Total Return and Risk:
Does Higher Total Return Always Require Accepting Higher Risk?

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Abstract

Standard & Poor's stock reports contain information to assist investors in their decisions to buy, sell, or hold common stock in publicly traded companies. A key determinant in the decisions involves whether or not an investor can expect adequate return for the risk taken. Expected return should come from historical relationships between measures of return and risk. Stock reports contain historical measures of return by showing the total dollar accumulation of a $10,000 investment over the past five years, and historical measures of risk in the form of valuations compared to market, company size, stability of earnings and dividends, stock price volatilities, and betas. This study compared the total return for companies to these risk measures. Regressions results show that the risk measures explained very little of total stock return, although valuation compared to market, the stability of earnings and dividends, and beta were found to have the expected positive relationship between risk and return. Nonparametric tests of medians support the regression results for valuation compared to market and the stability of earnings and dividends. However, the nonparametric results show beta has no relationship to total return.

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Introduction

Standard & Poor's stock reports contain information to assist investors in their decisions to buy, sell, or hold common stock in publicly traded companies. A key determinant in the decisions involves whether or not an investor can expect to be adequately compensated for the risk borne. Historical measures of return and risk provide investors with some indication of what to expect from future measures. Stock reports contain a historical measure of return by showing the total dollar accumulation of a $10,000 investment over the previous five years. Stock reports also contain a measure of risk, beta, which corresponds with the period of total dollar accumulation. Beta is calculated using five years of month-end stock prices. Other measures or risk also appear, in the stock reports, including the size of the company, a quality ranking for the stability of company earnings and dividends, volatility in the market value of a company's stock price, and the value of a company's stock compared to its current market price. This study compares the total return for companies to their beta and other risk measures using both parametric and nonparametric statistical analyses to determine the extent of any relationships between return and

risk measures. In particular, the nature of any relationship between total dollar accumulation and beta will be revealed.

Data are from Standard & Poor's stock reports found in Net Advantage, retrieved in May, 2014. The data used from the stock reports include the total dollar accumulation of an investment of $10,000 in company stock over the past five years, the beta using month-end prices for the previous five years, the quality of earnings and dividends as measured by their stability, the risk of owning the stock measured by the volatility in market value over the previous year, and a company's star rating which indicates its estimated valuation relative to its market value. The data contain 843 companies with complete data.

The methodology consists of both parametric and nonparametric statistical analyses. The parametric analyses involve Pearson correlations and ordinary least squares (OLS) regressions. All pairs of variables are examined for significant correlations. In the OLS regressions, total dollar accumulation is the dependent variable, and the risk measures are the explanatory variables. A stepwise procedure is also implemented to find OLS regressions that reflect the strongest explanatory variables and checks for the impact of multicollinearity. Since the parametric results assume normality in variable distributions and equal variances, nonparametric statistical analyses, which are not as sensitive to the form of variable distributions and variance equality are also used. Nonparametric tests include the Kruskall-Wallis and Mood's tests of medians. These tests examine the data for equality of dollar accumulation medians across risk levels.

The parametric results show that beta is a significant predictor of total dollar accumulation; however, the variation explained is very small. The same is true for the quality of earnings and dividends, as well as the volatility in market value. The nonparametric results provided by the Kruskall-Wallis and Mood's test of medians show that total dollar returns are different by risk level, but the medians for each risk level provided in the output of both tests show wide variation with no consistent pattern or trend. In addition, confidence intervals for total dollar return medians at the different levels of beta shown by the Mood's test of medians output reveal that almost all medians have 95 percent confident intervals that are nearly identical. The results show that while beta and some other risk measures are not associated with total dollar return, the best association is between the valuation relative to market and total dollar return. Companies assigned undervalued ratings in Standard and Poor's Net Advantage stock reports tend to be those with the highest total dollar returns in the previous five years. This study should help investors assess the usefulness of those stock reports.

The paper proceeds with a literature review, followed by a section describing in more detail the data and methodology. Another section presents and describes the results. The paper ends with conclusions from the study and some suggestions for further research.

Literature

Amihud and Mendelson (1989) did a joint test of the association of portfolio stock returns and risk. The beta and bid-ask spread risk measures were found to be significant and directly related to return and the residual risk and company size risk measures were not found to be significant. However, the paper does not contain any information about how much return variation was explained by any of the risk measures.

Fant and Peterson (1995) used annual stock returns from 1973 through 1991 to find a significant negative relationship between company size and stock returns, and a significant positive relationship between book to market ratios and stock returns. They did not find a

significant relationship between prior returns and stock returns, nor between end-of-year 100-day betas and stock returns. These authors did not report the extent of variation in returns explained.

Pettengill, Sundaram, and Mathur (1995) used 660 months of stock return data to calculate betas and form 20 portfolios based on a ranking of the betas. Portfolios with the lowest betas had lower average returns, and portfolios with the highest betas had the highest annualized average returns. A regression of these portfolio betas and portfolio returns produced results that explained over 88 percent of the variation in portfolio returns.

Guo and Whitelaw (2006) found that stock market volatility explained less than one percent of the expected returns on stocks using two set of monthly data and one set of quarterly data covering the time period from 1952 through 2002, thus calling into question the viability of using beta to estimate expected returns.

Nyberg (2012) used a QR-GARCH-M model and stock returns from the NYSE, AMEX, and NASDAQ for months from 1960 to 2009 and found a positive relationship between conditional mean and conditional variance of stock returns that was irrespective of the state of the business cycle and also showed that variance increased during recessions. Of course the strength of the overall relationships is not determined by the model.

Frazzini and Pedersen (2014) find that average returns in stock portfolios sorted by beta are similar. This phenomenon was observed for both U.S. and international stocks over various time periods. They also find that risk-adjusted returns are higher for low-beta stocks than for high-beta stocks. Their study uses 55,000 stocks from 20 different countries over periods as long as 1926 to 2012.

Data

All data are from Standard and Poor's Net Advantage Stock Reports retrieved in May, 2014. The total dollar accumulation return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends, and is identified as the return variable. The value of the company in comparison to its current market value is called Stars, which stands for Standard and Poor's Stock Appreciation Ranking System. Stars measures the short-term appreciation potential, coded one for the poorest potential and five for the best potential. Stocks with high potential for appreciation are considered low risk. The size of the company is measured with a variable called Market, which is the total of all traded common stock times the recent price per share in billions of dollars. The volatility of a stock compared to the movement of other stocks is called Beta. Beta is the regression coefficient obtained using the S & P 500 index to explain five years of month-end stock prices. Company stock with a low beta is considered to have a low level of risk. The stability of earnings and dividends through time is measured with a variable called Quality. Quality is a rating from A+ to D-, coded 1 for A+, 2 for A, 3 for A-, etc. that assesses the relative growth and stability of earnings and dividends over the past 10 years. Companies with a Quality coding of one are considered to be low risk. The volatility of a company's stock price over the past year is a measure of risk called Risk. Companies are rated into one of three Risk levels: low, medium, and high, which are coded 1, 2, and 3 respectively. The data contain 843 companies with complete sets of variables. Table 1 contains summary statistics for all the variables.

Table 1: Descriptive Statistics

	Mean	Std. Dev.	Median	Minimum	Maximum	Skewness	Kurtosis
Return	29,050	21,404	24,364	988	227,207	3.96	24.70
Stars	3.26	0.85	3	1	5	-0.04	0.19
Market	20.15	42.37	6.94	0.06	526.84	5.73	45.61
Beta	1.30	0.69	1.20	-0.10	5.08	1.20	2.40
Quality	4.56	1.62	5	1	8	-0.09	0.07
Risk	2.14	0.64	2	1	3	-0.12	-0.58

Note: N = 843. Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Stars stands for Standard and Poor's Stock Appreciation Ranking System, which measures short-term appreciation potential, coded one for the poorest potential and five for the best potential. Market is the total of all traded common stock times the recent price per share in billions of dollars. Beta is the regression coefficient obtained using the S & P 500 index to explain five years of month-end stock prices. Quality is a rating from A+ to D-, coded 1 for A+, 2 for A, 3 for A-, etc. that assess the relative growth and stability of earnings and dividends over the past 10 years. Risk Rates the volatility of the stock's price over the past year, with low, medium, and high categories coded 1, 2, and 3 respectively. All data are from Standard and Poor's Net Advantage Stock Reports retrieved in May, 2014.

Methodology

The methodology consists of both parametric and nonparametric statistical analyses. The parametric analyses involve Pearson correlations and ordinary least squares (OLS) regressions. All pairs of variables are examined for significant correlations. In the OLS regressions, total dollar accumulation is the dependent variable, and the risk measures are the explanatory variables. A stepwise procedure is also implemented to find OLS regressions that reflect the strongest explanatory variables and checks for the impact of multicollinearity. Since the parametric results assume normality in variable distributions and equal variances, nonparametric statistical analyses, which are not as sensitive to the form of variable distributions and variance equality are also used. Nonparametric tests include the Kruskall-Wallis and Mood's tests of medians. These tests examine the data for equality of dollar accumulation medians across risk levels.

Parametric

The Pearson correlations are parametric analyses that show relationships between each pair of variables in the analysis. These correlations are between each risk variable and the Return variable, as well as between each pair of risk variables. This provides an indication of potential associations, as well as possible multicollinearity problems in the regressions.

The ordinary least squares (OLS) regressions are also parametric analyses used to explain Return with the risk measures. A full regression using all risk measures to explain return is employed, in addition to a Stepwise procedure that puts one risk measure in at a time. The Stepwise procedure, which runs a series of OLS regressions starting with one explanatory variable at a time and adding those that still increase the adjusted R-square, is useful to show the strongest variables and their explanatory power. In addition, the Stepwise procedure shows the

impact on those variables previously entered of adding a new explanatory variable. This provides evidence of the impact that multicollinearity has on regression coefficients. Any coefficient previously entered that becomes less significant or that changes sign can be suspected as being impacted by multicollinearity from the new variable.

All regressions are testing the following null and alternative hypotheses:

H_0: Return is not associated with the measures of risk.

H_A: Return is associated with at least one measure of risk.

The general form of the full regression and the hypothesized direction of the relationships is:

$$\text{Return} = f(\underset{-}{\text{Stars}}, \underset{-}{\text{Market}}, \underset{-}{\text{Quality}}, \underset{+}{\text{Beta}}, \underset{+}{\text{Risk}})$$

Stars has a negative expected relationship to Return because companies that are most undervalued (having the highest number of stars, five) should pose the least amount of risk to investors, and should also provide the least return. Market has a negative expected relationship because the largest companies in terms of market capitalization should provide the least risk to investors, and consequently the least return. Quality has a negative expected relationship to return because companies with more stable earnings and dividends expose investors to less risk, and therefore investors should receive less return. Beta has a positive expected relationship to return because stocks whose prices fluctuate more in relation to a large group of stocks subject investors to more risk, which should result in more return. Finally, Risk also has a positive relationship because more volatile stock prices are riskier to investors and should provide investors with higher return.

Nonparametric

The nonparametric analyses involve testing the medians for differences by level of risk for each risk measure. Both the Kruskall-Wallis and Mood's tests are employed. These tests are alternatives to the one-way analysis of variance technique. The null and alternative hypotheses for both tests are:

H_0: Median returns are the same for all risk levels.

H_1: Median returns are not the same for all risk levels.

An assumption for the Kruskall-Wallis test is that samples from the different populations are independent and random samples from continuous distributions, with the distributions having the same shape. The Kruskal-Wallis test is more powerful than Mood's median test for data from many distributions, including data from the normal distribution, but is less robust against outliers. An assumption of Mood's median test is that data from each population are independent random samples, and population distributions have the same shape. Mood's median test is robust against outliers and errors in data. Mood's median test is less powerful than the Kruskall-Wallis for data from many distributions, including the normal. These are reasons to use both tests, but another reason is the each test provides output that is both similar and different. The similar output provided by both tests is the median return for each level of risk, along with a p-value providing a level of significance to reject the null hypothesis. However, the Kruskall-Wallis test also provides the average rank of the Return variable within each risk level, and a z-score for each risk level showing how many standard deviations is the mean for the risk level above or below the overall Return mean. In addition, Mood's median test shows the number of Return values in each risk level above and below the overall return median, and also provides a 95 percent confidence interval for the population median in each risk level. These confidence

intervals can be compared to see which do not overlap, therefore suggesting differences in Return median between specific risk levels.

Results

The results from examining the association between returns and various risk measures are first discussed for the parametric analyses, then for the nonparametric analyses.

Parametrics

The parametric analyses start with a correlation matrix and continue with a series of ordinary least square regressions.

The correlation matrix is shown in Table 2. Pearson correlations are show between all pairs of variables with their p-values below them in parentheses. Of the five risk measures used to explain return, only three are significant. The Stars, Beta, and Risk variables are significant, although Risk is significant at only the six percent level. Most of the risk variables have low correlations between each other. The highest correlation between any pair of risk variables occurs between Risk and Quality. However, since Quality is not correlated with Return, it is doubtful that the correlation will cause much distortion from multicollinearity in the regressions.

Table 2: Correlation Coefficients

	Return	Stars	Market	Beta	Quality
Stars	0.123				
	(0.00)				
Market	-0.020	0.077			
	(0.57)	(0.025)			
Beta	0.188	0.159	-0.125		
	(0.00)	(0.00)	(0.00)		
Quality	0.022	0.118	-0.290	0.398	
	(0.52)	(0.00)	(0.00)	(0.00)	
Risk	0.064	0.056	0.332	0.332	0.459
	(0.06)	(0.10)	(0.00)	(0.00)	(0.00)

Note: N = 843. Pearson correlations are on top, p-values are beneath them in parentheses. Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Stars stands for Standard and Poor's Stock Appreciation Ranking System, which measures short-term appreciation potential, coded one for the poorest potential and five for the best potential. Market is the total of all traded common stock times the recent price per share in billions of dollars. Beta is the regression coefficient obtained using the S & P 500 index to explain five years of month-end stock prices. Quality is a rating from A+ to D-, coded 1 for A+, 2 for A, 3 for A-, etc. that assess the relative growth and stability of earnings and dividends over the past 10 years. Risk Rates the volatility of the stock's price over the past year, with low, medium, and high categories coded 1, 2, and 3 respectively. All data are from Standard and Poor's Net Advantage Stock Reports retrieved in May, 2014.

The regressions are in Table 3. The full regression uses all five risk measures to explain Return. Three risk measures are significant. Stars and Beta are positively related to Return, and Quality is negatively related. The Stars and Beta coefficients imply that undervalued stocks have

typically had higher returns in the past, and stocks more volatile to the market also have had higher returns. The Beta relationship is consistent with the findings in Amihud and Mendelson (1989) and Pettengill, Sundaram, and Mathur (1995). However, the Quality coefficient implies that companies with more stable earnings and dividends have higher returns. Especially important is the very low adjusted r-square of the full regression, consistent with the findings in Guo and Whitelaw (2006). The Stepwise regressions, also in Table 3, reveal the same three significant risk measures, and suggest an absence of major distortion from multicollinearity.

Table 3: Regression Results

Full Regression
Return = 16,150 + 2,600 Stars - 11.6 Market + 5,982 Beta -1,149 Quality + 994 Risk
(0.00) (0.00) (0.52) (0.00) (0.03) (0.45)
Adjusted R-square = 4.4%; Highest Cook's Test value = 0.11
Stepwise Regressions
Return = 21,510 + 5,808 Beta
(0.00) (0.00)
Adjusted R-square = 3.4%; Highest Cook's Test value = 0.10
Return = 14,220 + 5,336 Beta + 2,421 Stars
(0.00) (0.00) (0.01)
Adjusted R-square = 4.2%; Highest Cook's Test value = 0.18
Return = 16,967 + 6,166 Beta + 2,520 Stars - 909 Quality
(0.00) (0.00) (0.00) (0.06)
Adjusted R-square = 4.5%; Highest Cook's Test value = 0.14

Note: N = 843 for all regressions. P-values are in parentheses. Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Stars stands for Standard and Poor's Stock Appreciation Ranking System, which measures short-term appreciation potential, coded one for the poorest potential and five for the best potential. Market is the total of all traded common stock times the recent price per share in billions of dollars. Beta is the regression coefficient obtained using the S & P 500 index to explain five years of month-end stock prices. Quality is a rating from A+ to D-, coded 1 for A+, 2 for A, 3 for A-, etc. that assess the relative growth and stability of earnings and dividends over the past 10 years. Risk Rates the volatility of the stock's price over the past year, with low, medium, and high categories coded 1, 2, and 3 respectively. All data are from Standard and Poor's Net Advantage Stock Reports retrieved in May, 2014.

Nonparametrics

The nonparametric analyses consist of both a Kruskal-Wallis test and a Mood's test for Return medians in the categories of each risk measure.

Table 4a has results from the Kruskal-Wallis test of Return medians for each Stars category. The test suggests that median Returns are different, with overvalued companies associated with lower past returns, and undervalued companies associated with higher past returns. Table 4b looks at the same two variables using the Mood's test. The Mood's test provides the number of companies in each Stars category whose median returns are below and above the overall median return. In addition, the test provides a graph of confidence intervals for median Return showing substantial differences in medians, especially between Stars level 1 and level 5 categories.

Table 5a has results from the Kruskal-Wallis test of Return medians for each Market category. Market categories were created after sorting the variable and dividing it into five approximately equal groups. The test suggests that median Returns are different, with larger companies associated with higher past returns, and smaller companies associated with lower past returns. Table 5b looks at the same two variables using the Mood's test. The Mood's test provides the number of companies in each Market category whose median returns are below and above the overall median return. In addition, the test provides a graph of confidence intervals for median Return showing substantial differences in medians, especially for the smallest of all companies in the fifth category compared to the other four categories with larger companies.

Table 6a has results from the Kruskal-Wallis test of Return medians for each Quality category. The test suggests that median Returns are different, with companies having more stable earnings and dividends associated with higher past returns, and companies with more volatile earnings and dividends associated with lower past returns. Table 6b looks at the same two variables using the Mood's test. The Mood's test provides the number of companies in each Quality category whose median returns are below and above the overall median return. In addition, the test provides a graph of confidence intervals for median Return showing substantial differences in medians, especially for companies with the highest volatility in category 8 compared to companies with more stable earnings and dividends, especially those in categories 1 through 4. Recall that no companies were classified by Standard and Poor's as category 7.

Table 7a has results from the Kruskal-Wallis test of Return medians for each Risk category. The test suggests that median Returns are different, with companies whose stock is classified as having medium volatility having the highest past returns, and companies whose stock has had the highest volatility have had the lowest past returns. Table 7b looks at the same two variables using the Mood's test. The Mood's test provides the number of companies in each Risk category whose median returns are below and above the overall median return. In addition, the test provides a graph of confidence intervals for median Return showing substantial differences in medians, especially for companies with the highest volatility in category 3 compared to companies with more stable stock prices in category 2.

Table 8a has results from the Kruskal-Wallis test of Return medians for each Beta category. Beta categories were created after sorting the variable and rounding to one decimal point. The categories do not contain an equal number of companies, but do contain companies with similar betas. The test suggests that median Returns are different, but there are no concentrations of differences throughout the categories, neither is any pattern observable. Table 8b looks at the same two variables using the Mood's test. The Mood's test provides the number of companies in each Beta category whose median returns are below and above the overall median return. Although the test suggests some differences in means, it is hard to discern any but a few differences, and again there appears to be no clustering of significance, nor discernible pattern.

Table 4a: Kruskal-Wallis Test for Return versus Stars

Stars	N	Median	Ave Rank	Z
1	19	16457	262.0	-2.90
2	104	22627	370.8	-2.29
3	417	24479	424.7	0.32
4	242	24972	437.6	1.18
5	61	27207	478.7	1.89
Overall	843		422.0	

H = 17.16 DF = 4 P = 0.002

H = 17.16 DF = 4 P = 0.002 (adjusted for ties)

Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Stars stands for Standard and Poor's Stock Appreciation Ranking System, which measures short-term appreciation potential, coded one for the poorest potential and five for the best potential.

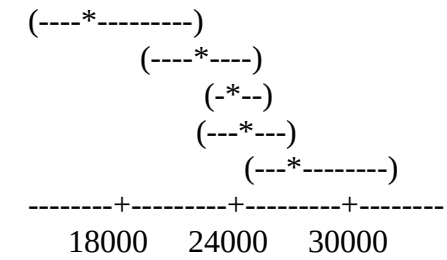
Table 4b: Mood Median Test for Return versus Stars

Chi-Square = 14.66 DF = 4 P = 0.005

Stars	N<=	N>	Median	Q3-Q1
1	16	3	16457	11710
2	57	47	22627	13111
3	208	209	24479	14351
4	119	123	24972	14739
5	22	39	27207	18905

Overall median = 24364

Individual 95.0% Confidence Intervals



Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Stars stands for Standard and Poor's Stock Appreciation Ranking System, which measures short-term appreciation potential, coded one for the poorest potential and five for the best potential.

Table 5a: Kruskal-Wallis Test for Return versus Market

Market	N	Median	Ave Rank	Z
1	169	24377	436.8	0.88
2	169	28510	478.6	3.38
3	168	26566	459.8	2.25
4	169	24134	417.9	-0.25
5	168	18985	316.6	-6.27
Overall	843		422.0	

H = 45.31 DF = 4 P = 0.000

H = 45.31 DF = 4 P = 0.000 (adjusted for ties)

Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Market is the total of all traded common stock times the recent price per share in billions of dollars.

Table 5b: Mood Median Test for Return versus Market

Chi-Square = 38.96 DF = 4 P = 0.000

Market	N<=	N>	Median	Q3-Q1	Individual 95.0% Confidence Intervals
1	84	85	24377	12112	(-*-----)
2	65	104	28510	15249	(---*----)
3	71	97	26566	14970	(---*---)
4	85	84	24134	16922	(---*------)
5	117	51	18985	14347	(--*----)

Overall median = 24364

20000 24000 28000 32000

Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Market is the total of all traded common stock times the recent price per share in billions of dollars.

Table 6a: Kruskal-Wallis Test for Return versus Quality

Quality	N	Median	Ave Rank	Z
1	39	25145	461.3	1.03
2	63	26661	453.3	1.06
3	72	27312	470.4	1.76
4	228	27188	462.9	2.97
5	204	22846	393.2	-1.94
6	182	22370	398.4	-1.48
8	55	17351	310.4	-3.52
Overall	843		422.0	

H = 27.44 DF = 6 P = 0.000

H = 27.44 DF = 6 P = 0.000 (adjusted for ties)

Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Quality is a rating from A+ to D-, coded 1 for A+, 2 for A, 3 for A-, etc. that assess the relative growth and stability of earnings and dividends over the past 10 years.

Table 6b: Mood Median Test for Return versus Quality

Chi-Square = 24.42 DF = 6 P = 0.000

QualNum	N<=	N>	Median	Q3-Q1	Individual 95.0% Confidence Intervals
1	17	22	25145	9375	(-*------)
2	29	34	26661	11433	(------*-----)
3	27	45	27312	10136	(----*--)
4	95	133	27188	15146	(--*--)
5	114	90	22846	15014	(--*---)
6	103	79	22370	20405	(---*---)
8	37	18	17351	21589	(-----*---------)

Overall median = 24364

15000 20000 25000 30000

Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Quality is a rating from A+ to D-, coded 1 for A+, 2 for A, 3 for A-, etc. that assess the relative growth and stability of earnings and dividends over the past 10 years.

Table 7a: Kruskal-Wallis Test for Return versus Risk

Risk	N	Median	Ave Rank	Z
1	121	23862	402.1	-0.97
2	486	26124	448.0	3.61
3	236	22171	378.7	-3.22
Overall	843		422.0	

H = 13.80 DF = 2 P = 0.001
H = 13.80 DF = 2 P = 0.001 (adjusted for ties)

Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Risk Rates the volatility of the stock's price over the past year, with low, medium, and high categories coded 1, 2, and 3 respectively.

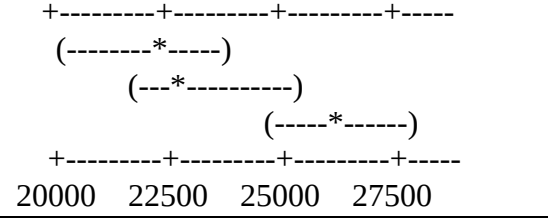
Table 7b: Mood Median Test for Return versus Risk

Chi-Square = 12.62 DF = 2 P = 0.002

Risk	N<=	N>	Median	Q3-Q1
3	139	97	22171	19021
2	64	57	23862	8713
1	219	267	26124	15369

Overall median = 24364

Individual 95.0% Confidence Intervals



Return is the current value of a $10,000 investment in the stock made five years ago, assuming year-end reinvestment of dividends. Risk Rates the volatility of the stock's price over the past year, with low, medium, and high categories coded 1, 2, and 3 respectively.

Table 8a: Kruskal-Wallis Test for Return versus Beta

Beta	N	Median	Ave Rank	Z
-0.1	1	6238	17.5	-1.66
0.1	1	33114	635.0	0.88
0.2	10	20197	299.1	-1.61
0.3	18	24067	417.8	-0.07
0.4	32	23375	387.1	-0.83
0.5	27	25653	415.6	-0.14
0.6	41	24544	446.3	0.65
0.7	40	27915	480.4	1.55
0.8	49	25751	400.8	-0.63
0.9	55	24364	419.7	-0.07
1.0	64	22618	399.5	-0.77
1.1	57	24244	390.5	-1.01
1.2	55	22880	350.1	-2.26
1.3	59	26971	472.2	1.64
1.4	50	21131	355.7	-1.99
1.5	45	21894	378.8	-1.22
1.6	37	22247	393.7	-0.72
1.7	36	24944	442.3	0.51
1.8	21	27990	449.6	0.53
1.9	21	24808	470.0	0.91
2.0	14	25060	448.1	0.40
2.1	15	23782	410.9	-0.18
2.2	10	40912	610.8	2.47
2.3	14	17848	329.9	-1.43
2.4	13	29857	534.5	1.68
2.5	5	32021	440.2	0.17
2.6	13	38821	649.8	3.40
2.7	7	23113	431.6	0.10
2.8	8	22251	428.1	0.07
2.9	2	44360	745.0	1.88
3.0	3	23849	430.0	0.06
3.1	4	41238	532.5	0.91
3.2	4	35704	592.5	1.40
3.3	1	37013	690.0	1.10
3.4	2	59433	511.0	0.52
3.5	1	41591	731.0	1.27
3.6	1	79411	818.0	1.63
3.8	1	43452	740.0	1.31
3.9	2	35129	476.0	0.31
4.0	1	31160	597.0	0.72
4.2	1	15351	142.0	-1.15
4.3	1	103664	831.0	1.68
5.1	1	15940	159.0	-1.08

N= 843. Overall average rank = 422. H = 67.68 DF = 42 P = 0.007 and (adjusted for ties). Return is the current value of a $10,000 stock investment made five years ago, assuming year-end dividend reinvestment. Beta is a regression coefficient from using the S & P 500 index to explain five years of month-end stock prices.

Table 8b: Mood Median Test for Return versus Beta

Chi-Square = 31.65 DF = 32 P = 0.484

Beta	N<=	N>	Median	Q3-Q1	Individual 95.0% Confidence Intervals
-0.1	1	0	6238	n/a	
0.1	0	1	33114	n/a	
0.2	8	2	20197	12019	(-*-)
0.3	9	9	24067	16432	(*-)
0.4	18	14	23375	8578	(*)
0.5	12	15	25653	11996	(*-)
0.6	20	21	24544	18327	(*-)
0.7	17	23	27915	19386	(-*-)
0.8	23	26	25751	11995	(*)
0.9	28	27	24364	12391	(*)
1.0	33	31	22618	13158	(*-)
1.1	29	28	24244	12206	(*)
1.2	33	22	22880	13522	(*)
1.3	26	33	26971	16732	(*)
1.4	32	18	21131	19826	(*)
1.5	25	20	21894	14820	(*-)
1.6	20	17	22247	16716	(*-)
1.7	18	18	24944	17578	(*-)
1.8	7	14	27990	12415	(*)
1.9	10	11	24808	25009	(*----)
2.0	7	7	25060	19044	(-*--)
2.1	8	7	23782	19704	(-*--)
2.2	2	8	40912	29128	(----*---)
2.3	9	5	17848	26297	(-*----)
2.4	5	8	29857	31505	(--*----)
2.5	2	3	32021	30812	(------*---)
2.6	2	11	38821	23938	(-*---)
2.7	4	3	23113	26688	(---*----------)
2.8	5	3	22251	37962	(-*----------)
2.9	0	2	44360	4474	(*)
3.0	2	1	23849	41845	(--*--------)
3.1	2	2	41238	91942	(------*----------)
3.2	1	3	35704	74407	(----*----------)
3.3	0	1	37013	n/a	
3.4	1	1	59433	84698	(----------*----------)
3.5	0	1	41591	n/a	
3.6	0	1	79411	n/a	
3.8	0	1	43452	n/a	
3.9	1	1	35129	37704	(----*----)
4.0	0	1	31160	n/a	
4.2	1	0	15351	n/a	
4.3	0	1	103664	n/a	
5.1	1	0	15940	n/a	
Overall			24364		35000 70000 105000

Levels with < 6 N confidence < 95.0%. Return is value of a $10,000 investment made 5 years ago with dividend reinvestment. Beta is a regression coefficient using the S&P500 index to explain 5 years of monthly stock prices.

Conclusion

This study finds evidence to support a relationship between return and risk. The best measures appear to be company valuation compared to market, company size, stability of earnings and dividends, and overall stock price volatility. Stock price volatility relative to other stocks, measured by beta, does not seem to have any relationship to returns. These findings are evident from using nonparametric analyses. The parametric analyses appear to mask the true underlying relationships.

This study is limited by the use of only data from Standard & Poor's stock reports. Especially limiting is the one-year overall stock price volatility measure that was used to explain five years of stock return. A better approach would be to match the time periods of risk and return. In addition, the volatility of earnings and dividends measure is proprietary, so its time period may also not match that for returns. However, the time period does match for returns and the beta calculation. Therefore this study should have some benefit to those stock investors looking for a way to estimate total expected return using historical risk measures.

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