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Is economic value added (eva) the best way to assemble a portfolio?

Tamas Pataky
University of Central Florida

IS ECONOMIC VALUE ADDED (EVA) THE BEST WAY TO ASSEMBLE A PORTFOLIO?

by

TAMAS J. PATAKY

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ABSTRACT

In search of a better investment metric, researchers began to study Economic Value Added, or EVA, which was introduced in 1991 by Stern Stewart & Co in their book, “The Quest for Value” (Turvey, 2000). Stern Stewart & Co devised EVA as a better alternative to evaluate investment projects within the corporate finance field, later to be considered for use as a performance metric for investor use. A wide array of multinational corporations, such as Coca-Cola, Briggs and Stratton, and AT&T adopted the EVA method, which led to EVA’s worldwide acclaim.

Several points in the study reveal that EVA does not offer less risk, higher returns, and more adaptability for an investor. In fact, EVA underperformed the traditional portfolio performance metrics in key measurements including mean returns, and confidence intervals. EVA is a difficult performance metric to calculate, with several complex components that can be calculated in several different ways such as NOPAT, cost of equity, and cost of debt. Any information that is inaccurate or lacking can significantly impact the outcomes. Traditional performance metrics, on the other hand, such as ROA, ROE, and E/P are simple to calculate with few components, and only one way to calculate them.

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CHAPTER 1: INTRODUCTION

Investors are constantly seeking ways to formulate more accurate performance measures to help better evaluate and predict the profitability of a firm. More profitable firms tend to produce greater return on investment. A shareholder's primary goal is to make the greatest possible risk adjusted return on investment. Estimating risk and return is very difficult because markets continually respond to changes due to a wide variety of broad economic and firm-specific factors. The decade between 2002 and 2011 was no different and some experts have deemed the years between 2007 and 2009 as the worst financial crisis since the Great Depression (Wheelock, 2010). During those three years, stock markets around the world plummeted after China and Europe had released slow growth reports (Shellock, 2007), the Dow Jones Industrial Average –a key index measuring overall market performance- plummeted 370 points in one day (Bryant, 2008), Greece's bond was downgraded to "junk" status (Atkins, 2010), and Ireland was bailed out with an 85 billion euro rescue package (Castle & Alderman, 2010). This means that investors have to find more innovative performance measurements that can adapt to volatile market conditions and to better manage their investments.

Traditional performance measures have been criticized for their inability to recognize certain costs such as depreciation, capitalized research and development, and goodwill amortization (Abate & Grant, 2004). In search of a better investment metric, researchers began to study Economic Value Added, or EVA, which was introduced in 1991 by Stern Stewart & Co in their book, "The Quest for Value" (Turvey, 2000). Stern Stewart & Co devised EVA as a better alternative to evaluate investment projects within the corporate finance field. It later came to be considered as a performance metric for investor use. "Coca-Cola's former chairman, Roberto

Goizueta, was an early and enthusiastic proponent of the practice…" (McGough, 2000). A wide array of multinational corporations, such as Coca-Cola, Briggs and Stratton, and AT&T adopted the EVA method, which led to EVA's worldwide recognition. Companies have been using EVA to calculate return on investment and to compensate managers accordingly (Turvey, 2000).

The origins of EVA can be traced back to 1890 when Alfred Marshall, a well-respected economist, defined economic profit as a company's total net gains less interest on invested capital (Grant J., 2003). EVA is essentially a version of economic profit. The difference between the two calculations is that EVA accounts for the revised accounting principles and distortions of today's Generally Accepted Accounting Principles (GAAP) (Sharma & Kumar, 2010). Stern Stewart defines Economic Value Added as the, "difference between the Net Operating Profit After Tax and the opportunity cost of invested Capital" (Stern Stewart). Simply, EVA suggests that an investment must earn more than its cost of capital in order for it to be of any value. EVA for an investment is calculated as net operating profit after tax (NOPAT) less the weighted average cost of capital multiplied by the total capital employed as visible in Equation 1:

$$EVA = NOPAT - WACC * TCE \tag{1}$$

NOPAT is a key element of EVA and is part of the reason why EVA is so unique in comparison to other performance measures such as return on assets (ROA), return on equity (ROE), and earnings per share (EPS) (Grant J, 2003). NOPAT allows for a more accurate evaluation of investment decisions by managers by minimizing non-operating income. According to Stern Stewart, certain non-operating items should not be included, or adjusted for when calculating NOPAT, such as "Operating Leases, LIFO reserve, goodwill amortization, capitalized R&D, bad debt/warranty reserves…" (Abate & Grant, 2004). This is because non-operating items are different between two firms, which make comparing two firms more difficult. NOPAT takes into account the elements of the accounting statement that actually contribute to the investment decision. NOPAT is calculated in Equation 2:

$$NOPAT = EBIT * (1 - t) \tag{2}$$

Where

$$t = Corporate\ tax\ rate$$

NOPAT's most important component is earnings before interest and taxes (EBIT). EBIT helps minimize the effect of non-operating income by excluding interest and taxes.

WACC is "Weighted Average Cost of Capital," which is the amount of money paid for each dollar of capital the firm uses, regardless of its source WACC can be calculated using Equation 3:

$$WACC = \frac{E}{V} * Re + \frac{D}{V} * Rd * (1 - t) \tag{3}$$

Where

$$E = \ Market\ value\ of\ firm's\ equity$$
$$D = Market\ valueof\ firm's\ debt$$
$$V = E + D$$
$$Re = Cost\ of\ equity$$
$$Rd = Cost\ of\ debt$$

Computing WACC can be difficult from an investor's point of view. For an outside investor, with no insider knowledge of a firm, the calculation of the cost of equity is very difficult (Silverman H., 2010). Many researchers rely on the CAPM, or "Capital Asset Pricing Model", which is very sensitive to the way in which beta, a component of the CAPM, is estimated, the expected return on the market portfolio, and even the identity of the risk free rate used (Silverman H., 2010). The cost of equity, however, is affected by a number of other factors such as political uncertainty of a company's home country, economic stability, and government regulations (Wachowicz J., 2012). This not only makes it difficult to calculate an accurate cost of equity but also an accurate EVA. In comparison, other performance measures such as return on assets (ROA), return on equity (ROE), and earnings per share (EPS) are calculated using a few items from publicly available accounting statements.

Coca-Cola was one of the first of major corporations to adopt EVA. By using EVA, Coca-Cola found it was using assets inefficiently and that several divisions of the company should be shut down (Turvey et al). They decided to focus on the soft drink business and sold off the wine, tea, plastic cutlery, pasta and other divisions. Furthermore, the company bought back a portion of their equity and issued debt to replace that capital. These actions resulted in a reduction of their cost of capital from 16% to 12%. Coca-Cola's stock price rose 320% in just five years after their announcement that they adopted EVA in 1991, not including dividends. Several other companies such as Equifax, Briggs & Stratton, AT&T, Quaker Oats, have experienced similar results (Turvey et al.).

EVA offers a more accurate return on investment which can yield higher returns for a company and its shareholders. The principle behind EVA is that a project is only deemed profitable if the returns are higher than the cost of capital. Cost of capital is the required return to cover the cost of a project. Therefore, if a company uses an accurate model to predict project cash flows and risk, EVA should be able to weed out poor investment projects that might have been deemed profitable using traditional accounting methods.

EVA is also powerful tool when used for compensating managers. “Managers who run their businesses according to the precepts of EVA have hugely increased the value of their companies” (Tully S., 1993). Managers often receive bonuses or additional income through stock options. This means that part of their salary is tied to company performance which affects stock performance. Therefore, a manager should logically choose to invest into projects that would offer the highest return on investment. Although traditional performance measures can help maximize the rate of return for an investment project, that does not mean that they will maximize the return for the shareholder (Shil N., 2009). This is because the rate of return will measure the return made on the project but does not include the cost of capital. EVA, on the other hand, is similar to net present value, which discounts the future cash flows of a project and illustrates the amount of total revenue made less the costs. By including the cost of capital, EVA provides a more accurate estimate of return on investment. The greater accuracy of return on investment creates a higher probability of picking an investment project that uses assets more efficiently. The more efficient use of assets leads to more profitable returns for the company and the shareholders.

EVA’s mainstream success then began to draw the attention of the investment community looking to get ahead in today’s already efficient market. EVA was touted as, “today’s hottest financial idea and getting hotter” (Tully S., 1993). EVA is a complex calculation that would have made it difficult for an average investor to collect the data required. Today, however, the relative ease of access to data, with the power of today’s technology, can make data compilation much easier (Colvin G., 2008). With the developments in data aggregation, researchers and investors are looking to EVA as the next step in performance measurement.

There are, however, many critics who question the validity and effectiveness of EVA as a performance measure (Chen & Dodd, 1997). The primary reason may be the origin of this performance measure. The EVA calculation was not introduced by academia but rather by a consulting firm, Stern Stewart & Co. (Grant J., 2003). Lowenstein commented, “Stern Stewart has protected its turf in part by tinkering with definitions of profit, in ways that are by turns sensible and dubious” (1997). Researchers are therefore wary of the intentions behind the creation of EVA, whether they were for financial gains or actually for the advancement of investment tools and the education community.

Although EVA, as an investment tool, is an uncertain measure of performance, not much research has been done on EVA’s ability to predict the performance of a portfolio. One of the key concepts of modern investing theory is diversification, which means to manage risk by widening the scope of investments within a portfolio. This allows an investor to manage the amount of risk by allocating funds into many different investments. If each investment is looked upon as different projects of a company, or in this case, a portfolio, EVA should be able to successfully identify the investments with positive returns. As some investments do not always garner positive returns, even after calculating a positive EVA, a diversified portfolio should allow some wiggle room for EVA to point out successful investments most of the time.

CHAPTER 2: LITERATURE REVIEW

After the successful adoption of EVA by multinational companies, researchers have been investigating the relationship between EVA and stock performance. Empirical results regarding EVA's effectiveness in selecting investments have been mixed, in both the foreign and the American markets (Worthington A., 2004). The real question is whether EVA offers any more value than traditional accounting measures when evaluating an investment (Biddle and Bowen, 1998).

Positive results have been reported by researchers such as Worthington and West (2004), who found that EVA could explain 27% of the variations in stock returns. The research suggested that EVA was the most powerful tool to choose investments by better predicting their return. By comparing EVA to certain performance metrics including earnings before extraordinary items (ERN), residual income (RI), and net cash flow from operations (NCF). Worthington and West concluded that, "The most logical pairing of information variables in explaining stock returns is therefore composed of EVA and RI [(Residual Income)]" (p. 214). Lefkowitcz (1999) found EVA to be a strong indicator of stock performance. Chong et. al found that a portfolio of 100 different stocks chosen by EVA made significantly higher returns, with a 2.45% annual return, compared to the S&P 100 index with an average return of 0.89% on an annualized basis. Stern Stewart found EVA to be the only performance measure necessary for a company and an investor to use when making investment decisions (Stewart, 2012).

Negative results have been found by a variety of authors including Cordeiro (2000). The purpose of his study is to measure the correlation between the adoption of EVA and a company's future performance compared to companies using "Historical accounting performance measures" including: ROA, ROE, ROS and EPS (Cordeiro J., 2000, p. 59). He finds no significant relationship between EVA adoption and actual performance. Using R^2 analysis, measuring the explanatory power of a variable, Chen and Dodd (1997) found that EVA could only account for 2.3% of stock price variability, while general operating measures, on average, could explain 6.2% of stock price variability, neither of which is very impressive. Each measure had extremely low R^2, from which Chen and Dodd concluded that no single performance measure can be used to explain a company's stock price variability (Chen & Dodd, 1997). Holler (2008) had similar results in which EVA explained 4% of stock price variability while residual income, a performance measure that is similar to EVA, could explain 7.4% of stock price variability. EVA also performed poorly when compared to earnings per share and even firm size. Cordeiro (2000) found that EVA produced an R^2 of 0.8%, while firm size and EPS produced R^2 of 17.9% and 4.05% respectively. Eljelly and Alghurair (2001) found EVA to be a poor evaluator of company value when examining the emerging market of Saudi Arabia.

Opinions of EVA's usefulness as a predictor of investment performance clearly vary; however, I have only encountered two papers, Chong (2009) and Abate and Grant (2004), which examined the use of EVA to select a portfolio of stocks. Chong (2009) studied "EVA-based stock portfolios" comprised of companies from the Stern Stewart 1000 (SS1000) database between 1996 and 2006. EVA was used to create a portfolio of the top 100 and the bottom 100 performing companies. The portfolios were then compared to the S&P 100 index, which was used as a benchmark. Results indicated strong evidence of positive relationship between portfolio performance and firm EVA. The study did not, however, compare EVA to other performance metrics, which may have provided similar or even better returns. Abate and Grant

(2004) created two portfolios using EVA of the top 50 and bottom 50 performing companies. The companies were chosen from the Dow Jones list, and compared the return of the portfolio to the average return of the Dow Jones for the year of 2001. The results showed that the EVA constructed portfolio outperformed the Dow Jones by 8.12 percentage points over the course of one year, 2001. This study was clearly not long enough by any means to draw any direct conclusions as to how effective EVA really is. Furthermore, the nature of study is questionable in that the research used subjective measures such as PRVit, that are measures that the authors had either constructed or are not commonly used –as no information on them could be found-. Although the research papers showed some promising results, their studies did not compare EVA's performance to other performance metrics. Therefore, no conclusive evidence shows whether using EVA rankings is a better way to assemble a portfolio than ranking stocks by other methods.

CHAPTER 3: RESEARCH QUESTIONS

In this paper, I will examine the effectiveness of using Economic Value Added to select stocks. I will compare EVA to other performance measures including Return on Assets (ROA), Return on Equity (ROE), and Earnings to Price Ratio (E/P). These three measures were picked because ROA and ROE are common indicators of firm performance, and E/P is the inverse of the very popular P/E ratio commonly used by investors.

I will select stocks from those in the S&P 500 index. The S&P 500 is chosen because it serves as a general indicator of the market performance. The financial sector will be avoided, as the fundamental operations, in terms of leverage, type of product, and others, is vastly different from the other corporate sectors. I will conduct my analysis between the years 2002 and 2011. The time frame includes years of prosperity and the recent recession, will expose EVA to the volatile conditions of the stock market, and test EVA's ability to assemble a strong portfolio. For each year examined, I will evaluate the performance of all stocks in the S&P 500 for the previous year. I will examine the use of four performance metrics to select stocks: ROE, ROA, earnings-to-price (E/P) ratio, and EVA. For each performance metric, two portfolios will be constructed: one consisting of the 50 stocks with the highest values and the other constructed of the 50 stocks with the lowest values.

For example, for fiscal year 2002, I will calculate the EVA of each firm at the end of 2001, then rank them from best to worst (highest to lowest). The 50 highest-ranked (top) firms and the 50 lowest-ranked (bottom) firms will be chosen. I will then take the ranked firms from 2001 and calculate the total return for each firm for 2002 as shown in Equation 4 below:

$$Total\ return = \frac{(S_1 + Div) - S}{S} \tag{4}$$

$$S = Stock\ price\ at\ beginning\ of\ 2002$$
$$S_1 = Stock\ price\ at\ the\ end\ of\ 2002$$
$$Div = Total\ cash\ dividends\ for\ 2002$$

The total returns of the companies in the top and bottom 50 will be averaged. This process will be repeated for years 2003 to 2011. The entire process will be repeated for each of the other three performance metrics and average returns are calculated for top and bottom 50 portfolios ranked using ROA, ROE, and E/P.

The total averaged returns of the top and bottom 50 of EVA will be compared. If EVA is as accurate as Stern Stewart suggests, the top EVA should yield the highest return and the bottom EVA should yield significantly lower returns. The total returns of the EVA will be compared to the other measures (ROA, ROE, and E/P). If EVA (or ROA, ROE, or E/P) is an effective way of selecting portfolios, the top (high) portfolio return should be higher than the bottom (low) portfolio return. If EVA is more effective that the other measures, the differences in returns across top and bottom portfolios should be larger for EVA than for the other performance metrics. The findings of the research should indicate whether EVA is a useful tool for building stock portfolios.

CHAPTER 4: METHODOLOGY

The list of S&P 500 companies used in this paper is from 2012. The 2012 list is used because I was not able to locate the annual listings of the S&P 500 for each year in the past decade. Not every firm in the 2012 S&P 500 index existed in prior years; therefore the number of firms examined is less than 500.

Annual financial data, company credit ratings, and other numerical information are gathered from the Compustat database. Financial data was gathered using the "Merged Global Fundamental Annual File" database and information on credit ratings was found using the "S&P Credit Ratings Xpress" database. Some companies were missing certain pieces of data such as ending price and rating type. Companies with missing data were excluded from the study. The datasets that are compiled are shown in Table 1 below:

Table 1

Compustat datasets

Merged Global Fundamental Annual File	S&P Credit Ratings Xpress
Data Date	Data Date
Data Year – Fiscal	Global Company Key
Ticker Symbol	Ticker Symbol
Company Name	Company Name
Assets – Total	Standard Industry Classification Code
Common/Ordinary Equity – Total	S&P Long Term Issuer Credit Rating
Common/Ordinary Stock (Capital)	
Long-Term Debt – Total	
Invested Capital – Total	
Preferred/Preference Stock (Capital) – Total	
Dividends Common/Ordinary	
Dividends – Preferred/Preference	
Earnings Before Interest and Taxes	
Earnings Per Share (Basic) – Incl. Extraordinary Items	
Net Income (Loss)	
Interest and Related Expense – Total	
Interest Paid – Net	
Dividends per Share – Ex-Date – Fiscal	
Price Close – Annual - Fiscal	

Financial firms are deemed ineligible for the study because their industry structure is vastly different from that of other industries. Financial firms are found according to their industry number, 6000-6999, and are then deleted from each year's list. Credit ratings are needed to calculate EVA; therefore any firms that did not have a credit rating listed were excluded. The number of firms left for each year is in the table below:

Table 2

Annual beginning and ending number of firms

Year	Number of Companies (Beginning)	Number of Firms Deleted	Number of Companies (Final)
2001	388	132	256
2002	387	130	257
2003	475	165	310
2004	463	149	314
2005	472	155	317
2006	473	156	317
2007	480	160	320
2008	486	160	326
2009	500	162	338
2010	500	153	347

Performance measures were calculated for each year, starting with EVA.

CALCULATING EVA

EVA has four major components that have to be calculated which include NOPAT, cost of equity, cost of debt, and WACC.

NOPAT is calculated by using Equation 2. The tax rate chosen for NOPAT is 35%, which is the general corporate tax rate. Although tax is subject to change depending on the type of company and/or industry, it is assumed that the companies in the S&P 500 are similar in size and therefore should be similarly taxed.

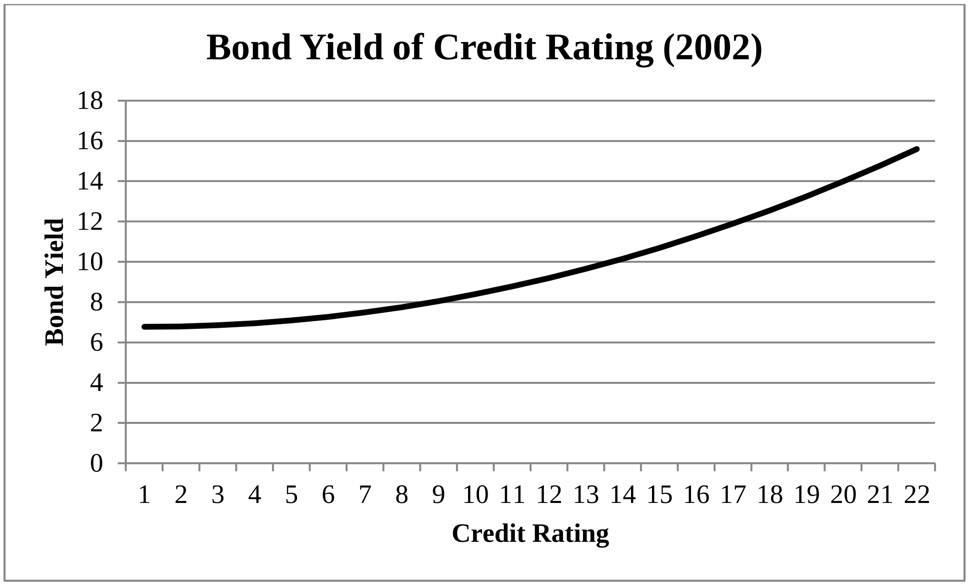
Cost of equity is calculated by using a power function. By using the Federal Reserve's AAA and BBB list of bond yields the two points are used as a method of finding the equation of the graph for each year. Each credit rating is assigned a number in ascending order starting with AAA bond yields at 0, and CC-, the lowest credit rating, at 21. 22 numbers are assigned in total. An adjusted variable is used in order to create the power function. The adjusted variable is found by setting the equation equal to the specific year's BBB yield. The give variables are plugged in, which is the AAA bond rate for the specific year, and the BBB credit rating number, 8.The equation then yields the answer to the adjusted variable, which is then used for the specific year. Equation 5, below, is used to estimate bond yields by credit rating for each year.

$$AAA\ bond\ rate + adj.variable * (Credit\ Rating\ \#)^2 \tag{5}$$

This method was chosen because the costs of equity could be universally applied to each firm – rather than having to calculate the CAPM for each company-.As an example, the estimated yields for each credit rating for 2002 are shown in Exhibit 2:

Exhibit 1

Bond yield by credit rating for 2002



The cost of debt is then calculated by Equation 6:

$$Cost\ of\ debt = \frac{Net\ Interest\ Paid}{(Total\ Assets - Preferred\ Stock - Common\ Stock} \tag{6}$$

The weighted average cost of capital is then calculated by Equation 3. All components are then combined using Equation 1 to calculate EVA.

The top portfolio includes companies with a high EVA, companies expected to offer the highest returns on investment. The bottom portfolio includes companies with the lowest EVA, companies expected to offer the lowest returns on investment.

CALCULATING ROA

In order to calculate ROA, net income is divided by total assets in Equation 7:

$$ROA = \frac{Net\ Income}{Total\ Assets} \quad (7)$$

Return on assets describes the profitability of the assets of a firm. A high ROA is desired for any firm because it suggests that the firm is efficiently and effectively using its assets. The issue with ROA is that it calculates the amount of tangible assets that a firm has and does not include intangible assets such as patents, trademarks, and software brand recognition. The growing technology sector, a sector of firms that usually use fewer tangible assets, tend to have higher ROAs. Companies like Coca-Cola for example, have their own truck fleet, import raw materials, and own several buildings. This makes it much more difficult to discern between companies that have lower ROAs due to their large amount of tangible assets, or because they do not use their assets effectively and efficiently.

The top companies for each year include companies with the highest ROA, companies that effectively use their assets. The bottom portfolio for each year includes companies with the lowest ROA, companies that either have a large amount of tangible assets or poorly allocate assets.

CALCULATING ROE

In order to calculate ROE, net income is divided by total equity in Equation 8:

$$ROE = \frac{Net\ Income}{Total\ Equity} \quad (8)$$

Return on equity measures the profitability of a firm per dollar invested by shareholders. A firm's ability to invest into effective and high value projects should yield a greater ROE. The

ROE metric is, however, sensitive to leverage. In other words, a company can be highly leveraged with debt and minimally financed with equity, therefore, creating a high ROE, at the cost of a lot of risk.

The top portfolio includes companies with a high ROE, firms that effectively allocate shareholder's money. The bottom portfolio includes companies with a low ROE, firms that do not allocate shareholder's money as effectively.

CALCULATING EARNINGS TO PRICE RATIO

In order to calculate the earnings to price ratio, earnings per share is divided by the beginning price of the stock in Equation 9:

$$Earnings\ to\ price\ ratio = \frac{Earnings\ per\ share}{Beginning\ price} \tag{9}$$

The E/P ratio is a metric that describes the market's willingness to pay for a company share. A company having a low E/P ratio could suggest future growth for it. Alternately, a low E/P ratio could suggest its stock is presently overpriced. A company having a high E/P ratio could mean the market expects lower future growth. On the other hand, it could indicate the stock is underpriced.

The reason why E/P was chosen, rather than using the popular price to earnings metric (P/E) is because the P/E ratio will be very high when a company reports earnings close to zero.

The top portfolio includes companies with the highest E/P ratios. A high E/P ratio is often consistent with stable companies that are well established. The bottom portfolio includes companies with the lowest E/P ratios, companies that are expected to grow, but with high risk.

CALCULATING THE SIGNIFICANCE OF THE FINDINGS

In order to calculate the significance of the findings, the returns produces using each performance metric are evaluated using four different comparison tools, including variance, confidence intervals, histogram comparisons, and correlation of the rankings.

TESTING THE DIFFERENCE IN AVERAGE RETURNS

The average returns from the top 50 portfolios created using each of the four performance metrics and the average returns from each of the four bottom 50 portfolios are compared to each other in order to determine any significant different between EVA and the rest of the performance metrics. Using a t-stat helps discover any significant differences in returns, and could explain whether EVA is a significantly different metric from the traditional ones. Significance of a mean return will be calculated by conducting an independent two-sample t-test.

An independent two-sample t-test will be used, with the assumption of equal sample sizes -50 stocks for each portfolio- and variance. In order to calculate the t-statistic for each set of variations, Equation 10 is used:

$$t = \frac{\overline{X_1} - \overline{X_2}}{s_{\overline{X_1} - \overline{X_2}}} \qquad \text{Equation 10}$$

Where

$$s_{\overline{X_1} - \overline{X_2}} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Using a sample size of 50, the degrees of freedom is 98. A t-statistic higher than 1.98 indicates significance at the 95% level for a 2-tailed test.

FINDING THE CONFIDENCE INTERVALS

Confidence intervals are used to determine reliability of an estimate, or in this case, a performance metric. Confidence intervals are calculated at the 95% confidence level as the mean return of the portfolio plus/minus two standard deviations. For each year and performance metric, I compare the confidence interval for the Top 50 portfolio return with the Bottom 50 portfolio return to see if they overlap. If the confidence intervals of the top and bottom portfolios overlap, then no significant difference can be discerned, and the performance metric is deemed useless. A useless performance metric would suggest that little difference exists between selecting stocks based on the metric or choosing them at random.

If EVA creates significantly fewer overlapping confidence intervals when compared to any of the traditional performance metrics, EVA would be considered a better performance metric.

USING HISTOGRAMS TO VISUALIZE THE DATA

Histograms allow researchers to evaluate results more visually. The histograms depict the frequency of returns within given ranges. When the ranges have been chosen, histograms of each set of returns (that is, for Top 50 and Bottom 50 portfolios for each performance metric for each year) are to be created. The graphs are then compared to see which sets have more densely packed sets of returns. The density of returns is a method to observe accuracy, similar to standard deviation. The more densely packed the returns are, the more stable and favorable a certain metric is compared to others.

The ranges of the frequency of returns were chosen based on the mean returns observed over the 10 years studied. The ranges of the returns grow in intervals of 12.5%. The volatility of different years and performance metrics yielded are shown below:

Table 3

Ranges of returns to analyze frequency

Return Range (positive values)	Return Range (negative values)
0 to 12.5	0 to -12.5
12.6 to 25.0	-12.6 to -25.0
25.1 to 37.5	-25.1 to -37.5
37.6 to 50.0	-37.6 to -50.0
50.1 to 62.5	-50.1 to -62.5
62.6 to 75.0	-62.6 to -75.0
75.1 to 87.5	-75.1 to -87.5
87.6 to 100.0	-87.6 to -100.0
100.0 to 112.5	-100.0 to -112.5

COMPARING METRICS BY FINDING THE CORRELATION OF THEIR RANKINGS

Correlation of the rankings compares two performance metrics based on their similarity to one another. If the components of two performance metrics are calculated very similarly, they should rank companies similarly. The S&P 500 is ranked according to each performance metric and the correlations between each metric are observed for each year. If EVA is a unique performance metric, a low correlation should be observed.

Two measures of correlation are estimated, Spearman's rank correlation coefficient (Spearman's rho) and Pearson product-moment correlation coefficient (Pearson's *r*).

Spearman's rho is a non-parametric measure that observes the significance of dependence between two variables. Non-parametric measures are used for data sets that are ranked with no exact interpretation, more specifically, ordinal data. Although the gathered data for this research is ranked based on real values, using both measures should allow for a clear understanding of the correlation of metrics. Spearman's rho uses a scale of 0 to +1. If the value is above 0.197, it is significantly different from zero at the 95% confidence level. The number of firms for each year will differ, based on available data; however, because the number of data points will range between 200 and 300, this 0.196 cutoff will not change.

Pearson's *r* measures linear dependence between two variables, performance metrics, using a -1 to +1 scale. A correlation +1 relationship represents perfect covariance, and a correlation of -1 represents perfect negative covariance. If the absolute value of the Pearson's correlation is more than 0.196, then the correlation is significantly different from zero at the 95% confidence level.

CHAPTER 5: EMPIRICAL RESULTS

MEAN RETURNS

The mean returns show little to no difference in the total average returns for each performance metric. During the positive economic years, prior to 2007, the mean returns were positive. The top portfolio showed considerably lower returns than the bottom mean returns. On the other hand, during negative economic years, 2007 and onwards, the top portfolios' mean returns were negative, but higher than the bottom portfolios' mean returns. This suggests there is more risk when investing into companies in poor financial position, however, there is also higher return expected when they do perform well.

EVA underperformed two of the other three performance metrics in the total average returns. Although EVA does not offer the lowest total returns, it does not, however, show any signs of significantly better earnings that the rest of the performance metrics. EVA yielded the highest returns, for the top portfolio, in four of the years, and the highest returns, for the bottom portfolio, in three of the years. Compared to E/P, for example, which yielded the most number of years with the highest earnings among the top and bottom portfolios, EVA did not outperform E/P. E/P yielded the highest returns, for the top portfolios, in four of the years, and the highest returns, for the bottom portfolios, in four of the years as well. Although EVA and E/P yielded a similar number of years of high earnings, EVA did not outperform any of the performance metrics in the total average returns. In fact, ROE yielded the highest total returns even though it did not show any significant number of years for highest returns. In order for EVA to be a better performance metric for stock performance, the total average returns and the number of years of highest earnings would have to be significantly higher.

Between 2007 and 2008 the returns of the top and bottom portfolios were within 1-11% of each other for each performance metric. This unusual phase may be result of the 2007 economic crisis. Stock markets had been severely impacted, affecting all companies. What is important to note is that no performance metric, including EVA, was able to prevent the disaster to a portfolio. The following years of data showed marginal differences in return of stocks, a time when the economy was attempting to regain ground through the aid of quantitative easing and other recovery efforts.

EVA did not seem to show any significant correlation in returns to any other performance metric. This may suggest that the components of EVA are significantly different from any of the other returns. The correlation of the rankings should offer more conclusive evidence of this.

Table 4

Mean returns of top and bottom portfolios

		ROA	ROE	E/P	EVA
2001-2002					
	Top 50	-7%	-9%	-5%	-19%
	Bottom 50	-26%	-28%	-26%	-24%
2002-2003					
	Top 50	19%	26%	41%	22%
	Bottom 50	73%	65%	67%	65%
2003-2004					
	Top 50	3%	8%	16%	7%
	Bottom 50	27%	25%	27%	26%
2004-2005					
	Top 50	1%	4%	2%	24%
	Bottom 50	12%	14%	22%	2%
2005-2006					
	Top 50	6%	11%	10%	19%
	Bottom 50	19%	19%	14%	12%
2006-2007					
	Top 50	15%	16%	21%	20%
	Bottom 50	4%	-3%	13%	15%
2007-2008					
	Top 50	-36%	-35%	-41%	-30%
	Bottom 50	-35%	-36%	-35%	-40%
2008-2009					
	Top 50	34%	48%	36%	19%
	Bottom 50	86%	66%	86%	65%
2009-2010					
	Top 50	20%	24%	11%	13%
	Bottom 50	17%	19%	18%	20%
2010-2011					
	Top 50	7%	1%	-2%	7%
	Bottom 50	3%	9%	7%	4%
Average Top 50		6%	10%	9%	8%
Average Bottom 50		18%	15%	19%	15%

CONFIDENCE INTERVALS

After conducting confidence intervals of the mean returns for each year, I found no convincing evidence that any of the performance metrics proved any more or less volatile than the other. The returns of each performance metric seemed to move in tandem, and years of higher volatility would result in overlapping confidence intervals for each performance metric.

It is important to note, however, that EVA had overlapping returns in 2002, and no signs of overlapping returns in 2004 and 2005, years when most performance metrics had overlapping returns. This may suggest that EVA performance differently than the rest of the performance metrics, and possibly, that it offers greater safety to investors. On the other hand, the 2005 year offered abnormal returns as visible in table 4, which means that 2004 is the only year of the two that offers reliable results. In the case that EVA only has one year that does not overlap when the rest do, which is similar to the result of ROE, the performance metric that did not create overlapping returns in 2007.

EVA had one of the lowest incidences of overlapping returns, with six years of overlapping returns. This would suggest that EVA may offer more safety to investors in that choosing a top or bottom portfolio using EVA yields significantly different returns. Although these findings may support EVA as a strong performance metric, there does not seem to be any significant evidence that EVA is a better metric than the rest.

Table 5

Confidence intervals of top and bottom portfolios

2001-2002	ROA	ROE	E/P	EVA
Top	-14%	-17%	-12%	**-26%**
	0%	-1%	3%	-12%
Bottom	-37%	-38%	-37%	-33%
	-16%	-18%	-16%	-14%

2002-2003	ROA	ROE	E/P	EVA
Top	12%	15%	33%	15%
	27%	37%	49%	30%
Bottom	52%	95%	97%	48%
	93%	134%	137%	83%

2003-2004	ROA	ROE	E/P	EVA
Top	-4%	1%	7%	2%
	9%	**15%**	**25%**	13%
Bottom	16%	14%	15%	15%
	38%	36%	39%	38%

2004-2005	ROA	ROE	E/P	EVA
Top	-5%	-2%	-9%	12%
	8%	**11%**	**13%**	35%
Bottom	4%	5%	10%	-4%
	19%	22%	33%	8%

2005-2006	ROA	ROE	E/P	EVA
Top	-4%	1%	-1%	**9%**
	16%	**21%**	**20%**	28%
Bottom	10%	9%	4%	6%
	28%	28%	23%	19%

2006-2007	ROA	ROE	E/P	EVA
Top	**7%**	5%	**11%**	**12%**
	23%	27%	31%	**28%**
Bottom	-7%	-11%	-2%	-1%
	14%	5%	28%	30%

2007-2008	ROA	ROE	E/P	EVA
Top	-42%	**-41%**	-48%	**-36%**
	-30%	-28%	**-34%**	-24%
Bottom	-41%	-43%	-43%	-46%
	-28%	-29%	-27%	-33%

2008-2009	ROA	ROE	E/P	EVA
Top	23%	28%	23%	13%
	46%	**68%**	48%	25%
Bottom	61%	48%	64%	41%
	111%	83%	109%	88%

2009-2010	ROA	ROE	E/P	EVA
Top	**11%**	**14%**	4%	8%
	30%	**34%**	**17%**	**18%**
Bottom	10%	12%	11%	12%
	24%	25%	25%	29%

2010-2011	ROA	ROE	E/P	EVA
Top	**-2%**	**-7%**	**-8%**	**0%**
	15%	**10%**	**4%**	**13%**
Bottom	-4%	-9%	-11%	-15%
	9%	27%	26%	23%

Bold numbers denote overlapping returns of the top 50 and bottom 50 portfolios.

CORRELATION OF THE RANKINGS

The correlation of the rankings was calculated using two different correlation measures, Spearman's Correlation and Pearson's R. All were significantly different from zero at the 95% confidence level. Although each performance metric shows moderately high correlation, some relationship should be expected as each performance metric uses some item from the income statement.

ROA and ROE showed the highest correlation as net income is integral to both of their calculations.

EVA has a moderate correlation with traditional performance metrics with the highest correlation to ROE, which revealed a total average 0.45 Spearman's, and 0.46 Pearsons' R correlations. This finding suggests some similarity in the components used to calculate both ROE and EVA. In fact, when observing the total average returns of the two metrics in Table 4, EVA and ROE do have similar returns, 8% and 10% for the top, respectively, and 15% and 15% for the bottom, respectively. This is not a positive finding as EVA should have little correlation with any of the performance metrics and significantly higher returns. If, however, EVA has lower volatility than ROE, according to the histograms, EVA may offer a lower risk of returns.

Table 6

Spearman's Rho of top and bottom portfolios

Total	ROA	ROE	E/P	EVA
ROA	1	0.78	0.42	0.41
ROE		1	0.48	0.45
E/P			1	0.29
EVA				1

2001-2002	ROA	ROE	E/P	EVA
ROA	1	0.91	0.76	0.75
ROE		1	0.78	0.76
E/P			1	0.70
EVA				1

2002-2003	ROA	ROE	E/P	EVA
ROA	1	0.85	0.64	0.52
ROE		1	0.67	0.57
E/P			1	0.34
EVA				1

2003-2004	ROA	ROE	E/P	EVA
ROA	1	0.85	0.52	0.53
ROE		1	0.61	0.62
E/P			1	0.40
EVA				1

2004-2005	ROA	ROE	E/P	EVA
ROA	1	0.77	0.32	0.41
ROE		1	0.46	0.51
E/P			1	0.36
EVA				1

2005-2006	ROA	ROE	E/P	EVA
ROA	1	0.77	0.34	0.06
ROE		1	0.49	0.15
E/P			1	-0.20
EVA				1

2006-2007	ROA	ROE	E/P	EVA
ROA	1	0.71	0.34	0.38
ROE		1	0.38	0.42
E/P			1	0.33
EVA				1

2007-2008	ROA	ROE	E/P	EVA
ROA	1	0.73	0.19	0.35
ROE		1	0.24	0.39
E/P			1	0.20
EVA				1

2008-2009	ROA	ROE	E/P	EVA
ROA	1	0.75	0.24	0.40
ROE		1	0.29	0.39
E/P			1	0.19
EVA				1

2009-2010	ROA	ROE	E/P	EVA
ROA	1	0.67	0.40	0.48
ROE		1	0.41	0.52
E/P			1	0.44
EVA				1

2010-2011	ROA	ROE	E/P	EVA
ROA	1	0.74	0.49	0.18
ROE		1	0.51	0.22
E/P			1	0.17
EVA				1

A correlation below .196 would suggest that performance metrics have little correlation.

Table 7

Pearson's r z-score of top and bottom portfolios

Total	ROA	ROE	E/P	EVA
ROA	1	0.76	0.37	0.40
ROE		1	0.45	0.46
E/P			1	0.28
EVA				1

2001-2002	ROA	ROE	E/P	EVA
ROA	1	0.83	0.55	0.57
ROE		1	0.59	0.62
E/P			1	0.38
EVA				1
2002-2003	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.84	0.61	0.48
ROE		1	0.64	0.54
E/P			1	0.30
EVA				1
2003-2004	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.86	0.48	0.50
ROE		1	0.61	0.60
E/P			1	0.38
EVA				1
2004-2005	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.76	0.27	0.39
ROE		1	0.44	0.49
E/P			1	0.33
EVA				1
2005-2006	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.75	0.29	0.09
ROE		1	0.45	0.18
E/P			1	-0.13
EVA				1

2006-2007	ROA	ROE	E/P	EVA
ROA	1	0.75	0.29	0.37
ROE		1	0.40	0.43
E/P			1	0.33
EVA				1
2007-2008	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.73	0.19	0.41
ROE		1	0.24	0.47
E/P			1	0.21
EVA				1
2008-2009	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.71	0.36	0.39
ROE		1	0.44	0.42
E/P			1	0.18
EVA				1
2009-2010	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.72	0.45	0.51
ROE		1	0.48	0.55
E/P			1	0.48
EVA				1
2010-2011	**ROA**	**ROE**	**E/P**	**EVA**
ROA	1	0.67	0.25	0.31
ROE		1	0.26	0.32
E/P			1	0.36
EVA				1

A correlation below .196 and above -.196 would suggest that correlation is not statistically significantly different from zero.

SIGNIFICANCE OF THE MEAN RETURNS

The t-test of the mean returns between portfolios selected using different performance metrics showed mixed results. Using a two-tail test with forty-eight degrees of freedom –found by df = N-2- the t-statistics have to be greater than 2.01 in order to be significant at the 95% confidence level. No distinct pattern is visible between EVA and the rest of the metrics. If EVA were to significantly outperform all of the performance metrics in mean returns, then a mixed pattern would be a positive sign in that it would mean that EVA is significantly different and better than the rest of the performance metrics.

2005 seemed to should the greatest significance as EVA's returns, top and bottom, were significantly different from the returns of all of the performance metrics, top and bottom. When looking at the Table 4 for the year 2005, EVA creates very different results, 24% return for the top and a 2% return for the bottom. It is almost as if the top and bottom returns should be reversed in order to match with the rest of the performance metrics. 2002 and 2009 yielded slightly similar results where the top return of EVA was significantly different from the rest of the performance metrics. In both of the years, EVA underperformed the rest of the performance metrics. After viewing Table Set 1 and 2, EVA did not show any signs of extreme volatility or a differently shaped graph relative to the other performance metrics.

EVA has the least in common with the E/P calculation. Six of the years showed significant t-stats. When observing the correlation of performance metrics in Tables 6 and 7, EVA and E/P had the least correlation, 0.29 and 0.28 for Spearman's Rho and Pearson's r, respectively. Therefore the findings in the significance of the returns agree with the data in Tables 6 and 7.

Table 8

Difference of means test compared to EVA portfolios (t-stat)

		ROA	ROE	E/P
2001-2002				
	Top 50	**2.25**	1.86	**2.68**
	Bottom 50	0.41	0.61	0.41
2002-2003				
	Top 50	0.53	0.53	**3.26**
	Bottom 50	0.54	0.05	0.15
2003-2004				
	Top 50	1.02	0.12	1.66
	Bottom 50	0.07	0.19	0.07
2004-2005				
	Top 50	**3.35**	**2.91**	**2.75**
	Bottom 50	1.83	**2.12**	**3.01**
2005-2006				
	Top 50	1.85	1.06	1.27
	Bottom 50	1.18	1.14	0.21
2006-2007				
	Top 50	0.80	0.49	0.19
	Bottom 50	1.15	1.94	0.14
2007-2008				
	Top 50	1.30	1.04	**2.41**
	Bottom 50	1.09	0.74	0.93
2008-2009				
	Top 50	**2.34**	**2.72**	**2.41**
	Bottom 50	1.23	0.06	1.28
2009-2010				
	Top 50	1.28	1.82	0.60
	Bottom 50	0.55	0.36	0.45
2010-2011				
	Top 50	0.04	0.96	1.90
	Bottom 50	0.11	0.40	0.27

Bold numbers denote significance of 1.98 at a 95% confidence level.

HISTOGRAM

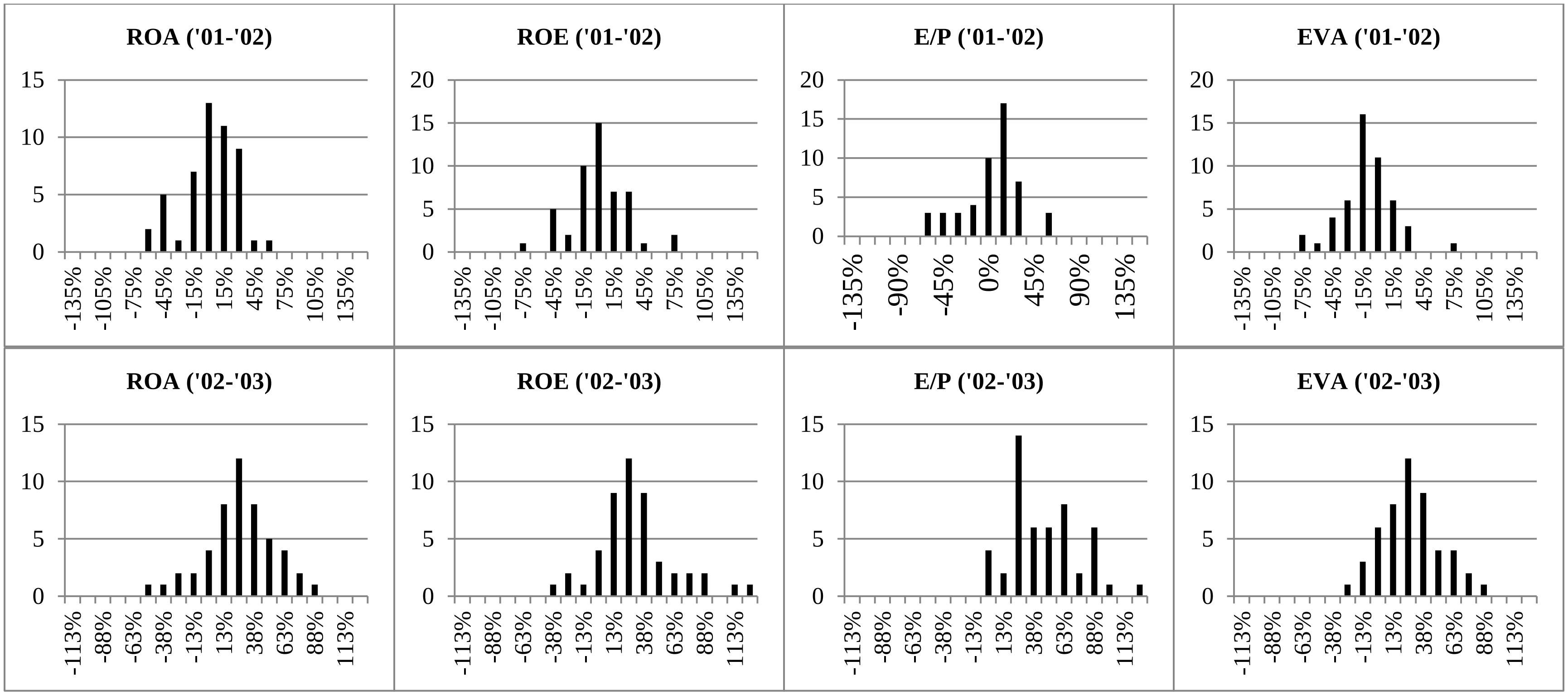
When looking at the visual depiction of the data, no real discernible difference can be detected. It could be said, however, that EVA does create a more “bell” shaped curve for the top mean returns when compared to the other metrics. Although a visual examination leads to little concrete evidence, it is important to note that some strength may lie behind EVA’s ability to find a more accurate grouping of returns, therefore, leading to more accurate and stable returns. On the other hand, EVA showed results similar to the traditional performance metrics in the bottom mean returns, which might suggest no more stability than the other metrics.

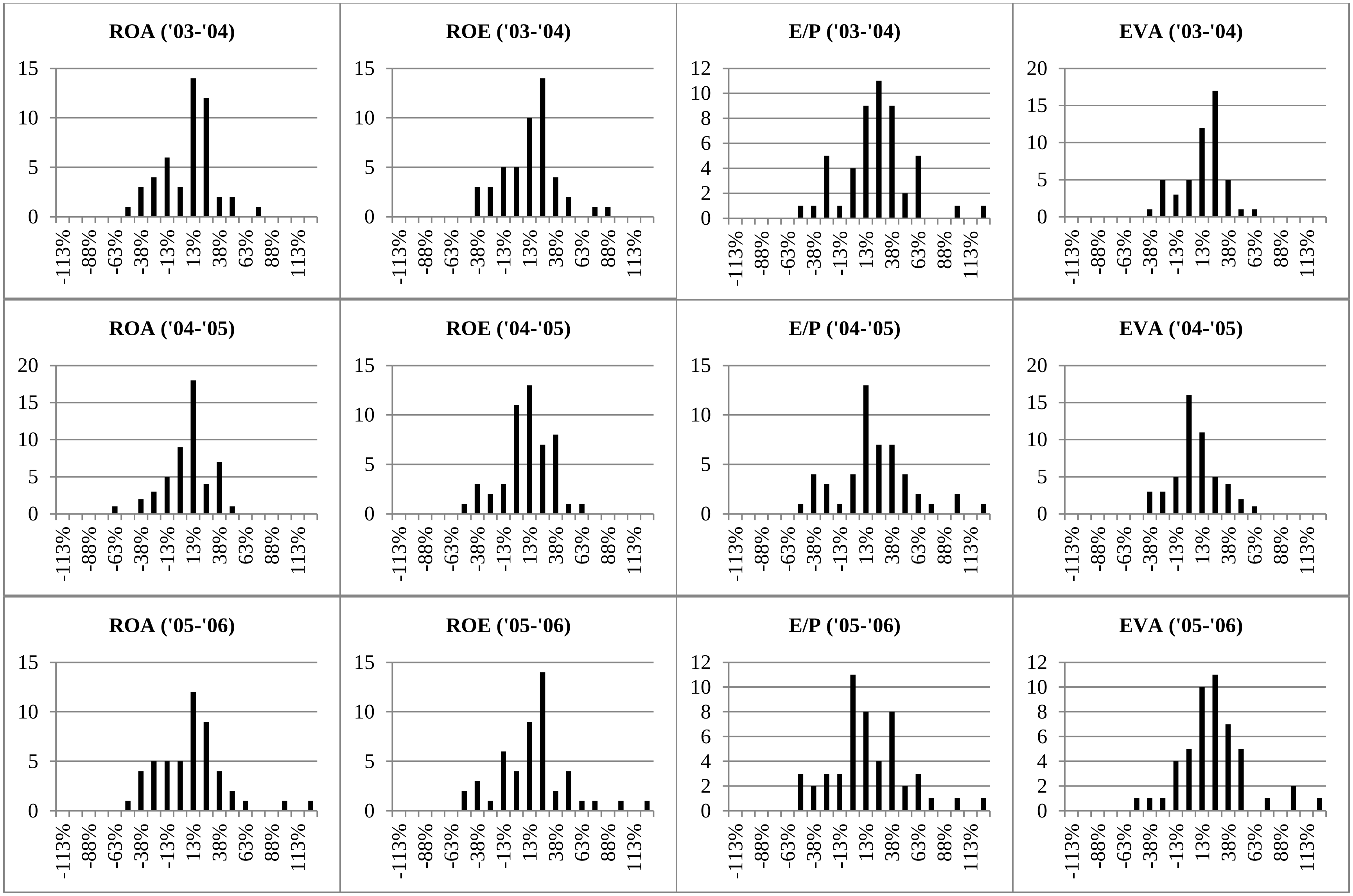
Each performance metric seemed to offer a tighter grouping of returns throughout the economic crisis, 2007 and onwards, compared to the prior years. In fact, using the data from Table 4 and comparing it to Table Set 1, it becomes visible that the performance metrics seem to offer similar returns throughout the economic crisis. This pattern may be due to similar investor sentiment throughout all industries. If EVA was a measure that would better adapt to a volatile environment, it should show a significantly better grouping of returns in Table Set 1, and offer higher overall returns in Table 4, neither of which is visible.

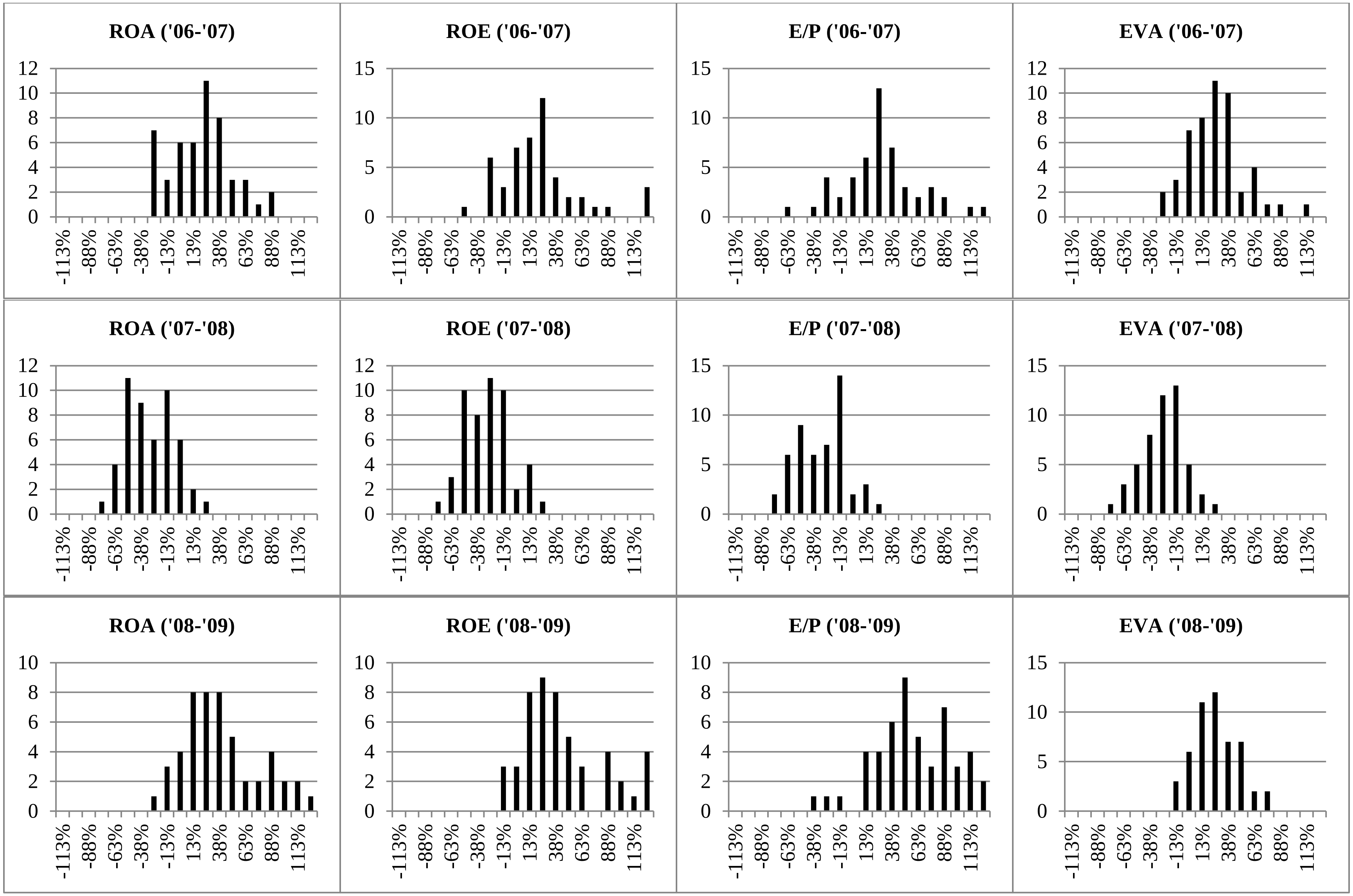
Table Set 2 offered mixed results with no outlying performance metric that would offer more or less stable returns. The bottom portfolio should offer the highest volatility as there is a higher risk of success. This lead to mixed results and, therefore, not much significance can be observed.

Table Set 1

Top 50 frequencies of returns




ROA ('03-'04)
15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROE ('03-'04)
15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
E/P ('03-'04)
12 10 8 6 4 2 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
EVA ('03-'04)
20 15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROA ('04-'05)
20 15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROE ('04-'05)
15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
E/P ('04-'05)
15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
EVA ('04-'05)
20 15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROA ('05-'06)
15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROE ('05-'06)
15 10 5 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
E/P ('05-'06)
12 10 8 6 4 2 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
EVA ('05-'06)
12 10 8 6 4 2 0
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%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EVA ('06-'07)
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E/P ('07-'08)
EVA ('07-'08)
ROA ('08-'09)
ROE ('08-'09)
E/P ('08-'09)
EVA ('08-'09)
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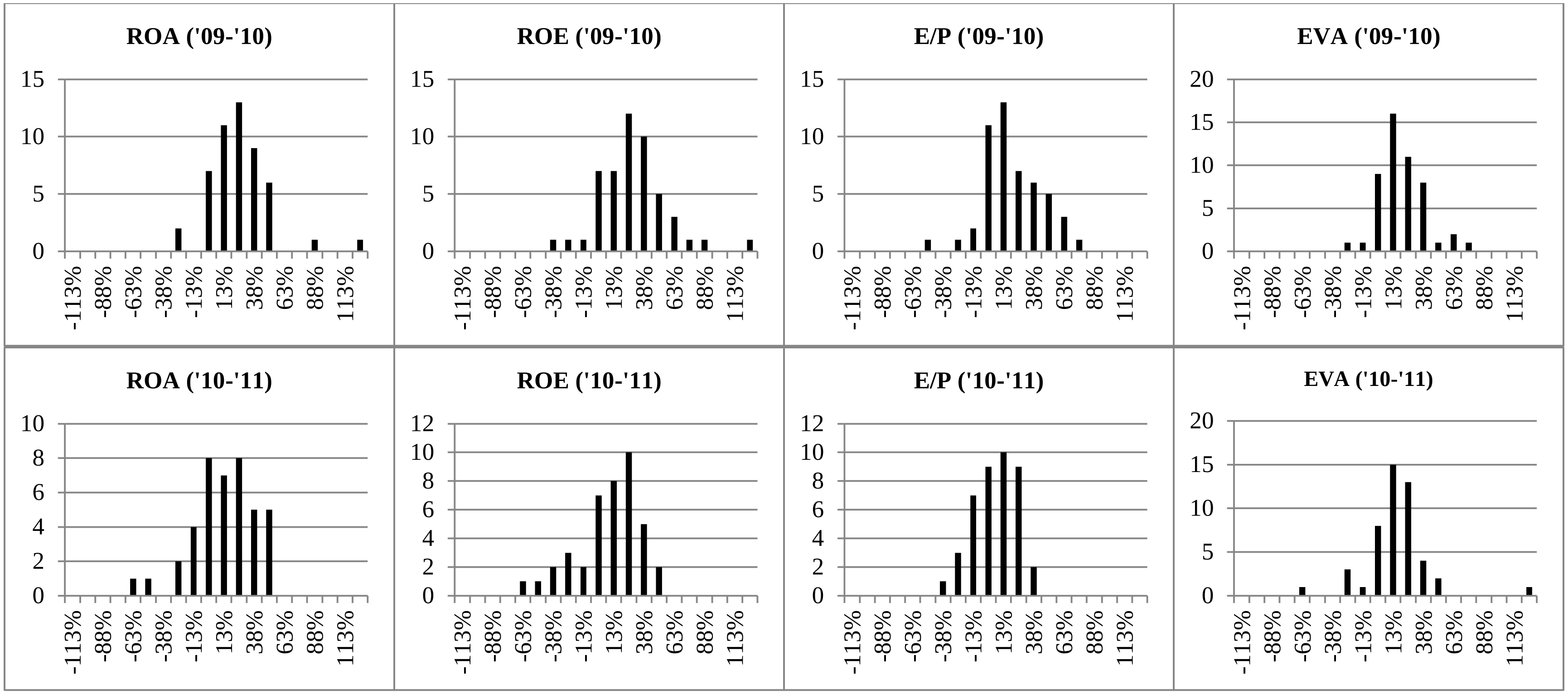
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EVA ('09-'10)
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ROE ('10-'11)
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EVA ('10-'11)
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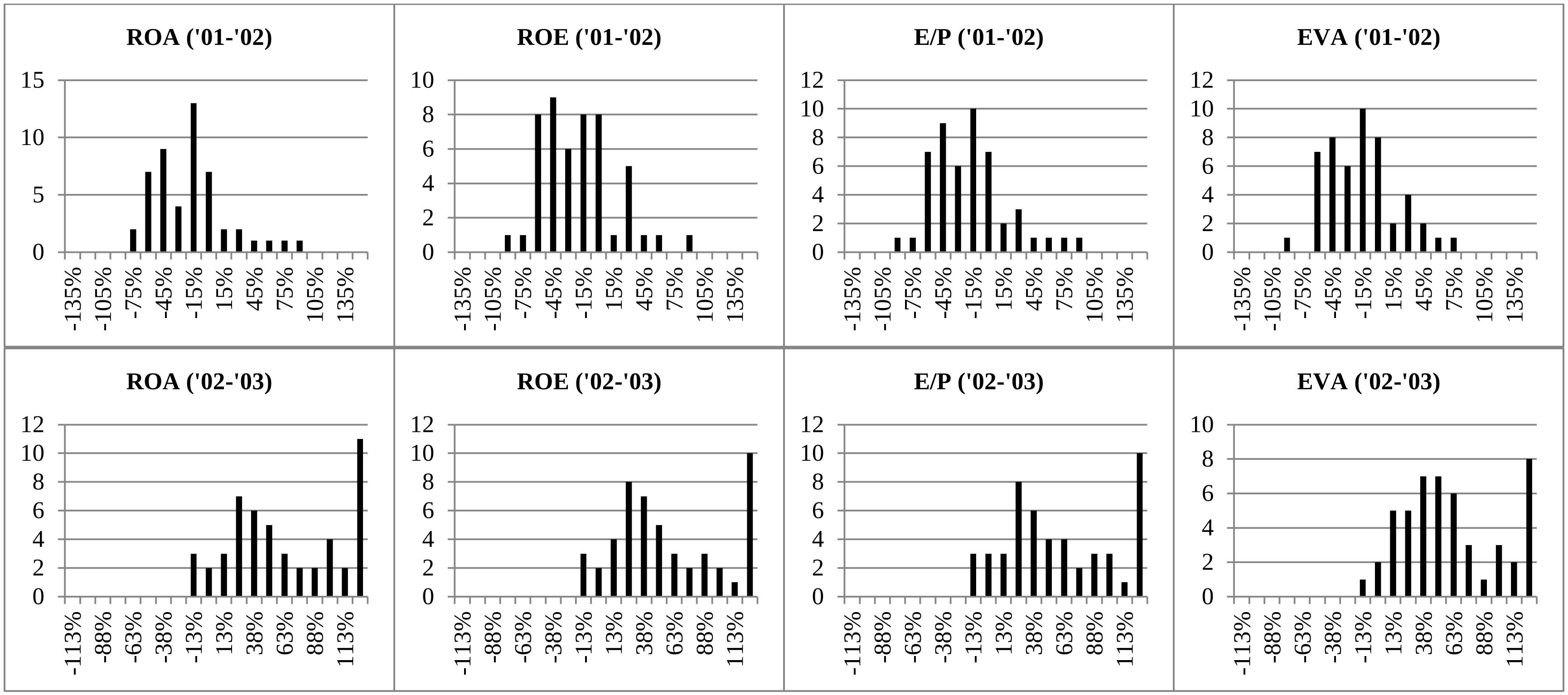
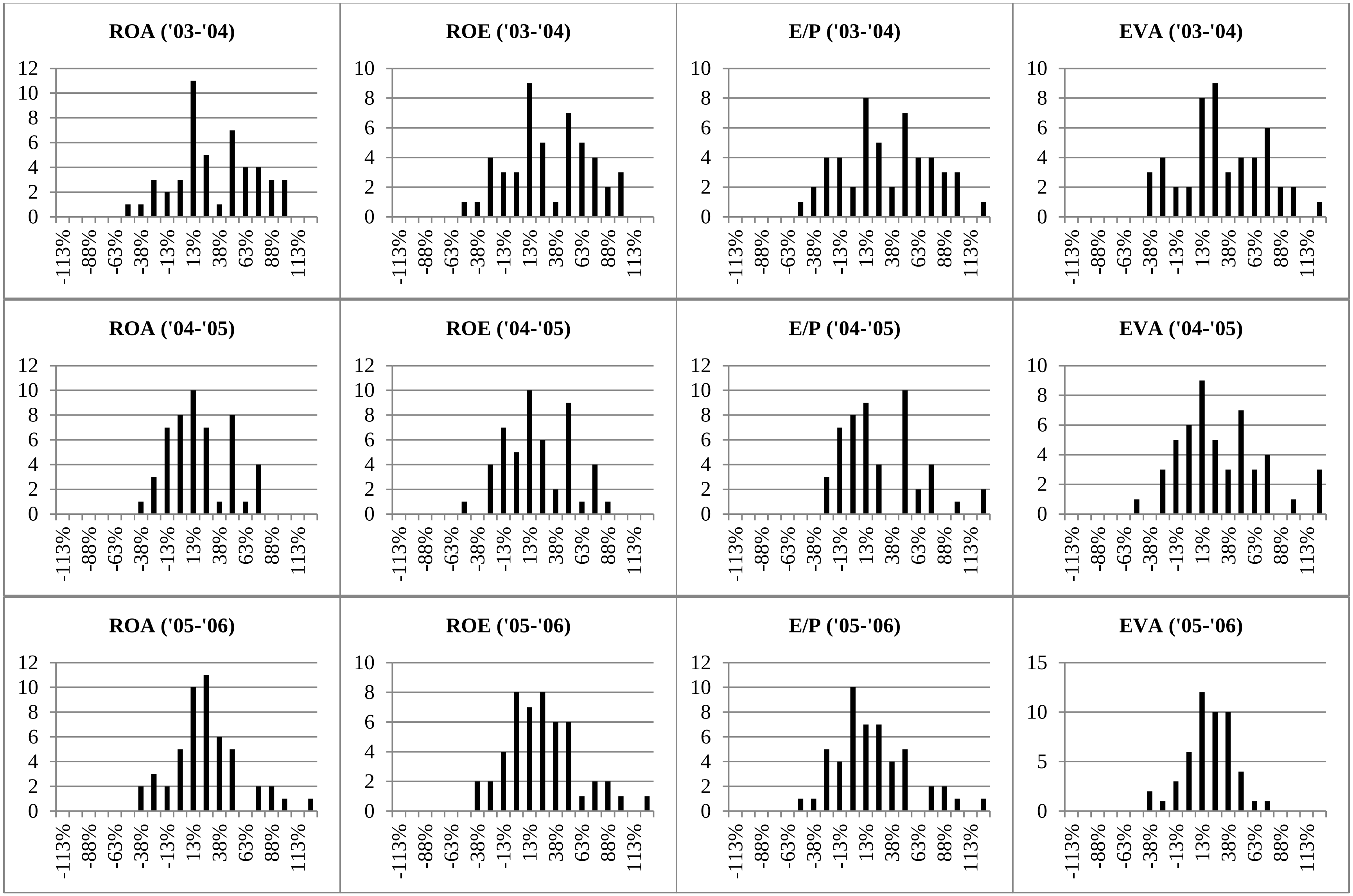
63%
88%
113%

Table Set 2

Bottom 50 frequencies of returns

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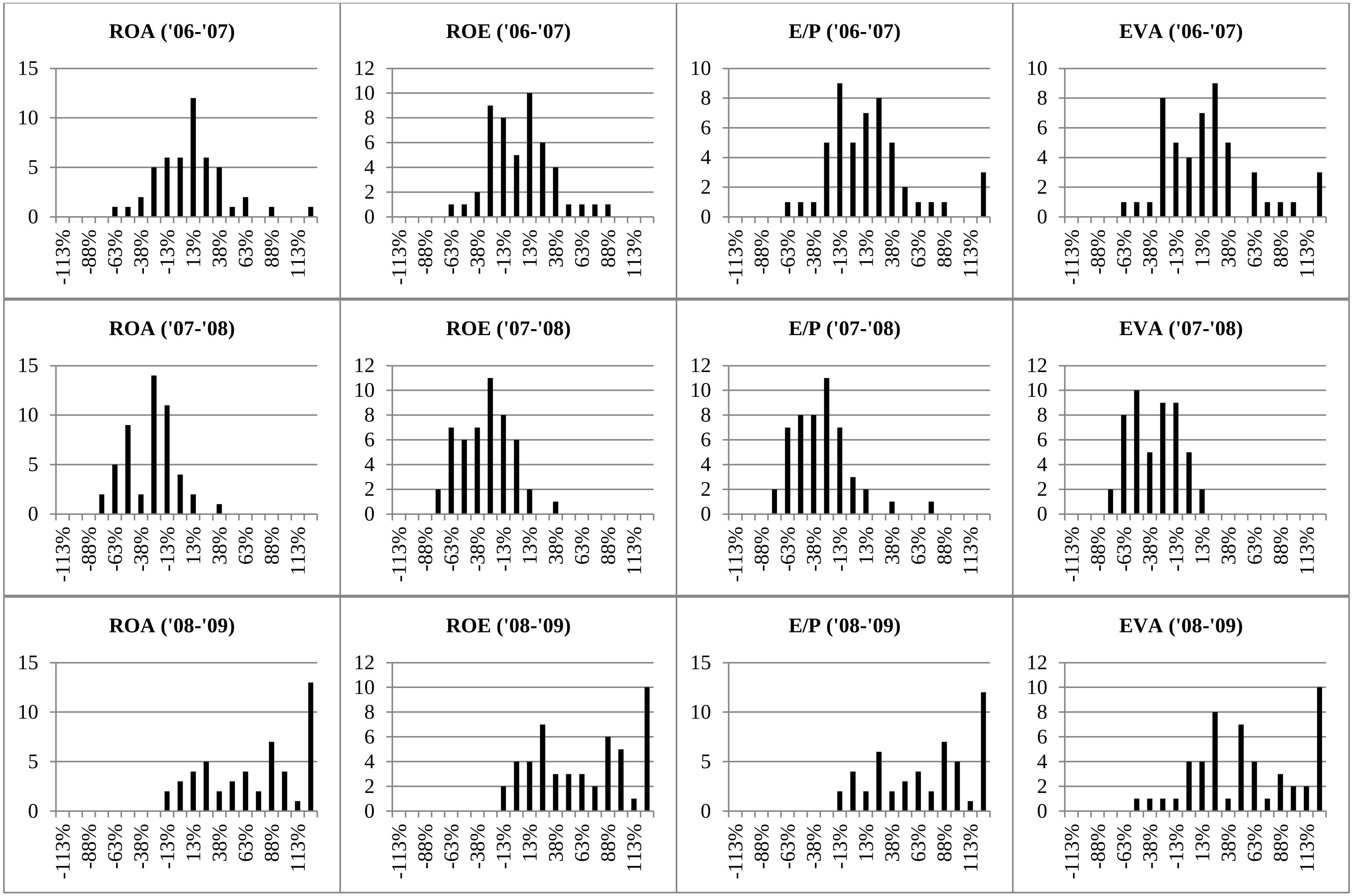
ROE ('03-'04)
E/P ('03-'04)
EVA ('03-'04)
ROA ('04-'05)
ROE ('04-'05)
E/P ('04-'05)
EVA ('04-'05)
ROA ('05-'06)
ROE ('05-'06)
E/P ('05-'06)
EVA ('05-'06)
0 2 4 6 8 10 12
0 5 10 15
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%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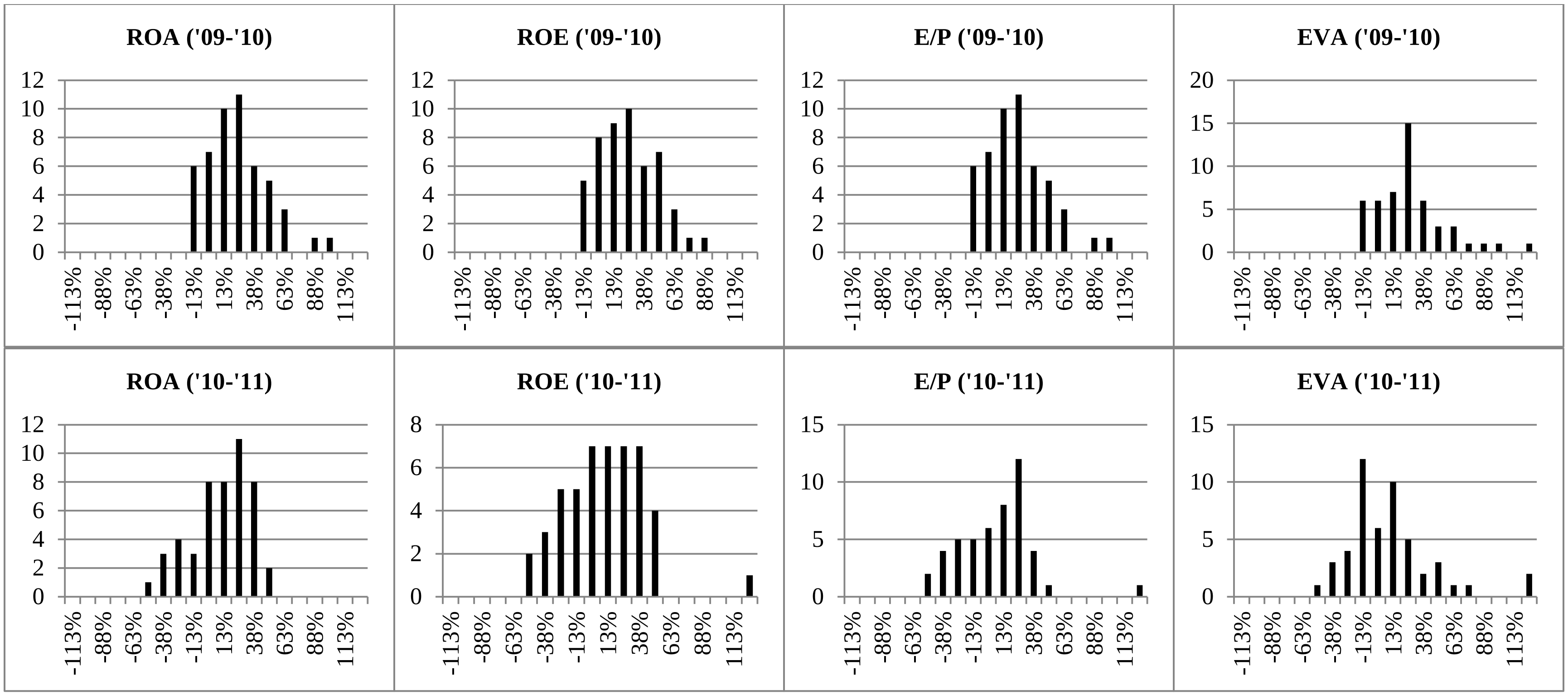
E/P ('06-'07)
EVA ('06-'07)
ROA ('07-'08)
ROE ('07-'08)
E/P ('07-'08)
EVA ('07-'08)
ROA ('08-'09)
ROE ('08-'09)
E/P ('08-'09)
EVA ('08-'09)
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%


ROA ('09-'10)
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-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROE ('09-'10)
0 2 4 6 8 10 12
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
E/P ('09-'10)
0 2 4 6 8 10 12
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
EVA ('09-'10)
0 5 10 15 20
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROA ('10-'11)
0 2 4 6 8 10 12
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
ROE ('10-'11)
0 2 4 6 8
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
E/P ('10-'11)
0 5 10 15
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%
EVA ('10-'11)
0 5 10 15
-113% -88% -63% -38% -13% 13% 38% 63% 88% 113%

CHAPTER 5: CONCLUDING REMARKS

Several results produced by this study suggest that selecting stocks using EVA does not offer less risk or higher returns for an investor. Although EVA did show better results than some of the performance metrics in different areas, such as the grouping of the histograms, there does not seem to be any strong evidence that EVA is a better metric. EVA is a difficult performance metric to calculate, with several complex components that can be calculated in several different ways such as NOPAT, cost of equity, and cost of debt. Any inaccurate information, or lack thereof, can significantly impact the outcome of returns. Traditional performance metrics, on the other hand, such as ROA, ROE, and E/P, are simple to calculate with few components, and offer only one way to calculate them.

Suggestions for future research on this topic would include reducing the limitations of the research.

The limitations of this studied included incomplete data of all S&P 500 companies, insufficient resources to gather the list of S&P 500 companies for each year, and the lack of data on bond yields for each credit rating.

All financial data was gathered from the Merged Global Fundamental Annual File and the S&P Credit Ratings Xpress databases, which, although provided the research with comprehensive information, large numbers of companies had to be deleted due to the lack of data. Most of the data lacking was the credit ratings of firms, which provided the basis for

Equation 5. Other missing data that was critical to the research included stock prices –beginning and/or ending-, and dividends.

Gathering annual lists of the S&P 500 also proved to be difficult. This meant that the research relied on the 2012 list of companies on the S&P 500. Many companies on the 2012 list had not yet been formed, or were still relatively small companies, meaning that most of the years of data had substantially fewer companies to sort through. Fewer companies meant that the performance metrics had to choose from a smaller list, therefore, making the potential for correlation higher.

The lack of data on bond yields of credit ratings made Equation 5 much more difficult and inaccurate to calculate, therefore, making EVA less accurate in the study. Much of today's calculations for cost of equity are estimates and cannot take all information of a company's borrowing costs into account. Bond yields are critical to calculating EVA, and could potentially change the outcome of the study.

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