%

Table 44, 45, 46, and 47 display proportion of bankruptcy in the Financials sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In the Financials sector, majority of bankrupt companies occur at the upper bound of WACC distribution as seen in Group 1-3 in Table 44. In Table 45, in Group 1-3, majority are non-bankrupt companies and in Group 4-5 in which ROIC is at the lower bound, there are more bankrupt companies. In Table 46, bankrupt companies generally occur at the upper bound of EVA distribution with more non-bankrupt companies occur the lower bound. In Table 47, the pattern is at the opposite of EVA. There are more non-bankrupt companies in Group 1-3 while in the last two groups in which NOPAT are at the lower bound, more bankrupt companies occur. From these 4 tables, we find out non-bankrupt companies tend to have higher WACC, higher ROIC, lower EVA, and higher NOPAT.

Table 48 Health Care

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	1	6	2.86%	17.14%
Group 2	2	5	5.71%	14.29%
Group 3	1	6	2.86%	17.14%
Group 4	3	4	8.57%	11.43%
Group 5	7	0	20.00%	0.00%

Table 49 Health Care

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	3	4	8.57%	11.43%
Group 2	0	7	0.00%	20.00%
Group 3	1	6	2.86%	17.14%
Group 4	5	2	14.29%	5.71%
Group 5	5	2	14.29%	5.71%

Table 50 Health Care

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	7	0.00%	20.00%
Group 2	1	6	2.86%	17.14%
Group 3	7	0	20.00%	0.00%
Group 4	6	1	17.14%	2.86%
Group 5	0	7	0.00%	20.00%

Table 51 Health Care

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	7	0.00%	20.00%
Group 2	0	7	0.00%	20.00%
Group 3	4	3	11.43%	8.57%
Group 4	7	0	20.00%	0.00%
Group 5	3	4	8.57%	11.43%

Table 48, 49, 50, and 51 display proportion of bankruptcy in the Health Care sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In Health Care sector, non-bankrupt companies occur frequently at the upper bound of

WACC as seen in Group 1-4 in Table 48. In Group 5 in which EVA is at the lowest bound, all 7 companies are bankrupt. In Table 49, there are more non-bankrupt companies occur in Group 1-3 in which ROIC are at the upper bound compared to more bankrupt companies in Group 4-5 in which ROIC are at the lower bound. In Table 50, the distribution of EVA follows similar pattern as seen Communications sector in which non-bankrupt companies occur in the upper and lower bound of EVA while more bankrupt companies at the middle. In Group 1 and Group 5, there are no bankrupt companies but all are non-bankrupt companies. In Group 2-4, there are more bankrupt companies. In Table 51, all companies are non-bankrupt in Group 1-2 and more bankrupt companies in Group 3-5 in which NOPAT are at the lower bound. From these 4 tables, we generally find that non-bankrupt companies have higher WACC, higher ROIC, and either higher or lower than average EVA, and higher NOPAT.

Table 52 Industrials

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	7	0.00%	20.59%
Group 2	2	5	5.88%	14.71%
Group 3	1	6	2.94%	17.65%
Group 4	4	3	11.76%	8.82%
Group 5	6	0	17.65%	0.00%

Table 53 Industrials

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	3	4	8.82%	11.76%
Group 2	1	6	2.94%	17.65%
Group 3	0	7	0.00%	20.59%
Group 4	3	4	8.82%	11.76%
Group 5	6	0	17.65%	0.00%

Table 54 Industrials

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	7	0.00%	20.59%
Group 2	3	4	8.82%	11.76%
Group 3	6	1	17.65%	2.94%
Group 4	3	4	8.82%	11.76%
Group 5	1	5	2.94%	14.71%

Table 55 Industrials

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	7	0.00%	20.59%
Group 2	0	7	0.00%	20.59%
Group 3	2	5	5.88%	14.71%
Group 4	7	0	20.59%	0.00%
Group 5	4	2	11.76%	5.88%

Table 52, 53, 54, and 55 display proportion of bankruptcy in the Industrials sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In Industrials sector, non-bankrupt companies occur at the upper bound of WACC again in Group 1-3 as seen in Table 52. More bankrupt companies occur at the lower bound of WACC as seen in Group 4-5. In Table 53, majority of companies in the upper bound of ROIC are non-bankrupt as seen in Group 1-3. In the lower bound specifically in Group 5, all 6 companies are

bankrupt. In Table 54, the distribution pattern follows that of Health Care sector in which more non-bankrupt companies occur at the upper and lower bound of EVA distribution with majority of bankrupt companies occurring in the middle. In Table 55, there are more non-bankrupt companies occur at the upper bound of NOPAT distribution in Group 1-3 with no bankrupt companies appearing in first two groups. As NOPAT decreases, we see more bankrupt companies occurring at Group 4-5. From these 4 tables, we find that non-bankrupt companies tend to have a higher WACC, higher ROIC, either higher or lower EVA than average, and higher NOPAT in the Industrials sector.

Table 56: Materials

WACC ranked from highest to lowest				
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	2	4	6.90%	13.79%
Group 2	3	3	10.34%	10.34%
Group 3	0	6	0.00%	20.69%
Group 4	2	4	6.90%	13.79%
Group 5	5	0	17.24%	0.00%

Table 57: Materials

ROIC ranked from highest to lowest				
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	2	4	6.90%	13.79%
Group 2	0	6	0.00%	20.69%
Group 3	0	6	0.00%	20.69%
Group 4	5	1	17.24%	3.45%
Group 5	5	0	17.24%	0.00%

Table 58: Materials

EVA ranked from highest to lowest				
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	6	0.00%	20.69%
Group 2	0	6	0.00%	20.69%
Group 3	5	1	17.24%	3.45%
Group 4	5	1	17.24%	3.45%
Group 5	2	3	6.90%	10.34%

Table 59: Materials

NOPAT ranked from highest to lowest				
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	6	0.00%	20.69%
Group 2	0	6	0.00%	20.69%
Group 3	1	5	3.45%	17.24%
Group 4	6	0	20.69%	0.00%
Group 5	5	0	17.24%	0.00%

Table 56, 57, 58, and 59 display proportion of bankruptcy in the Materials sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In the Materials sector, there are more non-bankrupt companies occur at the upper bound of WACC as seen in Group 1-4 in Table 56. In Group 5, all 5 companies are bankrupt companies. In Table 57, majority of companies are non-bankrupt companies in Group 1-3 with no bankrupt companies in Group 2-3, meaning no bankrupt companies have relatively higher ROIC in these groups. In Group 5 in which ROIC are at the lowest bound, all 5 companies are bankrupt as well. In Table 58, there are more non-bankrupt companies occurring at upper and lower bound of EVA distribution as seen in Group 1-2 and Group 4-5. More bankrupt companies accumulate in the middle of the distribution. In Table 59, specifically in Group 1-3, there is only 1 bankrupt

company meaning majority are non-bankrupt companies that have relatively higher NOPAT. In Group 4-5, more bankrupt companies occur. From these 4 tables, we find that non-bankrupt companies generally have higher WACC, higher ROIC, either higher or lower than average EVA and higher NOPAT in the Materials sector.

Table 60 Technology

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	4	1	14.81%	3.70%
Group 2	0	5	0.00%	18.52%
Group 3	0	5	0.00%	18.52%
Group 4	2	3	7.41%	11.11%
Group 5	4	3	14.81%	11.11%

Table 61 Technology

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	2	3	7.41%	11.11%
Group 2	0	5	0.00%	18.52%
Group 3	0	5	0.00%	18.52%
Group 4	2	3	7.41%	11.11%
Group 5	6	1	22.22%	3.70%

Table 62 Technology

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	5	0.00%	18.52%
Group 2	2	3	7.41%	11.11%
Group 3	5	0	18.52%	0.00%
Group 4	2	3	7.41%	11.11%
Group 5	1	6	3.70%	22.22%

Table 63 Technology

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	5	0.00%	18.52%
Group 2	0	5	0.00%	18.52%
Group 3	1	4	3.70%	14.81%
Group 4	4	1	14.81%	3.70%
Group 5	5	2	18.52%	7.41%

Table 60, 61, 62, and 63 display proportion of bankruptcy in the Technology sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In Technology sector, there are more bankrupt companies that occur at the upper and lower bound of WACC distribution as see in Group 1 and Group 2-4 in Table 60. There are more non-bankrupt companies in Group 2-4 and in Group 2-3, none are bankrupt companies. In Table 61, bankrupt companies occur frequently in Group 1 and Group 4-5. Non-bankrupt companies generally occur at the upper bound of ROIC distribution. In Table 62, majority of companies are non-bankrupt in Group 1-2 and Group 4-5 with more bankrupt companies occur in Group 3-4. In Table 63, more non-bankrupt companies occur in Group 1-3 and specifically in Group 1-2, there are no bankrupt companies. As NOPAT decreases, more bankrupt companies show up in Group 4-5 in which NOPAT are the lower bound of distribution. From these 4 tables, we can see that non-bankrupt companies tend to have higher WACC, higher ROIC, higher or lower than average EVA, and a higher NOPAT in the Technology sector.

Table 64 Utilities

	WACC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	1	3	5.26%	15.79%
Group 2	1	3	5.26%	15.79%
Group 3	0	4	0.00%	21.05%
Group 4	0	4	0.00%	21.05%
Group 5	0	3	0.00%	15.79%

Table 65 Utilities

	ROIC ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	1	3	5.26%	15.79%
Group 2	0	4	0.00%	21.05%
Group 3	0	4	0.00%	21.05%
Group 4	1	3	5.26%	15.79%
Group 5	0	3	0.00%	15.79%

Table 66 Utilities

	EVA ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	4	0.00%	21.05%
Group 2	0	4	0.00%	21.05%
Group 3	1	3	5.26%	15.79%
Group 4	1	3	5.26%	15.79%
Group 5	0	3	0.00%	15.79%

Table 67 Utilities

	NOPAT ranked from highest to lowest			
	Bankruptcy	Non-Bankruptcy	Bankruptcy%	Non-Bankruptcy%
Group 1	0	4	0.00%	21.05%
Group 2	0	4	0.00%	21.05%
Group 3	0	4	0.00%	21.05%
Group 4	2	2	10.53%	10.53%
Group 5	0	3	0.00%	15.79%

Table 64, 65, 66, and 67 display proportion of bankruptcy in the Utilities sector divided into 5 groups by WACC, ROIC, EVA and NOPAT ranked from highest to lowest.

In the Utilities sector, the size of the bankrupt companies is quite small because there are only 2 bankrupt companies in this sector. In Table 64, we can see that all bankrupt companies fall into Group 1-2 in which WACC is at the upper bound. However, there are still more non-bankrupt companies in Group 1-2. In Table 65, the two bankrupt companies fall in Group 1 and Group 4 while other non-bankrupt companies are almost evenly distributed among 5 groups. In Table 66, the bankrupt companies occur in Group 3-4 in which EVA are at the lower bound of distribution. Bankrupt companies also almost distribute evenly among 5 groups. In Table 67, the bankrupt companies only occur in Group 4 while non-bankrupt companies occur among 5 groups with similar frequency. From these 4 tables, we do not see a clear pattern of how bankrupt companies generally perform in the Utilities sector as they virtually occur in all 5 groups with similar occurrence rate. We do see that bankrupt companies generally have a lower EVA and NOPAT compared to its peers in the Utilities sector.

5. Correlation

After looking at the trend of financial performance among sectors, we perform correlation test between variables to better see the relationship between them. In Table 68, we can see that

ROIC and NOPAT both have positive correlation with WACC with the exception that has a negative correlation with WACC, meaning the higher WACC is, the lower EVA will be. This is normal as EVA is calculated by $\text{NOPAT} - \text{Invested Capital} * \text{WACC}$. The higher WACC, we can expect a lower EVA. Among WACC, NOPAT, ROIC, and EVA, each of the variable have positive correlation with each other except for that between EVA and WACC.

Table 68

Correlation: Entire Sample				
	WACC	ROIC	NOPAT	EVA
WACC	1.00000	0.00343	0.02131	-0.57956
ROIC	0.00343	1.00000	0.00504	0.01086
NOPAT	0.02131	0.00504	1.00000	0.22233
EVA	-0.57956	0.01086	0.22233	1.00000

Table 68 shows correlation between variables that include WACC, ROIC, NOPAT, and EVA in the entire sample.

In the bankruptcy sample, EVA and WACC also has a negative correlation with each other. The correlation becomes stronger in this sample as it changes from -0.57 to -0.97. The correlation between WACC and ROIC becomes stronger in this sample as it changes from 0.00343 in the entire sample to 0.00524. The correlation between WACC and NOPAT becomes weakening as it changes from 0.02131 in the entire sample to 0.01904. The relationship between ROIC and WACC and NOPAT becomes stronger as correlation increases from 0.00343 to 0.00524 and 0.005 to 0.033 respectively. However, ROIC has weakening correlation with EVA in this sample as correlation decreases from 0.01086 to 0.00397. NOPAT generally has stronger correlation with ROIC but weakening correlation with WACC and EVA. EVA also has weakening correlation with other variables except for correlation with WACC.

Table 69

Correlation: Bankruptcy Sample				
	WACC	ROIC	NOPAT	EVA
WACC	1.00000	0.00524	0.01904	-0.97262
ROIC	0.00524	1.00000	0.03321	0.00397
NOPAT	0.01904	0.03321	1.00000	0.20322
EVA	-0.97262	0.00397	0.20322	1.00000

Table 69 shows correlation between variables that include WACC, ROIC,

NOPAT, and EVA in the bankrupt companies sample.

In the non-bankruptcy sample, correlation does not follow the same pattern as we see in Table 68 and Table 69. In this sample, WACC has negative correlation with ROIC, NOPAT and EVA. Other than correlation with WACC, variables have positive correlation with each other. The correlation between WACC and EVA is -0.04363, which is much lower than that of the entire sample and bankruptcy sample. NOPAT has the strongest negative correlation with WACC, meaning higher the WACC is, lower the NOPAT will be. ROIC has stronger correlation with NOPAT and EVA in this sample with correlation at 0.18021 and 0.15165, which are all above 0.1. NOPAT has stronger positive correlation with ROIC and EVA compared to that in the entire sample and bankruptcy sample. Similar to EVA, it has stronger positive correlation with ROIC and NOPAT compared to that in the entire and bankruptcy sample.

Table 70

Correlation: Non-Bankruptcy Sample				
	WACC	ROIC	NOPAT	EVA
WACC	1.00000	-0.01685	-0.12443	-0.04363
ROIC	-0.01685	1.00000	0.18021	0.15165
NOPAT	-0.12443	0.18021	1.00000	0.30016
EVA	-0.04363	0.15165	0.30016	1.00000

Table 70 shows correlation between variables that include WACC, ROIC, NOPAT, and EVA in the non-bankrupt company's sample.

6. Logistic regression

The correlation tests suggest that between the four variables, a positive correlation usually exists except between WACC and EVA. We next conduct logistic regression analysis to analyze whether there exists significant relationship of each variable with bankruptcy. As bankruptcy is a categorical variable in the entire sample, it is noted as 1 that stands for Bankruptcy or 0 that stands for Non-Bankruptcy.

In Table 71, we can see a negative correlation between EVA and bankruptcy as the coefficient is -0.001996. The p-value of EVA is 0.336, which is bigger than 0.05, suggesting no significance in this variable in predicting bankruptcy. The AIC score is lower at 29.743 compared to regression model 2 and regression model 3, meaning better quality of regression model 1. We can also see that in regression model 1-3, EVA generally has a negative correlation to EVA except for in regression model 4. The negative relationship between EVA and bankruptcy shows that as EVA gets higher, bankruptcy gets lower, which means closer to 0 that stands for non-bankruptcy. This reflects the trend of majority sector performance as there are more non-bankrupt companies occur at upper bound of EVA distribution with some exceptions that also occur the lower bound of distribution.

As we introduce WACC, ROIC, and NOPAT in the regression models, the correlation between EVA and bankruptcy become lower. All three other variables have negative coefficients with bankruptcy in regression model 3-4. The results also show that all variables are not significant in predicting bankruptcy in Consumer Staples sector as their p-value is all above 0.05.

Table 71

Regression by Consumer Staples Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	-0.457951	-0.001996				25	29.743	0.336
2	0.886862	-0.001814	-22.484468			25	31.332	0.532
3	3.034882	-0.001759	-57.041131	-4.989767		25	29.01	0.0682
4	494.60	0.71	-4902.00	-498.40	-0.66	25	10	0.999

Signif. codes: '0.001***' '0.01**' '0.05*' '0.1' '.'

Table 71 presents coefficients of variables in 4 regressions model in the Consumer Staples sector. The table also shows 25 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R^2 in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Consumer Discretionary sector, we also see a negative correlation between EVA and bankruptcy in regression model 1-3. In this sector, the correlation between EVA and bankruptcy

becomes stronger as we introduce other variables into the models. All variables have negative correlation with bankruptcy in all 4 regression models except for correlation between EVA and bankruptcy in regression model 4 that shows a positive coefficient at 0.016018 at a 0.01 significance level. The AIC score is higher in regression model 1-3 than in regression model 4. In regression model 4 in which AIC is the lowest, both EVA and NOPAT show some significance in predicting bankruptcy and WACC and ROIC do not show any significance either. However, in regression model 3 in which AIC is the second to the lowest, we find that WACC show its significant at 0.01 level. Thus, we think that among 4 variables, WACC appears more significant in predicting bankruptcy.

Table 72

Regression by Consumer Discretionary Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	0.5354***	-1.27E-05				65	89.609	0.9677
2	2.382***	-6.06E-05	-24.49**			65	84.239	0.02152
3	4.098***	8.15E-05	-45.67***	-4.412***		65	66.093	0.000821
4	8.250205***	0.016018*	-52.95	-3.94	-0.024004*	65	24.332	0.0166

Signif. Codes: ***'0.001***'0.01***'0.05***'0.1***

Table 72 presents coefficients of variables in 4 regressions model in the Consumer Discretionary sector. The table also shows 65 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R^2 in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

Table 73

Regression by Energy Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	1.7425114***	0.0012018***				80	79.341	0.00209
2	4.297***	0.001189***	-33.31***			80	70.469	0.012696
3	4.289***	0.001174***	-33.4***	-4.65E-02		80	72.403	0.800068
4	4.605E+14***	7.736E+11***	5.723E+14***	1.809E+14***	-1.021E+12	80	586.7	<2e-16

Signif. Codes: ***'0.001***'0.01***'0.05***'0.1***

Table 73 presents coefficients of variables in 4 regressions model in the Energy sector. The table also shows 80 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R^2 in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Energy sector, we find EVA has positive coefficient in all 4 regression models. As we

introduce more variables, the coefficient becomes smaller except for that in the last regression model. This time, EVA shows significance in predicting bankruptcy in all 4 models. The model that has the lowest AIC score is the second model which includes EVA and WACC variables. WACC also demonstrates its significance in this sector specific model and shows a much stronger and negative correlation with bankruptcy than EVA. ROIC and NOPAT do not appear significant in the models in predicting bankruptcy. Thus, we think that both EVA and WACC are significant in predicting bankruptcy in this sector.

Table 74

Regression by Communications Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	-1.32E-01	-7.74E-04				24	32.372	0.145
2	4.45E-02	-7.55E-04	-2.32E+00			24	34.331	0.839
3	-2.24E-01	-7.70E-04	-1.25E+00	1.07E-01		24	34.004	0.459
4	-8.444E+14***	-1.507E+10***	1.045E+16***	2.299E+13***	-2.884E+11***	24	586.7	<2e-16

Signif. codes: 0.000*** 0.001** 0.01* 0.05. 0.1.

Table 74 presents coefficients of variables in 4 regressions model in the Communications sector. The table also shows 24 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R² in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Communications sector, we find that EVA has consistent negative correlation with bankruptcy in all 4 regression models. As more variables are introduced, the correlation between EVA and bankruptcy becomes slightly stronger as coefficients change from -7.74E-04 to -7.70E-04 from regression model 1 to 3. In the 4th model in which all variables are introduced, EVA shows its significance in predicting bankruptcy, however it does not show any significance in the other 3 models. In the model that has the best AIC score, EVA does not show significance level but only a negative correlation. Thus, we think that EVA is not significant in predicting bankruptcy but it is the best variable contributing to predict bankruptcy as shown in regression model 1 in which AIC is the lowest.

Table 75

Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	4.31E-01	0.007123*				34	30.14	0.0139
2	8.67E-01	0.007144*	-5.48E+00			34	31.863	0.6042
3	2.36E+00	0.01143*	-1.94E+01	-11.844556*		34	24.692	0.0203
4	3.81E+01	1.84E-01	9.12E+00	-2.73E+01	-1.55E-01	34	10	0.998

Signif. Codes: 0.001***, 0.01**, 0.05, 0.1.

Table 75 presents coefficients of variables in 4 regressions model in the Financials sector. The table also shows 34 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R^2 in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Financials sector, we find that EVA has consistent positive correlation with bankruptcy in all 4 regression models. As more variables are introduced, the correlation between EVA and bankruptcy becomes stronger as coefficients change from 0.007123 to 0.0184 from regression model 1 to 3. In the first three regression models, EVA shows its significance in predicting bankruptcy at 0.01 level. In the 4th model, EVA does not show any significance but the AIC score of this model is the lowest. In the second best model, which is regression model 3, we can see that EVA and ROIC has shown their significance in predicting bankruptcy at 0.01 level. ROIC shows a negative correlation with bankruptcy while EVA shows a positive correlation. WACC does not show any significance in the 4 models. Thus, we think that EVA and ROIC appear more significant in predicting bankruptcy in Financials sector.

Table 76

Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	-3.85E-01	-1.36E-04				35	50.728	0.545
2	3.19E+00	-8.91E-05	-48.97*			35	36.929	0.021
3	3.106*	-7.54E-05	-48.73*	-3.94E-01		35	36.975	0.3132
4	3.96E+00	6.67E-02	-8.41E+00	-1.12E-01	-6.93E-02	35	17.734	0.102

Signif. Codes: 0.001***, 0.01**, 0.05, 0.1.

Table 76 presents coefficients of variables in 4 regressions model in the Health Care sector. The table also shows 35 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R^2 in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Health Care sector, we find that EVA has consistent negative correlation with bankruptcy in first 3 regression models. As more variables are introduced, the correlation between EVA and bankruptcy becomes weaker as coefficients change from -1.36E-04 to -7.54E-05 from regression model 1 to 3. In the 4th model, EVA shows a positive correlation with bankruptcy. In all 4 models, EVA does not show its significance level. All other variables also show a negative correlation with bankruptcy. Among 4 models, WACC shows its significance at 0.01 level in regression model 2 and 3 in which AIC score is second to the lowest. Thus, we think that WACC appears more significant in predicting bankruptcy in Health Care sector.

Table 77

Regression by Industrials Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	-4.52E-01	-5.01E-04				34	48.644	0.46
2	7.176*	-4.73E-04	-94.82**			34	30.566	0.00563
3	10.78*	-1.96E-04	-140.5*	-2.79E+00		34	25.906	0.11
4	3.65E+02	1.04E-01	-3.97E+03	-1.12E+02	-8.33E-02	34	10	0.999

Signif. Codes: ***0.001, **0.01, *0.05, .0.1

Table 77 presents coefficients of variables in 4 regressions model in the Industrials sector. The table also shows 34 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R² in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Industrials sector, we find that EVA has consistent negative correlation with bankruptcy in first 3 regression models. As more variables are introduced, the correlation between EVA and bankruptcy becomes weaker as coefficients change from -5.01E-04 to -1.96E-05 from regression model 1 to 3. In the 4th model, EVA shows a positive correlation with bankruptcy. In all 4 models, EVA also does not show its significance level like in the Health Care sector. All other variables also show a negative correlation with bankruptcy but no significance level except for WACC. Among 4 models, WACC again shows its significance at 0.01 level in regression model 2 and 3 in which AIC score is second to the lowest. Thus, we

think that WACC appears more significant in predicting bankruptcy in Industrials sector.

Table 78

Regression by Materials Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	-2.99E-01	-0.002071				29	36.765	0.0955
2	2.78207	-0.002535	-42.839891			29	33.627	0.0456
3	3.220151	-0.002725	-50.362418	2.31E-01		29	34.145	0.293
4	2.26E+01	5.79E-02	4.81E+01	-8.48E-02	-2.00E-01	29	10	0.999

Signif. Codes: 0.0*** 0.001** 0.01* 0.05. 0.1

Table 78 presents coefficients of variables in 4 regressions model in the Materials sector. The table also shows 29 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R² in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Materials sector, we find that EVA also has consistent negative correlation with bankruptcy in first 3 regression models. As more variables are introduced, the correlation between EVA and bankruptcy becomes stronger as coefficients change from -0.00207 to 0.0579 from regression model 1 to 4. Both EVA and WACC also shows its significance in predicting bankruptcy in model 2 and 3 at 0.01 level while ROIC and WACC do not. Thus, we think that EVA and WACC appears to be more significant in predicting bankruptcy in Materials sector.

Table 79

Regression by Technology Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	-5.52E-01	-8.48E-05				27	39.557	0.846
2	-5.97E-01	-8.76E-05	4.42E-01			27	41.555	0.963
3	-9.86E-01	1.69E-04	2.44E+00	-1.87E-01		27	0.173	41.41
4	5.94E+02	3.71E+00	-2.74E+03	3.97E+01	-3.75E+00	27	10	0.987

Signif. Codes: 0.0*** 0.001** 0.01* 0.05. 0.1

Table 79 presents coefficients of variables in 4 regressions model in the Technology sector. The table also shows 27 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R² in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Technology sector, we find that EVA also has consistent negative correlation with bankruptcy in first 3 regression models. As more variables are introduced, the correlation

between EVA and bankruptcy becomes stronger as coefficients change from $-8.48E-05$ to 3.71 from regression model 1 to 4. In all 4 models, all variables do not show significance. Thus, we think that none of the variables appear significant in predicting bankruptcy in Technology sector. However, EVA, WACC, and ROIC all contribute to improve the quality of the model as shown in regression model 3 in which AIC score is the lowest.

Table 80

Regression by Utilities Sector								
Regression	Intercept	EVA	WACC	ROIC	NOPAT	# of Observations	AIC	Pr(> z)
1	-2.14E+00**	-2.94E-06				19	16.787	0.99165
2	-7.257E+00	3.83E-05	8.54E+01			19	13.622	0.2628
3	-7.28E+00	-2.10E-05	8.45E+01	1.91E+00		19	15.616	0.935
4	5.94E+02	3.71E+00	-2.74E+03	3.97E+01	-3.75E+00	19	10	0.987

Signif. Codes: 0.0***, 0.001**, 0.01*, 0.05., 0.1.

Table 80 presents coefficients of variables in 4 regressions model in the Utilities sector. The table also shows 19 companies involved, AIC score which is a score that evaluates the quality of the logistic regression model. AIC is similar to R^2 in linear regression model. A lower AIC implies a better fitness and quality of the model. Pr(>|z|) value is for each new variable introduced into the model.

In the Utilities sector, we find that EVA has negative correlation in regression model 1 in which EVA is the only variable involved and also in regression model 3 that includes EVA, WACC, and ROIC. In all 4 models, all variables do not show significance. Thus, we think that none of the variables appear significant in predicting bankruptcy in Utilities sector. However, EVA and WACC together can better predict bankruptcy as shows in model 2 in which the AIC score is the lowest.

7. Conclusions

This research intends to examine the relations between EVA and bankruptcy. Using secondary data from Bloomberg, a sample of public traded companies that filed for bankruptcy are captured during the period from 2015 to October 2017, which accounts for in 178 bankruptcy filing companies in total. A sample list of public traded companies is formed as benchmark to the

bankruptcy filing companies based on the same sectors. The whole dataset is formed when combining the bankruptcy filing companies and non-bankruptcy filing ones.

We present descriptive statistics of the entire sample and then show statistics based on each sector that is divided based on bankrupt and non-bankrupt subgroup. We compare the mean of WACC, ROIC, EVA, total invested capital, financial leverage, and net liability, and NOPAT between non-bankrupt and bankrupt group in each sector to understand the general trend of financial performance in bankrupt versus non-bankrupt companies in each sector. Next, we present univariate grouping tests to compare the distribution of bankruptcy in each sector based on the ranking of WACC, ROIC, EVA, NOPAT that divides the companies into several subgroups. From the comparison, we find that non-bankrupt companies generally have higher WACC, ROIC, and NOPAT while bankrupt companies have the opposite trend. Sometimes, non-bankrupt companies have higher EVA but occasionally in some sectors, non-bankrupt companies have either higher or lower than average EVA.

Next, we perform correlation of the 4 variables, WACC, ROIC, NOPAT, and EVA. We generally find that WACC and EVA exist a negative correlation while other variables generally have positive correlation with each other.

Last, we conduct logistic regression analysis to further explore whether the relationship between EVA and bankruptcy is significant and meaningful for 10 sectors. In Consumer Discretionary, Energy, Financials, Materials sectors, we find that EVA is significant in predicting bankruptcy. In Consumer Staples, Energy, Health Care, Materials and Industrials sectors, WACC appears significant in predicting bankruptcy. None of the variables show significance in predicting bankruptcy in Communications, Technology, and Utilities sectors. However, EVA generally helps and contributes to improve the fitness of the regression model.

Thus, the results lead to conclude that EVA generally does contribute to predict bankruptcy but its significance level can vary across different sectors.

In general, firms that have higher NOPAT and higher WACC (compared to a negative WACC of bankrupt companies), higher ROIC will be more likely stay non-bankrupt. Firms can consider to use EVA as an indicator to help detect bankruptcy level. Some non-bankrupt firms have higher EVA while some have either higher or lower than average EVA. Further research can be conducted further on why some non-bankrupt firms have higher or lower than average EVA but still can survive and factors may drive this pattern. Future research can also conduct on Communications, Technology and Utilities to find out what variables are significant in driving bankruptcy as the results of the regression tests show that none of the 4 variables are significant in explaining bankruptcy.

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Appendix

The sample data is extracted from Bloomberg based on most recent quarter information. A list of bankruptcy firms is also available on Bloomberg.

Use “BNKH” function, Bloomberg will automatically redirect to a site in which it lists names of companies that filed bankruptcy and company identifier. It will also show which state of jurisdiction receive the bankruptcy filing.

In this site, one can customize the bankruptcy announcement period and download the data in an excel file. The excel file will show the name, identifier, basic liability and asset information. The data is limited from this extraction but the most important is to gain a list of bankruptcy companies.

One challenge is that Bloomberg does not separate public and private bankruptcy companies. Thus, the most time consuming part is to find out which companies are public. Luckily, the identifier that Bloomberg provides gives some hints on how companies are being identified. In the excel file, filter out any companies that do not end with “US Equity”, which suggests companies are not public without this ending.

After forming a list of bankrupt companies, the next step is to retrieve relevant financial data including EVA. Manually inputting information will be very time consuming, however, Bloomberg and Excel can be connected to each other so that inputting in Bloomberg formula in Excel can give you relevant information you request. For example, if you want to get WCAA on a company, you can type in =BDP (company ticker, Bloomberg Item). This generic formula works as long as the company ticker is correct and the information requested is available in Bloomberg. The Bloomberg Item can be found from using “FLDS” function after typing “Company_name US Equity”. Bloomberg should tell the formula retrieve information such as WACC. Replicate the formula in other cells can eventually give you a large dataset.

To get a list of non-bankrupt companies will be much easier because any companies that do not file bankruptcy can be used as a benchmark. Type “watch list” in Bloomberg, it will show public traded companies in various sectors. One can download the list of companies in excel based on different sectors. To randomly pick peer companies, one can consider using =randbetween() function or rand() function to choose peer companies randomly in excel. Randbetween function will give an integer value while rand() will give value between 0 and 1. One can randomly pick companies that have a consistent randbetween value or a rand() value that is greater than 0.5 etc. Repeat this excel function for other sectors.

After forming a list of non-bankrupt companies, one can replicate the steps mentioned above to retrieve same financial information requested for bankrupt companies. Additional formatting will be needed to make the data look organized. Combining the bankrupt and non-bankrupt companies dataset will give you a complete dataset.