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*Application of Carhart Four-Factor Model to the AAI-Generated Portfolios*

*By*

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*Honors Thesis*

*In*

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University of Richmond  
Richmond, VA*

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## **Abstract**

American Association of Individual Investors (AAII) provides stock screens that follow the investment strategies of some of the most well-known investors. This paper uses Carhart four-factor model and adjusts returns for transaction costs to see whether these portfolios generate abnormal returns. I find that the number of portfolios with excess returns significantly decreases under the restrictions of the four-factor model and transaction costs assumptions. In addition, I find that momentum is a statistically significant factor in explaining the returns of these portfolios. The results of this study suggest that markets are inefficient in the weakest form, since information about the past price trends can be used to generate abnormal returns.

## **I. Introduction**

Over the past fifty years, much of the research in finance has focused on asset-pricing models and the existence of abnormal returns for a well-diversified portfolio. As a result, three well-known models have emerged: Capital Asset Pricing Model (CAPM), Fama-French three-factor Model, and Carhart four-factor model. Although both CAPM and Fama-French models have been widely applied around the world, these models have failed to explain abnormal returns that famous investors such as Warren Buffett and Peter Lynch are able to generate. Can individual investors outperform the market using the strategies of some of the most successful investors? The American Association of Individual Investors (AAII) is a non-profit organization that provides educational resources for individual investors. The creators of the association have developed stock screens that follow successful investment strategies of more than 50 well-known investors. AAII claims that its model portfolios outperform the market 5-to-1.

When it comes to active trading, individual investors are often at a disadvantage. Unlike big fund managers, they do not have access to the same informational resources. Due to the high transaction costs, gains from active trading tend to be low for individual investors, and they often end up holding a broadly diversified index fund. Stock screens from AAII could give small investors an opportunity to engage in active trading. For an annual fee of \$29 one can have the access to about 60 different stock screens and learn about number of different styles and methodologies used by famous investors. Another advantage of AAII stock portfolios is that they are machine-generated and are thus free of psychological biases that individual investors face.

This study examines whether using AAII stock screens is a good investment practice. I look at the historical performance of the AAII stock screen-generated portfolios and use three different asset pricing models to determine whether these portfolios have been able to generate

abnormal returns. I find that when I use the Carhart four-factor model and adjust the individual portfolio returns for transaction costs, the number of portfolios that generate abnormal returns significantly decreases.

## II. Prior Studies

This study has implications for three areas in finance. It contributes to the study of overall market efficiency, behavioral finance, and investment strategies. Individuals have to make a choice between passive and active investing. Their choice depends on whether they believe that markets are efficient or not. Market efficiency theory suggests that current stock price “fully reflects” all the available information and one cannot expect to generate excess returns on a risk-adjusted basis. Fama (1970) discusses three forms of inefficiency. He argues that markets are efficient in a *weak form* if the current stock price already reflects the historical prices and the return trends. This form of efficiency suggests that one cannot use technical analysis to generate excess future returns. *Semi-strong form* efficiency suggests that all publicly available information is fully priced. Therefore, investors can use neither technical nor fundamental analysis to outperform the market index. Markets are efficient in a *strong form* if share prices fully reflect both public and private information. This form of efficiency suggests that even if you are a corporate insider and have access to confidential information, you cannot expect to beat the market. Thus, active investors believe that markets are inefficient, and they constantly monitor price movements to exploit any discrepancy from the stock’s actual value. On the other hand, passive investors will generally hold a broadly-diversified market index fund and hope for long-term price appreciation. Malkiel (2003) argues that even if markets are efficient, passive

investment strategy still outperforms the active investment strategy because of the high transaction costs involved in active trading.

The market efficiency hypothesis assumes that investors are rational, utility-maximizers not prone to any psychological biases. However, studies such as Kahneman and Tversky (1979) and DeBondt and Thaler (1985) have shown that investors tend to value gains and losses differently and overreact to unexpected news. Jegadeesh and Titman (1993) and Greenblatt, Titman, and Wermers (1995) find that stocks and mutual funds tend to exhibit momentum. This can be explained through herding behavior or the tendency of individuals to mimic behaviors of others. Such findings have led to the emergence of behavioral finance. Proponents of behavioral finance believe that stock prices reflect the beliefs and decisions of both rational and irrational investors (Hirshleifer, 2001). Thus, inefficiencies in the financial markets are caused by psychological biases.

Behavioral finance suggests that rational investors can earn excess returns exploiting the inefficiencies created by irrational investors. A number of studies have looked at different investment practices and individual stock-picking skills. Barber, Lehavy, McNichols and Trueman (2001) find that purchasing stocks with the most favorable consensus recommendations leads to abnormal returns. However, they argue that frequent trading is necessary to generate such returns, which increases the transaction costs. On the other hand, Metrick (1998) examines the equity-portfolio recommendations made by investment newsletters and argues that they do not show superior stock picking abilities. Schadler and Cotten (2008) analyze the performance of AAI screens and find that 32% of the portfolios successfully beat the S&P 500 when they use a one-factor model and adjust for transaction costs. A working paper by North and Stevens (2013) extends the study by Schadler and Cotten by using a three-factor model. They find that number

of portfolios that are able to generate abnormal returns far exceed what pure chance would have predicted. I extend studies done by Schadler and Cotten and North and Stevens by using a four-factor model to measure the performance of the AAI portfolios.

### **III. Methodology**

I use different methodologies to see how AAI portfolios perform compared to the market. I use index comparisons, Sharpe and Sortino ratios, and three different asset-pricing models. In addition, I adjust the returns for transaction costs.

#### *Index Comparisons*

To see whether AAI portfolios are able to outperform the market on average, I use the S&P 500 as a benchmark index. However, because these portfolios differ based on their strategies and size of the stocks held, other indices such as S&P Midcap 400 or S&P Smallcap 600 might be a better fit. To find the best-fit indices, I use the indices whose returns most highly correlate with the portfolio returns in question. This is the method used by Schadler and Cotton (2008).

#### *Sharpe and Sortino Ratios*

The Sharpe ratio is a risk-to-reward ratio that William Sharpe first introduced in 1966 to measure the mutual fund performance. It measures the expected return per unit of risk and can be calculated as follows:

$$(1) \quad \frac{r_p - r_f}{\sigma_p}$$

where  $r_p$  is the portfolio return,  $r_f$  is the risk-free rate, and  $\sigma_p$  is the standard deviation that reflects the volatility of the portfolio. The higher the Sharpe ratio, the higher the expected return for a given level of risk.

The standard deviation term in the Sharpe ratio treats both upside and downside deviations equally, but high upside deviation is good for investors because it translates into higher returns. The Sortino ratio considers this fact and breaks down the standard deviation into upside and downside deviations. The simple Sortino ratio can be calculated as follows:

$$(2) \quad \frac{\sigma_{upside}}{\sigma_{downside}}$$

If this ratio is more than one, then the portfolio has more upside deviation and therefore offers more downside risk protection.

### *Jensen's Alpha*

Jensen's alpha, which Michael Jensen introduced in 1967, is widely used to measure portfolio performance. It is an excess return over the return that the asset-pricing models predict. If markets are efficient, Jensen's alpha should be equal to zero. Thus, finding a positive value for alpha suggests that a manager has superior stock-picking abilities. Obtaining an accurate value for Jensen's alpha requires a reliable asset-pricing model.

### *Asset-pricing Models*

Asset-pricing models are well established in the finance literature. The Capital Asset Pricing Model (CAPM) is probably the most important topic taught in introductory finance course. CAPM, which was developed by Jack Treynor (1962), William Sharpe (1964), John Lintner (1965a,b) and Jan Mossin (1966) independently, is the simplest way to determine a



theoretical required rate of return on an asset. It allows investors to calculate a risk-to-reward ratio based on a security's sensitivity to the expected market return. Portfolio performance relative to CAPM can be estimated as follows:

$$(3) \quad (r_{pi} - r_f) = \alpha + \beta_1(r_m - r_f) + \mu$$

where  $r_{pi}$  is a return on portfolio  $i$  generated by AAI,  $r_f$  is a risk-free rate assumed to be one-month treasury bill return, and  $(r_m - r_f)$  is a market risk premium. The constant term,  $\alpha$ , is the Jensen's alpha. If  $\alpha$  is statistically significant, it would mean that AAI portfolios are able to generate excess returns.

CAPM often indicates statistically significant returns for portfolio managers. Many researchers argue that this happens because other risk factors have not been included. Over the years, researchers have found factors that explain average stock returns better than CAPM. For example, DeBondt and Thaler (1985) find that stock returns tend to reverse in the long-run and portfolios of prior "losers" outperform the prior "winners." Jegadeesh and Titman (1993) find that in the short-run stocks tend to exhibit momentum. Thus, the strategy of buying past winners and selling past losers leads to significant abnormal returns. On the other hand, some have concluded that size, earnings/price, cash flow/price, and book to market value ratios are important variables in explaining returns. Such criticisms have led to the emergence of new models. The Fama-French three-factor and Carhart four-factor models are the most popular.

Fama and French (1996) argue that three factors explain most of the anomalies. Their model extends CAPM by adding size and value factors. Performance can be estimated as follows:

$$(4) \quad (r_{pi} - r_f) = \alpha + \beta_1(r_m - r_f) + \beta_2(SMB) + \beta_3(HML) + \mu$$

where  $SMB$  is a size premium, measured as a difference between the return on stocks with relatively small market capitalization and the return on stocks with large capitalization.  $HML$  is a

value premium, measured as a difference between the returns on stocks with high book-to-market ratio (value) and stocks with low book-to-market ratio (growth).

Fama and French (1993) argue that the size of the firm is related to profitability. Smaller firms usually have lower earnings than big firms. Thus, the size premium is a risk premium for the possibility of receiving lower average returns. However, one can also argue that there is more “inefficiency” in small-caps. Unlike small-caps, large-cap stocks tend to be well covered by the Wall Street analysts. Stock reports are regularly updated and published on research databases. An investor can find numerous reports about a single large-cap stock with up-to-date information and make informed decisions. However, many analysts tend to overlook small-caps, and there are fewer reports available on them. Although small-caps have become more liquid over the last few years, they are still more thinly traded than the large-caps. Because of these inefficiencies, a rational investor requires a higher return when investing in smaller-caps.

HML is a difference between the returns on stocks with high book-to-market ratio (value) and stocks with low book-to-market ratio (growth). A high book-to-market ratio is often associated with weak firms that have persistently low earnings, whereas low book-to-market ratios are typical of strong companies with high earnings. Thus, HML is a risk premium related to the possibility of financial distress. However, HML could be capturing an inefficiency. The stock market often overreacts to good and bad news, resulting in a price that does not reflect the true value of the company based on its long-term fundamentals. Once the price adjusts to the actual value, investors that bought the stock when it was undervalued are able to earn higher returns.

Another model and the main focus of this study is Carhart four-factor model (1997). Carhart (1997) finds that the momentum factor first introduced by Jegadeesh and Titman (1993)

explains the persistence of high returns for mutual funds. His four-factor model is constructed by adding a one-year momentum factor to the Fama-French three-factor model. Performance relative to Carhart's model can be estimated as follows:

$$(5) \quad (r_{pi}-r_f) = \alpha + \beta_1(r_m-r_f) + \beta_2(SMB) + \beta_3(HML) + \beta_4(MOM) + \mu$$

The momentum factor (MOM) describes the tendency of rising stock prices to continue rising and falling prices to continue falling. Thus, if an investor buys a stock whose price has been on the rise recently, and if other investors follow, the mere belief that the stock price will continue to rise will lead to the actual price increase. The momentum factor suggests that smart investors who are able to predict which stocks will become "Wall Street Darlings" will be able to earn high profits. Momentum is not a risk premium, but a pure anomaly. There is no reason why an increase in a stock price should, by itself, lead to further price appreciation. According to behavioral finance theorists, momentum in a stock is the result of investor herding. If markets are efficient, the coefficient,  $\beta_4$ , on the momentum factor should not be statistically significant. We should not be able to use the information about past price trends and expect to generate profits. If this study finds that the momentum factor helps explain the returns, we can argue that markets are inefficient in the *weakest form*. Including the momentum factor in the model controls for some of the behavioral inefficiencies.

Carhart four-factor model has been widely applied to mutual fund performances and stock market returns in international financial markets. Fama and French (2011) apply Carhart four-factor model to the stock markets in North America, Europe, Japan and Asia Pacific and find statistically significant value and momentum premium in all of the markets except for Japan. Fletcher (2012) finds that Carhart's conditional four-factor model is the most reliable model to explain expected returns on the U.K. portfolio. Cakici, Fabozzi and Tan (2013) apply asset-

pricing models to the emerging markets and find strong value and momentum effects in all of the regions except Eastern Europe. L'Her, Masmoudi, and Suret (2004) apply Carhart four-factor model to the Canadian Stock Market and find that momentum factor returns are significant throughout the year, while size and value premiums vary. These studies suggest that a comprehensive asset-pricing model must account for market risk, size, value, and momentum.

### *Transaction Costs*

The transaction costs associated with trading can have a significant effect on the returns, especially for small investors. To have an accurate measure of portfolio returns, it is important to control for transaction costs. I follow Schadler and Cotten (2008) and North and Stevens (2013) to adjust for transaction costs. I assume a 100% turnover rate. This means that there are two trades per month; all the stocks in the portfolio are bought at the beginning of the month and all of them are sold at the end of the month. In fact, the turnover rate is about 40% for the AAI portfolios, but because of the data that are available I am limited to a 100% turnover rate. Like Schadler and Cotten and North and Stevens, I assume a \$7 fee per trade. Transaction costs are calculated as:

$$(6) \quad \$ \text{ transaction costs} = (\$7)(2)(\# \text{ of stocks in the portfolio})$$

Since transaction costs will be a higher percentage of the initial investment when the initial investment is small, the size of the initial investment will impact the percentage returns. I am assuming an initial investment of \$50,000, similar to the amount used by Schadler and Cotten in their study. Since AAI portfolios are mostly for small investors, I want to see how the portfolios perform net of the transaction costs, when the size of the initial investment is relatively small.

The returns can be calculated using the following formula:

$$(7) \quad r_{adjusted} = \frac{\$50,000 (1+r_{pi}) - \$ transaction costs}{\$50,000} - 1$$

where  $r_{adjusted}$  is the portfolio return after the transaction costs and  $r_{pi}$  is the portfolio return before the adjustment is made. I adjust the returns of only those portfolios that are able to generate statistically significant Jensen's alphas under the four-factor model.

If the AAI portfolios generate statistically significant abnormal returns under the strict restrictions of the four-factor model and after introducing transaction costs, then using AAI screens will be a good investment practice. Furthermore, the investors whose strategies these screens are using arguably possess superior skills.

#### **IV. Data**

Data used in this study come from the American Association of Individual Investors (AAII). AAI is a non-profit association that offers educational materials to individual investors. AAI provides stock screens that reflect interpretations of the investment approaches advocated by successful strategists. Historical performance of the computer-generated portfolios is publicly available on AAI's website ([www.aai.com](http://www.aai.com)). Data used for this study provide monthly price change for a total of 84 portfolios spanning the period from January 1998 through October 2013. Of these 84 portfolios, 16 are stock market indices, one is the Treasury Bill Index and one is the exchange-listed stock portfolio. Since indices do not involve picking any stocks, they cannot be used for the study. This leaves me with 66 portfolios for the purposes of this study. Sample portfolios include value, growth, growth/value, and specialty/sector portfolios. The number of portfolios that can be classified under each strategy are presented in *Table 1*.<sup>1</sup>

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<sup>1</sup> For complete summary statistics see Appendix I.

Table 1. Investment Strategies and Number of Portfolios Using Each Strategy

Investment Strategy	Growth	Value	Growth and Value	Growth with Price Momentum	Value with Price Momentum	Growth and Value with Price Momentum	Earnings Estimate	Specialty	All Strategies
Number of Portfolios	4	15	21	6	6	7	6	1	66
% of the Total Sample	6%	23%	32%	9%	9%	11%	9%	2%	100%

Table 2. Summary Statistics for AAI Portfolios

	Growth (n=4)	Value (n=15)	Growth and Value (n=21)	Growth with Price Momentum (n=6)	Value with Price Momentum (n=6)	Growth and Value with Price Momentum (n=7)	Earnings Estimate (n=6)	Specialty (n=1)	All Strategies (n=66)
MMR > S&P	4	14	21	6	6	7	6	0	64 (97%)
Average difference	0.69%	1.02%	0.76%	1.24%	1.07%	0.97%	1.04%	-0.14%	
GMMR > S&P	4	13	20	6	6	6	4	0	59 (89%)
Average difference	0.61%	0.85%	0.61%	0.97%	0.95%	0.69%	0.81%	-0.36%	
MMR > Best Fit Index	4	15	20	6	6	7	6	0	64 (97%)
Average difference	0.92%	1.16%	0.92%	1.28%	1.26%	1.00%	1.12%	-0.05%	
GMMR > Best Fit Index	3	11	18	6	5	6	4	0	53 (80%)
Average difference	0.60%	0.58%	0.32%	0.70%	0.61%	0.50%	0.51%	-0.77%	

Note: MMR stands for arithmetic mean monthly return and GMMR stands for geometric mean monthly return. Differences are calculated over the period 1998-2013.

Market risk, size, value and momentum premiums are obtained from Kenneth French's website. Market risk premium is the excess return above the risk-free rate ( $r_m - r_f$ ). Market return is found as a return on all firms that are listed on NYSE, AMEX, and NASDAQ, and one-month Treasury bill rate is used as a risk-free rate. Size premium is based on the performance of small-cap stocks relative to large-cap stocks (SMB,  $r_{small} - r_{big}$ ). Fama and French calculate this factor by creating portfolios based on their size and by subtracting the average return on the three large-cap portfolios from the average return on the three small-cap portfolios. The value premium is determined as the performance of value stocks relative to growth stocks (HML,  $r_{high} - r_{low}$ ). It is calculated as the difference between the average return on the two value portfolios and the two growth portfolios. Fama-French momentum factor is constructed as the average of the returns on two high-prior-return portfolios minus the average of the returns on two low-prior-return portfolios. Fama-French benchmark factors are widely used when explaining returns using the three-factor model. These benchmark returns are updated every month and cover the period from July 1926 through October 2013.<sup>2</sup>

To measure the returns on the AII portfolios, the risk-free rate must be subtracted from the actual portfolio returns. Following Fama and French, I use one-month Treasury bill rate as a risk-free rate. One-month Treasury bill rates can also be obtained from the Kenneth French's website.

## V. Empirical Results

I analyze the performance of 66 AII portfolios using the methodologies described in Section III. I first look at the performance relative to the S&P 500 and best-fit indices. *Table 2*

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<sup>2</sup> Complete information on the four factors can be found on Kenneth French's website.

shows portfolios under each strategy that were able to outperform the S&P 500 and their best-fit index. Based on the arithmetic mean of monthly returns over the measurement period, 64 out of the 66 portfolios were able to beat the S&P 500 and their best-fit index. In addition to arithmetic mean returns, I also look at the differences between the geometric mean returns. Geometric mean return tells an investor what the average compounded rate of return would be if the portfolio was held during the entire measurement period. Based on the geometric mean monthly returns, I find that 59 of the portfolios beat the S&P and 54 of the portfolios beat their best-fit index. Overall, based on both arithmetic and geometric averages, 80-97% of portfolios outperform the market. This result is close to the 91% that AAI reports.

Next, I use Sharpe and Sortino ratios to compare AAI portfolios to the S&P 500. The Sharpe and Sortino ratios for S&P 500 are 0.05 and 0.70, respectively. Fifty-seven of the AAI portfolios have a Sharpe ratio higher than 0.05 and 63 have Sortino ratios higher than 0.70. Based on these ratios, AAI portfolios offer higher reward for the given level of risk compared to the S&P 500. Most of these portfolios also offer more upside potential than the S&P 500.

To see whether AAI portfolios generate statistically significant abnormal returns on the risk-adjusted basis, I run separate regressions for all 66 portfolios using CAPM, Fama-French three-factor model and Carhart four-factor model without adjusting for transaction costs. *Table 3* shows the main findings of the regression analysis.<sup>3</sup> Under CAPM, 59% of the portfolios generate statistically significant abnormal returns. Using the three-factor model the percentage of portfolios with statistically significant abnormal returns decreases to 48%. Only 39% of the portfolios generate excess returns under Carhart four-factor model. The adjusted  $R^2$  increases moving from one-factor to three-factor and four-factor models. I find that Carhart four-factor model has the highest explanatory power. In addition, top portfolios that are able to generate

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<sup>3</sup> Detailed regression results are reported in the Appendix



Table 3. Number of Portfolios with Statistically Significant Positive Alphas

	Growth (n=4)	Value (n=15)	Growth and Value (n=21)	Growth with Price Momentum (n=6)	Value with Price Momentum (n=6)	Growth and Value with Price Momentum (n=7)	Earnings Estimate (n=6)	Specialty (n=1)	All Strategies (n=66)
CAPM	3	8	12	4	5	3	4	0	39 (59%)
Three Factor	3	6	8	4	4	3	4	0	32 (48%)
Four Factor	1	7	7	2	2	3	4	0	26 (39%)
Four Factor Adjusted for Transaction Costs	0	3	0	1	0	1	0	0	5 (8%)

Table 4. Number of Portfolios with Statistically Significant Momentum Factor

Investment Strategy	Growth	Value	Growth and Value	Growth with Price Momentum	Value with Price Momentum	Growth and Value with Price Momentum	Earnings Estimate	Specialty	All Strategies
Number of Portfolios with Significant Positive Momentum	2	2	9	5	6	4	2	0	30
Portfolios with Positive Momentum as a % of Total Number of Portfolios in the Strategy	50%	13%	43%	83%	100%	57%	33%	0%	<b>45%</b>
Number of Portfolios with Significant Negative Momentum	0	1	5	0	0	0	2	0	8
Portfolios with Negative Momentum as a % of Total Number of Portfolios in the Strategy	0%	7%	24%	0%	0%	0%	33%	0%	<b>12%</b>

statistically significant abnormal returns under CAPM are top portfolios under three-factor and four-factor models as well.

Thirty of the 66 portfolios have statistically significant positive coefficients on the momentum factor and only 8 of the portfolios have statistically significant negative coefficients. This finding suggests the existence of market inefficiencies. AAI portfolios are apparently using information about the past price trends to generate returns. This should not be happening if markets are efficient in the weakest form. According to the proponents of behavioral finance, momentum is a result of investor herding. Since investor herding is a behavioral bias, the positive coefficient on the momentum factor suggests that although AAI portfolios are computer-generated, they are not completely free of behavioral biases. Therefore, the users of AAI portfolios are still somewhat subject to the cognitive biases that many investors face.

Finding statistically significant positive coefficient on the momentum factor also suggests that the investors whose strategies are adopted in the AAI screens are exploiting behavioral inefficiencies. We hear stories about how these successful investors have a market insight and know exactly which stocks are going to perform well. However, it appears that their insight lies in exploiting the behavioral inefficiencies in the market.

Next, I look at the portfolios that generated statistically significant abnormal returns under the four-factor model and adjust the returns for transaction costs using the methodology outlined in Section III. After introducing the transaction costs, only 5 portfolios generate statistically significant abnormal returns. Compared to the rest of the portfolios, these five portfolios have the lowest adjusted  $R^2$ s. Therefore, it is possible that these five portfolios use strategies different from what the models are controlling for. There is also a possibility that the returns on the rest of the portfolios were artificially low due to the high turnover rate assumption.

In reality, investors do not liquidate their entire portfolios every month, and therefore their transaction costs are much lower. It is possible that less actively traded AAI portfolios generate statistically significant abnormal returns with lower transaction costs.

## **VI. Conclusions**

This study analyzes the performance of AAI stock screen-generated portfolios during the period from 1998 to 2013. The majority of the portfolios beat the S&P 500 and their best-fit indices based on arithmetic and geometric average monthly returns without adjusting for transaction costs. In addition, AAI portfolios offer better risk-to-reward ratios and more upside potential than S&P 500.

Out of the three different factor models used, Carhart four-factor model has the highest explanatory power. Even under the strictest restrictions of the four-factor model, 26 out of 66 AAI portfolios generate statistically significant abnormal returns. However, once transaction costs are included in the four-factor model, this number decreases to just 5. Thus, the claim that 91% of the portfolios outperform the market is invalid. In addition, this study finds that momentum is an important factor in explaining returns. About 45% of the AAI portfolios have a statistically significant positive coefficient on the momentum.

The findings of this study suggest that markets are inefficient in the weakest form. We should not be able to use information about the past returns to earn abnormal returns; however, a positive coefficient on the momentum can account for this possibility. Only five portfolios generate statistically significant abnormal returns after I introduce the momentum factor and transaction costs. This suggests that these portfolios use unique strategies not captured by the factors in the model. Although AAI portfolios are computer-generated and are supposed to be free of behavioral biases, the positive coefficient on the momentum factor suggests otherwise. I

conclude that using AAI stock screens is a good investment practice in the absence of high transaction costs. However, one would not be able to randomly pick one of the AAI portfolios and expect to generate abnormal returns after adjusting for transaction costs. Further studies could examine how different turnover rates and holding periods affect the performance of the AAI portfolios.

## Appendix I. Summary Statistics

Table 1. Summary Statistics

Variables	Strategy	Number of Stocks Held	N	Min.	Max.	Arithmetic Mean	Geometric Mean	Std. Deviation	Sharpe Ratio	$\sigma_{up}\sigma_{down}$	Arithmetic ( $r_p-r_{S\&P}$ )	Geometric ( $r_p-r_{S\&P}$ )	Arithmetic ( $r_p-r_{Best\ fit}$ )	Geometric ( $r_p-r_{Best\ fit}$ )
O'Shaughnessy Tiny Titans	Value/Price MOM	25	190	-21.42%	37.12%	2.11%	1.92%	8.89%	0.22	0.96	1.89%	1.61%	1.92%	1.26%
O'Shaughnessy Small Cap Growth and Value	Value/Price MOM	25	190	-18.60%	18.40%	1.56%	1.51%	6.97%	0.20	0.79	1.33%	1.20%	1.51%	0.95%
O'Shaughnessy Growth	Value/Price MOM	50	190	-18.34%	18.50%	1.39%	1.34%	6.96%	0.17	0.73	1.16%	1.03%	1.34%	0.75%
Lakonishok	Value/Price MOM	31	190	-17.98%	16.24%	1.09%	1.14%	5.54%	0.16	0.84	0.87%	0.83%	1.14%	0.42%
O'Shaughnessy All Cap	Value/Price MOM	22	190	-21.61%	18.40%	1.03%	1.02%	6.33%	0.13	0.81	0.80%	0.71%	1.02%	0.40%
O'Shaughnessy Growth Market Leaders	Value/Price MOM	10	190	-18.78%	13.19%	0.57%	0.61%	5.61%	0.07	0.77	0.34%	0.30%	0.61%	-0.11%
Piotroski: 9	Value	9	190	-29.65%	61.80%	3.19%	2.83%	11.20%	0.27	1.96	2.97%	2.52%	2.83%	2.34%
Piotroski High F-Score	Value	21	190	-42.01%	43.12%	2.57%	2.31%	9.55%	0.25	1.08	2.34%	2.00%	2.31%	1.72%
Graham Enterprising Investor Revised	Value	9	190	-22.38%	36.43%	1.76%	1.65%	8.01%	0.20	1.22	1.54%	1.34%	1.65%	1.09%
Price-to-Free Cash Flow	Value	30	190	-31.81%	51.19%	1.70%	1.57%	8.21%	0.18	1.19	1.48%	1.26%	1.57%	1.07%
Graham Enterprising Investor	Value	4	190	-23.46%	33.06%	1.51%	1.39%	8.06%	0.16	1.32	1.28%	1.08%	1.39%	0.90%
Weiss Blue Chip Div. Yield	Value	12	190	-16.89%	15.95%	0.84%	0.88%	5.62%	0.12	0.89	0.62%	0.57%	0.88%	0.21%
Graham Defensive Investor Non-Utility	Value	21	190	-17.34%	25.83%	1.42%	1.41%	6.33%	0.19	0.92	1.19%	1.10%	1.41%	0.79%
Fundamental Rule of Thumb	Value	50	190	-19.60%	33.28%	1.22%	1.12%	7.85%	0.13	1.20	1.00%	0.81%	1.12%	0.58%
Cash Rich Firms	Value	30	190	-21.14%	17.14%	0.89%	0.88%	6.34%	0.11	0.79	0.67%	0.57%	0.88%	0.04%
Schloss	Value	12	190	-40.49%	26.56%	1.10%	0.93%	8.48%	0.11	1.01	0.88%	0.62%	0.93%	0.25%
Magic Formula	Value	30	190	-22.51%	30.70%	0.97%	0.88%	7.61%	0.10	1.07	0.75%	0.57%	0.88%	0.12%
Graham Defensive Investor Utility	Value	19	190	-13.41%	11.49%	0.54%	0.65%	4.16%	0.08	0.80	0.32%	0.34%	0.65%	-0.09%
O'Shaughnessy Value	Value	50	190	-23.84%	22.01%	0.48%	0.48%	6.20%	0.05	0.84	0.25%	0.17%	0.48%	-0.16%
Dogs of the Dow LowPriced 5	Value	5	190	-34.80%	27.61%	0.25%	0.16%	7.31%	0.01	0.79	0.02%	-0.15%	0.16%	-0.02%
Dogs of the Dow	Value	10	190	-23.39%	17.07%	0.19%	0.22%	5.65%	0.00	0.77	-0.04%	-0.09%	0.22%	-0.08%
Insider Net Purchases	Specialty	28	190	-27.27%	27.77%	0.08%	-0.05%	8.12%	-0.01	0.95	-0.14%	-0.36%	-0.05%	-0.77%
Value on the Move PEG With Est. Growth	Growth/Value/Price MOM	40	190	-23.49%	15.23%	1.53%	1.54%	6.12%	0.22	0.71	1.31%	1.23%	1.54%	0.89%
Stock Market Winners	Growth/Value/Price MOM	12	190	-23.51%	21.97%	1.66%	1.63%	6.79%	0.22	0.95	1.43%	1.32%	1.63%	0.98%
Value on the Move PEG With Hist. Growth	Growth/Value/Price MOM	80	190	-19.56%	12.29%	1.07%	1.15%	4.80%	0.18	0.62	0.85%	0.84%	1.15%	0.43%
MAGNET Simple	Growth/Value/Price MOM	3	190	-33.99%	51.79%	2.08%	1.37%	13.83%	0.14	1.48	1.85%	1.06%	1.37%	1.40%
Oberweis Octagon	Growth/Value/Price MOM	16	190	-23.62%	24.60%	1.32%	1.13%	8.83%	0.13	0.95	1.10%	0.82%	1.13%	0.65%
MAGNET Complex	Growth/Value/Price MOM	2	190	-28.21%	62.67%	1.46%	0.93%	12.50%	0.10	1.79	1.24%	0.62%	0.93%	0.69%
Muhlenkam	Growth/Value/Price MOM	18	190	-18.03%	20.94%	0.32%	0.31%	6.44%	0.02	0.76	0.10%	0.00%	0.31%	-0.28%
Zweig	Growth/Value	11	190	-24.66%	32.21%	1.63%	1.49%	8.26%	0.17	1.19	1.40%	1.18%	1.49%	0.99%
Shadow Stock Screen	Growth/Value	N/A	190	-21.48%	27.85%	1.20%	1.21%	6.22%	0.16	1.24	0.98%	0.90%	1.21%	0.57%
Templeton	Growth/Value	22	190	-23.16%	14.50%	0.85%	0.88%	5.71%	0.12	0.68	0.63%	0.57%	0.88%	0.18%
Rule #1 Investing	Growth/Value	14	190	-26.95%	26.44%	1.14%	0.99%	8.18%	0.12	0.90	0.91%	0.68%	0.99%	0.28%
T. Rowe	Growth/Value	8	190	-20.01%	33.50%	0.93%	0.83%	7.76%	0.09	1.28	0.70%	0.52%	0.83%	0.29%
Wanger Revised	Growth/Value	30	190	-20.18%	22.37%	0.80%	0.77%	6.61%	0.09	0.88	0.57%	0.46%	0.77%	0.16%
Murphy Technology	Growth/Value	11	190	-44.97%	58.46%	0.49%	-0.13%	12.78%	0.02	1.11	0.26%	-0.44%	-0.13%	-0.37%
Neff	Growth/Value	22	190	-21.73%	32.56%	1.66%	1.57%	7.53%	0.19	1.10	1.43%	1.26%	1.57%	1.02%
Buffett: Hagstrom	Growth/Value	30	190	-19.05%	12.68%	1.11%	1.18%	5.12%	0.18	0.77	0.89%	0.87%	1.18%	0.89%
Price-to-Sales	Growth/Value	55	190	-20.66%	18.31%	1.23%	1.24%	6.09%	0.17	0.72	1.00%	0.93%	1.24%	0.38%
Dividend Screen Non-DRP	Growth/Value	30	190	-15.39%	17.58%	0.89%	0.99%	4.33%	0.16	0.75	0.66%	0.68%	0.99%	0.26%
Lynch	Growth/Value	25	190	-21.35%	18.79%	0.98%	1.02%	5.65%	0.14	0.93	0.76%	0.71%	1.02%	0.37%
Foolish Small Cap 8 Revised	Growth/Value	6	190	-31.10%	27.71%	1.49%	1.20%	9.92%	0.13	1.08	1.27%	0.89%	1.20%	0.73%
Buffettology: Sustainable Growth	Growth/Value	33	190	-20.46%	16.07%	0.91%	0.93%	5.91%	0.12	0.83	0.68%	0.62%	0.93%	0.23%
Buffettology: EPS Growth	Growth/Value	47	190	-20.87%	15.09%	0.86%	0.89%	5.63%	0.12	0.72	0.64%	0.58%	0.89%	0.19%
Dreman	Growth/Value	21	190	-22.25%	23.85%	0.84%	0.87%	5.78%	0.11	0.80	0.62%	0.56%	0.87%	0.21%
Kirkpatrick Value	Growth/Value	2	190	-25.30%	49.00%	1.22%	0.95%	9.87%	0.10	1.47	0.99%	0.64%	0.95%	0.54%
Dividend (High Relative Yield)	Growth/Value	40	190	-14.38%	12.20%	0.64%	0.74%	4.44%	0.10	0.76	0.42%	0.43%	0.74%	0.01%

Table 1 (continued)

Variables	Strategy	Number of Stocks Held	N	Min.	Max.	Arithmetic Mean	Geometric Mean	Std. Deviation	Sharpe Ratio	$\sigma_{up}/\sigma_{down}$	Arithmetic ( $r_p-r_{S\&P}$ )	Geometric ( $r_p-r_{S\&P}$ )	Arithmetic ( $r_p-r_{best\ fit}$ )	Geometric ( $r_p-r_{best\ fit}$ )
Dividend Screen DRP	Growth/Value	30	190	-18.33%	20.51%	0.60%	0.67%	5.10%	0.08	0.86	0.38%	0.36%	0.67%	-0.03%
Kirkpatrick Bargain	Growth/Value	15	190	-22.07%	20.65%	0.65%	0.65%	6.12%	0.07	0.83	0.42%	0.34%	0.65%	0.01%
Fisher (Philip)	Growth/Value	20	190	-27.96%	32.76%	0.69%	0.38%	10.06%	0.05	1.06	0.47%	0.07%	0.38%	-0.16%
O'Neil's CAN SLIM	Growth/Price MOM	6	190	-23.48%	69.59%	2.05%	1.90%	8.72%	0.21	1.77	1.82%	1.59%	1.90%	1.28%
O'Neil's CAN SLIM No Float	Growth/Price MOM	16	190	-35.58%	23.44%	1.34%	1.32%	6.38%	0.18	0.87	1.11%	1.01%	1.32%	0.57%
O'Neil's CAN SLIM Revised	Growth/Price MOM	8	190	-27.09%	52.24%	1.47%	1.32%	8.55%	0.15	1.45	1.24%	1.01%	1.32%	0.70%
Kirkpatrick Growth	Growth/Price MOM	11	190	-23.59%	63.68%	1.52%	1.29%	9.63%	0.14	1.60	1.30%	0.98%	1.29%	0.75%
Driehaus	Growth/Price MOM	15	190	-26.02%	50.86%	1.27%	0.98%	10.06%	0.11	1.38	1.04%	0.67%	0.98%	0.50%
Foolish Small Cap 8	Growth/Price MOM	16	190	-22.97%	38.37%	1.18%	0.88%	10.21%	0.10	1.37	0.95%	0.57%	0.88%	0.41%
Dual Cash Flow	Growth	20	190	-23.67%	34.31%	1.20%	1.15%	7.07%	0.14	1.15	0.97%	0.84%	1.15%	0.59%
Invest Ware Quality Growth	Growth	32	190	-22.46%	17.72%	0.55%	0.57%	5.77%	0.06	0.84	0.32%	0.26%	0.57%	-0.13%
Return on Equity	Growth	39	190	-22.59%	14.62%	1.04%	1.06%	5.92%	0.14	0.78	0.82%	0.75%	1.06%	0.40%
IBD Stable 70 price	Growth	68	190	-22.02%	18.38%	0.87%	0.91%	5.46%	0.12	0.82	0.64%	0.60%	0.91%	0.24%
Est. Rev: Up 5	Earnings Estimates	42	190	-22.17%	30.41%	2.22%	2.09%	8.08%	0.25	1.03	1.99%	1.78%	2.09%	1.45%
Est. Rev. Top 30 Up	Earnings Estimates	178	190	-27.17%	35.93%	2.12%	1.97%	8.44%	0.23	1.00	1.90%	1.66%	1.97%	1.35%
P/E Relative	Earnings Estimates	32	190	-18.36%	18.44%	1.26%	1.32%	5.24%	0.20	0.92	1.04%	1.01%	1.32%	0.63%
Dreman With Est. Revisions	Earnings Estimates	13	190	-26.26%	21.43%	1.25%	1.24%	6.26%	0.17	0.60	1.02%	0.93%	1.24%	0.62%
Est. Rev: Lowest 30 Down	Earnings Estimates	218	190	-29.96%	42.98%	0.44%	0.07%	10.75%	0.02	1.13	0.22%	-0.24%	0.07%	-0.41%
Est. Rev: Down 5	Earnings Estimates	76	190	-30.59%	33.49%	0.28%	0.06%	9.02%	0.01	0.94	0.05%	-0.25%	0.06%	-0.58%
$(r_m-r_f)$			190	-17.15%	11.34%	0.44%	0.32%	4.80%						
SMB			190	-11.60%	14.62%	0.36%	0.31%	3.24%						
HML			190	-20.79%	19.72%	0.16%	0.06%	4.35%						
MOM			190	-34.72%	18.39%	0.41%	0.23%	5.86%						

## Appendix II. Capital Asset Pricing Model Regression Results

Table 2. Capital Asset Pricing Model Regression Results

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	$R^2$	Adjusted $R^2$	F
Buffett: Hagstrom	Growth/Value	0.70*** (0.17)	0.95*** (0.03)	0.80	0.80	744.06
Buffettology: EPS Growth	Growth/Value	0.41** (0.20)	1.02*** (0.04)	0.76	0.76	593.29
Buffettology: Sustainable Growth	Growth/Value	0.45** (0.22)	1.05*** (0.05)	0.73	0.73	515.21
O'Neil's CAN SLIM	Growth/Price MOM	1.81*** (0.61)	0.57*** (0.13)	0.09	0.08	17.95
O'Neil's CAN SLIM Revised	Growth/Price MOM	1.08** (0.54)	0.89*** (0.11)	0.25	0.25	63.30
O'Neil's CAN SLIM No Float	Growth/Price MOM	0.97*** (0.36)	0.84*** (0.07)	0.40	0.40	127.01
Cash Rich Firms	Value	0.42 (0.27)	1.08*** (0.06)	0.67	0.67	379.94
Dual Cash Flow	Growth	0.70** (0.33)	1.14*** (0.07)	0.60	0.60	283.16
Dividend (High Relative Yield)	Growth/Value	0.33* (0.20)	0.72*** (0.04)	0.61	0.61	297.28
Dogs of the Dow	Value	-0.19 (0.28)	0.86*** (0.06)	0.54	0.53	217.03
Dogs of the Dow LowPriced 5	Value	-0.19 (0.40)	1.01*** (0.08)	0.44	0.44	146.53
Dreman	Growth/Value	0.48 (0.31)	0.83*** (0.06)	0.47	0.47	169.87
Dreman With Est. Revisions	Earnings Estimates	0.88** (0.35)	0.83*** (0.07)	0.41	0.40	129.55
Driehaus	Growth/Price MOM	0.68 (0.57)	1.33*** (0.12)	0.40	0.40	127.72
Dividend Screen DRP	Growth/Value	0.28 (0.26)	0.75*** (0.06)	0.50	0.49	184.33
Dividend Screen Non-DRP	Growth/Value	0.61*** (0.22)	.63*** (0.05)	0.49	0.49	183.94
Est. Rev: Lowest 30 Down	Earnings Estimates	-0.37 (0.44)	1.85*** (0.09)	0.68	0.68	399.09
Est. Rev: Down 5	Earnings Estimates	-0.41 (0.36)	1.58*** (0.07)	0.71	0.70	451.77
Est. Rev. Top 30 Up	Earnings Estimates	1.52*** (0.39)	1.36*** (0.08)	0.60	0.60	285.24
Est. Rev: Up 5	Earnings Estimates	1.65*** (0.38)	1.29*** (0.08)	0.58	0.58	264.39
Fisher (Philip)	Growth/Value	0.03 (0.51)	1.51*** (0.11)	0.52	0.52	204.52
Foolish Small Cap 8	Growth/Price MOM	0.54 (0.54)	1.45*** (0.11)	0.47	0.46	164.52
Foolish Small Cap 8 Revised	Growth/Value	0.97* (0.59)	1.19*** (0.12)	0.33	0.33	93.46



Table 2. (continued)

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	$R^2$	Adjusted $R^2$	F
Price-to-Free Cash Flow	Value	1.17*** (0.42)	1.22*** (0.09)	0.51	0.51	195.30
Fundamental Rule of Thumb	Value	0.71* (0.40)	1.17*** (0.08)	0.51	0.51	194.84
Graham Defensive Investor Non-Utility	Value	1.01*** (0.33)	0.92*** (0.07)	0.49	0.49	181.35
Graham Defensive Investor Utility	Value	0.36 (0.27)	0.41*** (0.06)	0.22	0.22	53.81
Graham Enterprising Investor	Value	1.21** (0.54)	0.69*** (0.11)	0.17	0.17	38.38
Graham Enterprising Investor Revised	Value	1.36*** (0.49)	0.92*** (0.10)	0.30	0.30	82.01
IBD Stable 70 price	Growth	0.45** (0.22)	0.95*** (0.05)	0.70	0.70	431.77
Insider Net Purchases	Specialty	-0.44 (0.42)	1.19*** (0.09)	0.50	0.50	186.32
Invest Ware Quality Growth	Growth	0.11 (0.24)	0.99*** (0.05)	0.68	0.68	404.12
Kirkpatrick Bargain	Growth/Value	0.35 (0.38)	0.68*** (0.08)	0.28	0.28	74.23
Kirkpatrick Growth	Growth/Price MOM	1.09* (0.62)	0.97*** (0.13)	0.24	0.23	57.86
Kirkpatrick Value	Growth/Value	0.97 (0.69)	0.55*** (0.14)	0.07	0.07	14.34
Lakonishok	Value/Price MOM	0.71*** (0.26)	0.88*** (0.05)	0.58	0.57	255.53
Lynch	Growth/Value	0.61** (0.29)	0.83*** (0.06)	0.50	0.50	190.52
Magic Formula	Value	0.45 (0.37)	1.18*** (0.08)	0.56	0.55	234.77
MAGNET Complex	Growth/Value/Price MOM	1.03 (0.85)	0.97*** (0.18)	0.14	0.14	30.55
MAGNET Simple	Growth/Value/Price MOM	1.52 0.91* (0.19)	1.28*** (0.19)	0.20	0.19	45.78
Muhlenkam	Growth/Value/Price MOM	-0.08 (0.35)	0.91*** (0.07)	0.46	0.45	158.15
Murphy Technology	Growth/Value	-0.19 (0.76)	1.55*** (0.16)	0.34	0.33	95.57
Neff	Growth/Value	1.15*** (0.37)	1.16*** (0.08)	0.55	0.55	228.70
O'Shaughnessy All Cap	Value/Price MOM	0.63* (0.33)	0.92*** (0.07)	0.49	0.49	180.60
O'Shaughnessy Growth Market Leaders	Value/Price MOM	0.17 (0.26)	0.91*** (0.05)	0.60	0.60	285.52
O'Shaughnessy Growth	Value/Price MOM	0.89*** (0.32)	1.14*** (0.07)	0.61	0.61	296.85

Table 2. (continued)

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	$R^2$	Adjusted $R^2$	F
O'Shaughnessy Small Cap Growth and Value	Value/Price MOM	1.09*** (0.35)	1.06*** (0.07)	0.54	0.53	217.53
O'Shaughnessy Tiny Titans	Value/Price MOM	1.56*** (0.48)	1.26*** (0.10)	0.46	0.46	161.03
O'Shaughnessy Value	Value	0.03 (0.28)	1.01*** (0.06)	0.61	0.61	295.21
Oberweis Octagon	Growth/Value/Price MOM	0.80 (0.49)	1.18*** (0.10)	0.41	0.41	133.08
P/E Relative	Earnings Estimates	0.89*** (0.24)	0.85*** (0.05)	0.60	0.60	283.41
Value on the Move PEG With Est. Growth	Growth/Value/Price MOM	1.09*** (0.27)	1.01*** (0.06)	0.62	0.62	311.93
Value on the Move PEG With Hist. Growth	Growth/Value/Price MOM	0.72*** (0.21)	0.79*** (0.04)	0.63	0.63	320.82
Piotroski High F-Score	Value	2.14*** (0.61)	0.99*** (0.13)	0.25	0.24	61.26
Piotroski: 9	Value	2.97*** (0.80)	0.51*** (0.17)	0.05	0.04	9.31
Price-to-Sales	Growth/Value	0.78*** (0.26)	1.04*** (0.05)	0.67	0.66	374.75
Return on Equity	Growth	0.58*** (0.22)	1.06*** (0.05)	0.73	0.73	517.21
Rule #1 Investing	Growth/Value	0.57 (0.39)	1.29*** (0.08)	0.57	0.57	250.84
Schloss	Value	0.71 (0.88)	0.54*** (0.11)	0.25	0.25	62.86
Shadow Stock Screen	Growth/Value	0.90** (0.38)	0.70*** (0.08)	0.29	0.29	76.60
T. Rowe	Growth/Value	0.53 (0.47)	0.91*** (0.10)	0.32	0.31	86.59
Templeton	Growth/Value	0.44* (0.25)	0.94*** (0.05)	0.63	0.63	316.88
Wanger Revised	Growth/Value	0.30 (0.27)	1.14*** (0.06)	0.68	0.68	400.25
Weiss Blue Chip Div. Yield	Value	0.45* (0.26)	0.90*** (0.05)	0.59	0.59	271.80
Stock Market Winners	Growth/Value/Price MOM	1.44*** (0.47)	0.49*** (0.10)	0.12	0.12	25.63
Zweig	Growth/Value	1.13** (0.45)	1.13*** (0.09)	0.43	0.43	143.43

Note: Standard errors are shown in parentheses; \* indicates significance at the 90% level, \*\* at 95%, and \*\*\* at 99%

### Appendix III. Fama-French Three-Factor Model Regression Results

Table 3. Fama-French Three Factor Model Regression Results

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	SMB	HML	$R^2$	Adjusted $R^2$	F
Buffett: Hagstrom	Growth/Value	0.66*** (0.17)	0.93*** (0.04)	0.09* (0.06)	0.08** (0.04)	0.80	0.80	255.82
Buffettology: EPS Growth	Growth/Value	0.30* (0.18)	0.94*** (0.04)	0.36*** (0.06)	0.15*** (0.04)	0.80	0.80	251.86
Buffettology: Sustainable Growth	Growth/Value	0.32 (0.20)	0.96*** (0.04)	0.38*** (0.07)	0.21*** (0.05)	0.78	0.78	226.17
O'Neil's CAN SLIM	Growth/Price MOM	1.73*** (0.60)	0.45*** (0.13)	0.44** (0.20)	-0.24* (0.14)	0.13	0.12	9.46
O'Neil's CAN SLIM Revised	Growth/Price MOM	1.00** (0.46)	0.77*** (0.10)	0.68*** (0.15)	-0.71*** (0.11)	0.47	0.46	55.68
O'Neil's CAN SLIM No Float	Growth/Price MOM	0.93*** (0.34)	0.79*** (0.07)	0.31*** (0.11)	-0.33*** (0.08)	0.49	0.48	58.73
Cash Rich Firms	Value	0.25 (0.24)	0.95*** (0.05)	0.58*** (0.08)	.075 (0.05)	0.74	0.74	180.86
Dual Cash Flow	Growth	0.47* (0.28)	0.97*** (0.06)	0.71*** (0.09)	0.28*** (0.07)	0.71	0.70	149.10
Dividend (High Relative Yield)	Growth/Value	0.24 (0.16)	0.68*** (0.04)	0.14*** (0.05)	0.38*** (0.04)	0.75	0.74	183.53
Dogs of the Dow	Value	-0.18 (0.21)	0.91*** (0.05)	-0.31*** (0.07)	0.50*** (0.05)	0.74	0.73	173.15
Dogs of the Dow LowPriced 5	Value	-0.22 (0.32)	1.04*** (0.07)	-0.28*** (0.11)	0.70*** (0.08)	0.64	0.63	110.41
Dreman	Growth/Value	0.36 (0.26)	0.77*** (0.06)	0.18** (0.09)	0.51*** (0.06)	0.62	0.61	99.75
Dreman With Est. Revisions	Earnings Estimates	0.86** (0.35)	0.83*** (0.08)	-.030 (0.11)	0.23*** (0.08)	0.43	0.43	47.69
Driehaus	Growth/Price MOM	0.45 (0.50)	1.11*** (0.11)	1.06*** (0.17)	-0.31*** (0.12)	0.54	0.53	73.13
Dividend Screen DRP	Growth/Value	0.16 (0.18)	0.70*** (0.04)	0.11* (0.06)	0.63*** (0.04)	0.77	0.77	210.77
Dividend Screen Non-DRP	Growth/Value	0.49*** (0.18)	0.56*** (0.04)	0.25*** (0.06)	0.42*** (0.04)	0.68	0.67	129.32
Est. Rev: Lowest 30 Down	Earnings Estimates	-0.72** (0.35)	1.60*** (0.08)	1.00*** (0.11)	0.71*** (0.08)	0.81	0.81	265.00
Est. Rev: Down 5	Earnings Estimates	-0.72*** (0.25)	1.37*** (0.06)	0.81*** (0.08)	0.67*** (0.06)	0.86	0.85	366.45
Est. Rev. Top 30 Up	Earnings Estimates	1.37*** (0.34)	1.22*** (0.07)	0.71*** (0.11)	-0.29*** (0.08)	0.71	0.70	148.73
Est. Rev: Up 5	Earnings Estimates	1.54*** (0.33)	1.16*** (0.07)	0.62*** (0.11)	-0.37*** (0.08)	0.69	0.69	141.17
Fisher (Philip)	Growth/Value	-.23 (0.47)	1.32*** (0.10)	0.76*** (0.16)	0.43*** (0.11)	0.59	0.59	90.58
Foolish Small Cap 8	Growth/Price MOM	0.41 (0.48)	1.30*** (0.10)	0.80*** (0.16)	-0.57*** (0.11)	0.60	0.60	93.83
Foolish Small Cap 8 Revised	Growth/Value	0.82 (0.58)	1.05*** (0.13)	0.64*** (0.19)	-.099 (0.13)	0.38	0.37	37.38
Price-to-Free Cash Flow	Value	0.81*** (0.27)	0.99*** (0.06)	0.85*** (0.09)	0.93*** (0.06)	0.80	0.79	242.67
Fundamental Rule of Thumb	Value	0.40 (0.33)	0.93*** (0.07)	0.97*** (0.11)	0.37*** (0.08)	0.67	0.66	124.32
Graham Defensive Investor Non-Utility	Value	0.78*** (0.27)	0.76*** (0.06)	0.63*** (0.09)	0.49*** (0.06)	0.66	0.66	121.51
Graham Defensive Investor Utility	Value	0.36 (0.25)	0.43*** (0.06)	-0.15* (0.08)	0.29*** (0.06)	0.34	0.33	31.37
Graham Enterprising Investor	Value	1.08** (0.52)	0.59*** (0.12)	0.36** (0.17)	0.38*** (0.12)	0.22	0.21	17.52

Table 3. (continued)

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	SMB	HML	$R^2$	Adjusted $R^2$	F
IBD Stable 70 price	Growth	0.36* (0.21)	0.89*** (0.05)	0.22*** (0.07)	0.22*** (0.05)	0.74	0.73	171.97
Insider Net Purchases	Specialty	-0.78** (0.34)	0.92*** (0.07)	1.15*** (0.11)	0.30*** (0.08)	0.68	0.68	134.79
InveSt Ware Quality Growth	Growth	0.04 (0.23)	0.94*** (0.05)	0.20*** (0.08)	0.10* (0.05)	0.70	0.69	142.52
Kirkpatrick Bargain	Growth/Value	0.28 (0.38)	0.63*** (0.08)	0.21* (0.12)	.139 (0.09)	0.30	0.29	26.58
Kirkpatrick Growth	Growth/Price MOM	1.01* (0.55)	0.85*** (0.12)	0.68*** (0.18)	-0.70*** (0.13)	0.41	0.40	42.38
Kirkpatrick Value	Growth/Value	0.83 (0.69)	0.45*** (0.15)	0.38* (0.23)	0.30* (0.16)	0.10	0.08	6.64
Lakonishok	Value/Price MOM	0.61** (0.25)	0.80*** (0.06)	0.33*** (0.08)	0.12** (0.06)	0.61	0.61	98.06
Lynch	Growth/Value	0.44* (0.26)	0.71*** (0.06)	0.50*** (0.09)	0.28*** (0.06)	0.60	0.60	94.27
Magic Formula	Value	0.15 (0.28)	0.97*** (0.06)	0.83*** (0.09)	0.61*** (0.07)	0.75	0.74	182.38
MAGNET Complex	Growth/Value/Price MOM	1.00 (0.82)	0.90*** (0.18)	.433 (0.27)	-0.60*** (0.19)	0.20	0.19	15.77
MAGNET Simple	Growth/Value/Price MOM	1.31 (0.90)	1.10*** (0.20)	0.74*** (0.30)	.144 (0.21)	0.22	0.21	17.72
Muhlenkam	Growth/Value/Price MOM	-0.30 (0.30)	0.75*** (0.07)	0.60*** (0.10)	0.45*** (0.07)	0.60	0.59	93.32
Murphy Technology	Growth/Value	-0.39 (0.75)	1.38*** (0.17)	0.78*** (0.25)	-.042 (0.17)	0.37	0.36	36.68
Neff	Growth/Value	0.84*** (0.25)	0.96*** (0.06)	0.78*** (0.08)	0.76*** (0.06)	0.79	0.79	235.71
O'Shaughnessy All Cap	Value/Price MOM	0.48 (0.31)	0.83*** (0.07)	0.34*** (0.10)	0.39*** (0.07)	0.57	0.57	82.89
O'Shaughnessy Growth Market Leaders	Value/Price MOM	0.17 (0.26)	0.90*** (0.06)	.057 (0.09)	-0.12** (0.06)	0.61	0.61	98.72
O'Shaughnessy Growth	Value/Price MOM	0.74*** (0.29)	1.00*** (0.06)	0.60*** (0.10)	-.031 (0.07)	0.68	0.68	133.29
O'Shaughnessy Small Cap Growth and Value	Value/Price MOM	0.93*** (0.32)	0.92*** (0.07)	0.63*** (0.11)	-.001 (0.07)	0.61	0.61	98.30
O'Shaughnessy Tiny Titans	Value/Price MOM	1.29*** (0.42)	1.02*** (0.09)	1.06*** (0.14)	-.026 (0.10)	0.60	0.59	91.45
O'Shaughnessy Value	Value	-0.02 (0.19)	1.02*** (0.04)	-0.15** (0.06)	0.65*** (0.04)	0.84	0.83	314.55
Oberweis Octagon	Growth/Value/Price MOM	0.66 (0.47)	1.05*** (0.10)	0.64*** (0.16)	-0.19* (0.11)	0.48	0.47	56.95
P/E Relative	Earnings Estimates	0.83*** (0.23)	0.82*** (0.05)	.083 (0.07)	0.29*** (0.05)	0.66	0.65	118.83
Value on the Move PEG With Est. Growth	Growth/Value/Price MOM	0.92*** (0.24)	0.87*** (0.05)	0.61*** (0.08)	.038 (0.06)	0.72	0.71	156.17
Value on the Move PEG With Hist. Growth	Growth/Value/Price MOM	0.61*** (0.19)	0.69*** (0.04)	0.47*** (0.06)	-.040 (0.04)	0.73	0.72	164.18
Piotroski High F-Score	Value	1.80*** (0.54)	0.76*** (0.12)	0.89*** (0.18)	0.75*** (0.13)	0.41	0.40	42.91
Piotroski: 9	Value	2.76*** (0.79)	0.34* (0.17)	0.74*** (0.26)	.083 (0.18)	0.09	0.07	5.91
Price-to-Sales	Growth/Value	0.54*** (0.19)	0.85*** (0.04)	0.76*** (0.06)	0.28*** (0.04)	0.83	0.82	294.93
Return on Equity	Growth	0.43** (0.19)	0.93*** (0.04)	0.56*** (0.06)	.02 (0.04)	0.82	0.81	275.19
Rule #1 Investing	Growth/Value	0.33 (0.34)	1.11*** (0.08)	0.67*** (0.11)	0.48*** (0.08)	0.68	0.67	130.81

Table 3. (continued)

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	SMB	HML	$R^2$	Adjusted $R^2$	F
Shadow Stock Screen	Growth/Value	(0.52)	(0.11)	(0.17)	(0.12)	0.39	0.39	40.45
		0.74**	0.60**	0.36**	0.44***			
T. Rowe	Growth/Value	(0.36)	(0.08)	(0.12)	(0.08)	0.39	0.38	38.81
		0.34	0.77***	0.53***	0.36***			
Templeton	Growth/Value	(0.45)	(0.10)	(0.15)	(0.10)	0.68	0.68	133.74
		0.32	0.86***	0.30***	0.27***			
Wanger Revised	Growth/Value	(0.24)	(0.05)	(0.08)	(0.06)	0.77	0.76	204.57
		0.11	0.99***	0.61***	0.22***			
Weiss Blue Chip Div. Yield	Value	(0.24)	(0.05)	(0.08)	(0.05)	0.69	0.69	138.01
		0.33	0.83***	0.26***	0.40***			
Stock Market Winners	Growth/Value/Price MOM	(0.23)	(0.05)	(0.08)	(0.05)	0.16	0.15	11.98
		1.32***	0.39***	0.46***	0.00***			
Zweig	Growth/Value	(0.46)	(0.10)	(0.15)	(0.11)	0.46	0.45	52.89
		1.00**	1.04***	0.37**	0.23**			
		(0.45)	(0.10)	(0.15)	(0.10)			

Note: Standard errors are shown in parentheses; \* indicates significance at the 90% level, \*\* at 95%, and \*\*\* at 99%

## Appendix IV. Carhart Four-Factor Model Regression Results

Table 4. Carhart's Four Factor Model Regression Results

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	SMB	HML	MOM	R <sup>2</sup>	Adjusted R <sup>2</sup>	F
Buffett: Hagstrom	Growth/Value	0.68*** (0.17)	0.92*** (0.04)	0.09* (0.06)	0.05 (0.06)	-0.03 (0.04)	0.81	0.80	191.44
Buffettology: EPS Growth	Growth/Value	0.32* (0.19)	0.93*** (0.04)	0.35*** (0.06)	0.12** (0.06)	-0.03 (0.05)	0.80	0.80	188.31
Buffettology: Sustainable Growth	Growth/Value	0.41** (0.20)	0.92*** (0.05)	0.37*** (0.07)	0.09 (0.07)	-0.13** (0.05)	0.79	0.79	174.99
O'Neil's CAN SLIM	Growth/Price MOM	1.51*** (0.61)	0.53*** (0.14)	0.48*** (0.20)	0.04 (0.21)	0.29* (0.16)	0.15	0.13	7.98
O'Neil's CAN SLIM Revised	Growth/Price MOM	0.72 (0.46)	0.88*** (0.11)	0.73*** (0.15)	-0.35** (0.16)	0.37*** (0.12)	0.50	0.49	46.10
O'Neil's CAN SLIM No Float	Growth/Price MOM	0.64** (0.33)	0.91*** (0.08)	0.37*** (0.11)	0.06 (0.11)	0.40*** (0.09)	0.54	0.53	54.18
Cash Rich Firms	Value	0.29 (0.24)	0.93*** (0.06)	0.57*** (0.08)	0.03 (0.08)	-0.05 (0.06)	0.75	0.74	135.46
Dual Cash Flow	Growth	0.43 (0.29)	0.99*** (0.07)	0.72*** (0.09)	0.34*** (0.10)	0.06 (0.08)	0.71	0.70	111.73
Dividend (High Relative Yield)	Growth/Value	0.13 (0.16)	0.72*** (0.04)	0.16*** (0.05)	0.52*** (0.06)	0.15*** (0.04)	0.76	0.76	148.44
Dogs of the Dow	Value	-0.19 (0.22)	0.92*** (0.05)	-0.31*** (0.07)	0.52*** (0.07)	0.02 (0.06)	0.74	0.73	129.25
Dogs of the Dow LowPriced 5	Value	-0.23 (0.33)	1.05*** (0.08)	-0.28*** (0.11)	0.71*** (0.11)	0.02 (0.09)	0.64	0.63	82.38
Dreman	Growth/Value	0.18 (0.26)	0.84*** (0.06)	0.22*** (0.09)	0.74*** (0.09)	0.25*** (0.07)	0.64	0.63	82.69
Dreman With Est. Revisions	Earnings Estimates	0.59* (0.34)	0.94*** (0.08)	0.02 (0.11)	0.58*** (0.12)	0.36*** (0.09)	0.48	0.47	42.53
Driehaus	Growth/Price MOM	0.53 (0.51)	1.07*** (0.12)	1.05*** (0.17)	-0.42*** (0.18)	-0.11 (0.14)	0.54	0.53	54.94
Dividend Screen DRP	Growth/Value	0.09 (0.18)	0.72*** (0.04)	0.12* (0.06)	0.71*** (0.06)	0.09* (0.05)	0.78	0.77	160.97
Dividend Screen Non-DRP	Growth/Value	0.37** (0.18)	0.61*** (0.04)	0.27*** (0.06)	0.57*** (0.06)	0.15*** (0.05)	0.69	0.69	104.45
Est. Rev: Lowest 30 Down	Earnings Estimates	-0.31 (0.32)	1.43*** (0.07)	0.90*** (0.10)	0.18* (0.11)	-0.55*** (0.08)	0.85	0.84	253.06
Est. Rev: Down 5	Earnings Estimates	-0.48** (0.24)	1.27*** (0.06)	0.77*** (0.08)	0.36*** (0.08)	-0.32*** (0.06)	0.87	0.87	315.67
Est. Rev. Top 30 Up	Earnings Estimates	1.32*** (0.34)	1.24*** (0.08)	0.72*** (0.11)	-0.22* (0.12)	0.08 (0.09)	0.71	0.70	111.54
Est. Rev: Up 5	Earnings Estimates	1.49*** (0.34)	1.18*** (0.08)	0.63*** (0.11)	-0.30*** (0.12)	0.07 (0.09)	0.70	0.70	105.76
Fisher (Philip)	Growth/Value	-0.06 (0.48)	1.25*** (0.11)	0.73*** (0.16)	0.20 (0.16)	-0.23* (0.13)	0.60	0.59	69.64
Foolish Small Cap 8	Growth/Price MOM	0.03 (0.46)	1.45*** (0.11)	0.87*** (0.15)	-0.07 (0.16)	0.51*** (0.12)	0.64	0.63	80.93
Foolish Small Cap 8 Revised	Growth/Value	0.72 (0.59)	1.09*** (0.14)	0.66*** (0.19)	0.03 (0.20)	0.13 (0.16)	0.38	0.37	28.17
Price-to-Free Cash Flow	Value	0.78*** (0.28)	1.01*** (0.06)	0.86*** (0.09)	0.98*** (0.10)	0.05 (0.07)	0.80	0.79	181.65
Fundamental Rule of Thumb	Value	0.49 (0.34)	0.90*** (0.08)	0.96*** (0.11)	0.26** (0.12)	-0.11 (0.09)	0.67	0.66	93.87
Graham Defensive Investor Non-Utility	Value	0.67*** (0.27)	0.80*** (0.06)	0.65*** (0.09)	0.62*** (0.09)	0.14** (0.07)	0.67	0.66	93.37
Graham Defensive Investor Utility	Value	0.13 (0.24)	0.53*** (0.06)	-0.11 (0.08)	0.59*** (0.08)	0.31*** (0.06)	0.41	0.40	32.46
Graham Enterprising Investor	Value	0.94* (0.54)	0.64*** (0.12)	0.39** (0.17)	0.53*** (0.18)	0.16 (0.14)	0.23	0.21	13.49
Graham Enterprising Investor Revised	Value	1.06*** (0.44)	0.76*** (0.10)	0.68*** (0.14)	0.70*** (0.15)	0.05 (0.12)	0.46	0.45	39.90
IBD Stable 70 price	Growth	0.25 (0.21)	0.94*** (0.05)	0.24*** (0.07)	0.36*** (0.07)	0.14*** (0.05)	0.74	0.74	134.87
Insider Net Purchases	Specialty	-0.71** (0.34)	0.89*** (0.08)	1.13*** (0.11)	0.21* (0.12)	-0.09 (0.09)	0.69	0.68	101.39
InveSt Ware Quality Growth	Growth	0.04 (0.24)	0.95*** (0.06)	0.20*** (0.08)	0.11 (0.08)	0.01 (0.06)	0.70	0.69	106.34

Table 4. (continued)

Portfolio name	Strategy	$\alpha$	$(r_m - r_f)$	SMB	HML	MOM	R <sup>2</sup>	Adjusted R <sup>2</sup>	F
Kirkpatrick Bargain	Growth/Value	-0.06 (0.36)	0.77*** (0.08)	0.27** (0.12)	0.58*** (0.12)	0.46*** (0.10)	0.38	0.36	27.83
Kirkpatrick Growth	Growth/Price MOM	0.88 (0.56)	0.90*** (0.13)	0.70*** (0.18)	-0.53*** (0.19)	0.18 (0.15)	0.41	0.40	32.24
Kirkpatrick Value	Growth/Value	0.49 (0.70)	0.59*** (0.16)	0.45** (0.23)	0.74*** (0.24)	0.45*** (0.18)	0.13	0.11	6.65
Lakonishok	Value/Price MOM	0.47* (0.25)	0.85*** (0.06)	0.36*** (0.08)	0.30*** (0.09)	0.19*** (0.07)	0.63	0.62	78.08
Lynch	Growth/Value	0.39 (0.27)	0.73*** (0.06)	0.51*** (0.09)	0.36*** (0.09)	0.07 (0.07)	0.61	0.60	71.03
Magic Formula	Value	0.22 (0.29)	0.94*** (0.07)	0.81*** (0.09)	0.51*** (0.10)	-0.10 (0.08)	0.75	0.74	137.70
MAGNET Complex	Growth/Value/Price MOM	0.84 (0.84)	0.97*** (0.19)	0.46* (0.27)	-0.39 (0.29)	0.22 (0.22)	0.21	0.19	12.06
MAGNET Simple	Growth/Value/Price MOM	1.02 (0.91)	1.22*** (0.21)	0.80*** (0.30)	0.51* (0.31)	0.38 (0.24)	0.23	0.22	14.01
Muhlenkam	Growth/Value/Price MOM	-0.43 (0.30)	0.81*** (0.07)	0.63*** (0.10)	0.63*** (0.10)	0.18** (0.08)	0.61	0.60	72.79
Murphy Technology	Growth/Value	0.07 (0.75)	1.19*** (0.17)	0.68*** (0.24)	-0.64*** (0.26)	-0.61*** (0.20)	0.40	0.39	31.23
Neff	Growth/Value	0.80*** (0.26)	0.97*** (0.06)	0.79*** (0.08)	0.80*** (0.09)	0.05 (0.07)	0.79	0.79	176.39
O'Shaughnessy All Cap	Value/Price MOM	0.13 (0.28)	0.98*** (0.07)	0.41*** (0.09)	0.85*** (0.10)	0.47*** (0.07)	0.65	0.64	85.34
O'Shaughnessy Growth Market Leaders	Value/Price MOM	-0.23 (0.22)	1.07*** (0.05)	0.13* (0.07)	0.39*** (0.07)	0.53*** (0.06)	0.74	0.73	130.28
O'Shaughnessy Growth	Value/Price MOM	0.28 (0.24)	1.19*** (0.06)	0.68*** (0.08)	0.56*** (0.08)	0.61*** (0.06)	0.79	0.78	172.44
O'Shaughnessy Small Cap Growth and Value	Value/Price MOM	0.43 (0.27)	1.12*** (0.06)	0.72*** (0.09)	0.64*** (0.09)	0.66*** (0.07)	0.74	0.73	128.45
O'Shaughnessy Tiny Titans	Value/Price MOM	1.03*** (0.42)	1.12*** (0.10)	1.11*** (0.14)	0.30** (0.14)	0.34*** (0.11)	0.62	0.61	74.02
O'Shaughnessy Value	Value	-0.07 (0.19)	1.04*** (0.04)	-0.14** (0.06)	0.72*** (0.06)	0.08 (0.05)	0.84	0.83	238.21
Oberweis Octagon	Growth/Value/Price MOM	0.23 (0.45)	1.22*** (0.11)	0.72*** (0.15)	0.37** (0.16)	0.57*** (0.12)	0.54	0.53	53.32
P/E Relative	Earnings Estimates	0.63*** (0.22)	0.90*** (0.05)	0.12* (0.07)	0.55*** (0.07)	0.27*** (0.06)	0.69	0.69	105.00
Value on the Move PEG With Est. Growth	Growth/Value/Price MOM	0.66*** (0.22)	0.98*** (0.05)	0.66*** (0.07)	0.39*** (0.08)	0.36*** (0.06)	0.76	0.76	148.68
Value on the Move PEG With Hist. Growth	Growth/Value/Price MOM	0.34** (0.16)	0.80*** (0.04)	0.52*** (0.05)	0.31*** (0.06)	0.36*** (0.04)	0.80	0.80	186.37
Piotroski High F-Score	Value	1.92*** (0.55)	0.70*** (0.13)	0.87* (0.18)	0.59*** (0.19)	-0.17 (0.15)	0.41	0.40	32.56
Piotroski: 9	Value	2.66*** (0.81)	0.38** (0.19)	0.76*** (0.26)	0.22 (0.28)	0.14 (0.21)	0.09	0.07	4.53
Price-to-Sales	Growth/Value	0.41** (0.19)	0.91*** (0.04)	0.79*** (0.06)	0.45*** (0.06)	0.17*** (0.05)	0.84	0.83	238.48
Return on Equity	Growth	0.33* (0.19)	0.97*** (0.04)	0.58*** (0.06)	0.15** (0.06)	0.13*** (0.05)	0.82	0.82	214.14
Rule #1 Investing	Growth/Value	0.51 (0.34)	1.04*** (0.08)	0.64*** (0.11)	0.25** (0.12)	-0.25*** (0.09)	0.69	0.68	103.32
Schloss	Value	0.71 (0.53)	0.67*** (0.12)	0.51*** (0.17)	0.11 (0.18)	-0.26* (0.14)	0.32	0.31	22.03
Shadow Stock Screen	Growth/Value	0.55 (0.36)	0.68*** (0.08)	0.40*** (0.12)	0.68*** (0.12)	0.25*** (0.09)	0.42	0.40	33.10
T. Rowe	Growth/Value	0.37 (0.46)	0.76*** (0.11)	0.53*** (0.15)	0.31** (0.16)	-0.05 (0.12)	0.39	0.37	29.01
Templeton	Growth/Value	0.43* (0.24)	0.82*** (0.06)	0.28*** (0.08)	0.12 (0.08)	-0.15** (0.06)	0.69	0.69	104.17
Wanger Revised	Growth/Value	0.10 (0.24)	0.99*** (0.06)	0.62*** (0.08)	0.22*** (0.08)	0.00 (0.06)	0.77	0.76	152.61
Weiss Blue Chip Div. Yield	Value	0.38* (0.24)	0.81*** (0.05)	0.25*** (0.08)	0.33*** (0.08)	-0.07 (0.06)	0.69	0.69	103.98
Stock Market Winners	Growth/Value/Price MOM	1.08** (0.46)	0.49*** (0.11)	0.50*** (0.15)	0.32** (0.16)	0.32*** (0.12)	0.19	0.18	11.05
Zweig	Growth/Value	0.60 (0.43)	1.21*** (0.10)	0.45*** (0.14)	0.76*** (0.15)	0.54*** (0.11)	0.52	0.51	49.96

Note: Standard errors are shown in parentheses; \* indicates significance at the 90% level, \*\* at 95%, and \*\*\* at 99%. Portfolios with positive momentum factor are highlighted in green and portfolios with negative momentum factor are highlighted in red.

## Appendix V. Carhart Four-Factor Model Adjusted for Transaction Costs

Table 5. Carhart's Four Factor Model Regression Results - Adjusted for Transaction Costs Using a Hypothetical \$50,000 Portfolio

Portfolio name	Strategy	Number of Stocks	Transaction Costs	$\alpha$	$(r_m - r_f)$	SMB	HML	MOM	$R^2$	Adjusted $R^2$	F
Buffett: Hagstrom	Growth/Value	30	\$ 420.00	-0.16 (0.17)	0.92*** (0.04)	0.09* (0.06)	0.05 (0.06)	-0.03 (0.04)	0.81	0.80	191.44
Buffettology: EPS Growth	Growth/Value	47	\$ 658.00	-1.00*** (0.19)	0.93*** (0.04)	0.35*** (0.06)	0.12** (0.06)	-0.03 (0.05)	0.80	0.80	188.31
Buffettology: Sustainable Growth	Growth/Value	33	\$ 462.00	-0.51** (0.20)	0.92*** (0.05)	0.37*** (0.07)	0.09 (0.07)	-0.13** (0.05)	0.79	0.79	174.99
O'Neil's CAN SLIM	Growth/Price MOM	6	\$ 84.00	1.35** (0.61)	0.53*** (0.14)	0.48** (0.20)	0.04 (0.21)	0.29* (0.16)	0.15	0.13	7.98
O'Neil's CAN SLIM No Float	Growth/Price MOM	16	\$ 224.00	0.19 (0.33)	0.91*** (0.08)	0.37*** (0.11)	0.06 (0.11)	0.40*** (0.09)	0.54	0.53	54.18
Dreman With Est. Revisions	Earnings Estimates	21	\$ 294.00	0.01 (0.34)	0.94*** (0.08)	0.02 (0.11)	0.58*** (0.12)	0.36*** (0.09)	0.48	0.47	42.53
Dividend Screen Non-DRP	Growth/Value	30	\$ 420.00	-0.47** (0.18)	0.61*** (0.04)	0.28*** (0.06)	0.57*** (0.06)	0.15*** (0.05)	0.69	0.69	104.45
Est. Rev: Down 5	Earnings Estimates	76	\$ 1,064.00	-2.61*** (0.24)	1.27*** (0.06)	0.77*** (0.08)	0.36*** (0.08)	-0.32*** (0.06)	0.87	0.87	315.67
Est. Rev. Top 30 Up	Earnings Estimates	178	\$ 2,492.00	-3.66*** (0.34)	1.24*** (0.08)	0.72*** (0.11)	-0.22* (0.12)	0.08 (0.09)	0.71	0.70	111.54
Est. Rev: Up 5	Earnings Estimates	42	\$ 588.00	0.31 (0.34)	1.18*** (0.08)	0.63*** (0.11)	-0.30*** (0.12)	0.07 (0.09)	0.70	0.69	105.76
Price-to-Free Cash Flow	Value	30	\$ 420.00	-0.06 (0.28)	1.01*** (0.06)	0.86*** (0.09)	0.98*** (0.10)	0.05 (0.07)	0.80	0.79	181.65
Graham Defensive Investor Non-Utility	Value	21	\$ 294.00	0.09 (0.27)	0.80*** (0.06)	0.65*** (0.09)	0.62*** (0.09)	0.14** (0.07)	0.67	0.66	93.37
Graham Enterprising Investor	Value	4	\$ 56.00	0.82 (0.54)	0.64*** (0.12)	0.39** (0.17)	0.53*** (0.18)	0.16 (0.14)	0.23	0.21	13.49
Graham Enterprising Investor Revised	Value	9	\$ 126.00	0.81* (0.44)	0.76*** (0.10)	0.68*** (0.14)	0.70*** (0.15)	0.05 (0.12)	0.46	0.45	39.90
Insider Net Purchases	Specialty	28	\$ 392.00	-1.50*** (0.34)	0.89*** (0.08)	1.13*** (0.11)	0.21* (0.12)	-0.09 (0.09)	0.69	0.68	101.39
Lakonishok	Value/Price MOM	31	\$ 434.00	-0.40 (0.25)	0.85*** (0.06)	0.36*** (0.08)	0.30*** (0.09)	0.19*** (0.07)	0.63	0.62	78.08
Neff	Growth/Value	22	\$ 308.00	0.19 (0.26)	0.97*** (0.06)	0.79*** (0.08)	0.80*** (0.09)	0.05 (0.07)	0.79	0.79	176.39



Table 5. (continued)

Portfolio name	Strategy	Number of Stocks	Transaction Costs	$\alpha$	$(r_m - r_f)$	SMB	HML	MOM	R <sup>2</sup>	Adjusted R <sup>2</sup>	F
O'Shaughnessy Tiny Titans	Value/Price MOM	25	\$ 350.00	0.33 (0.42)	1.12*** (0.10)	1.11*** (0.14)	0.30** (0.14)	0.34*** (0.11)	0.62	0.61	74.02
P/E Relative	Earnings Estimates	32	\$ 448.00	-0.27 (0.22)	0.90*** (0.05)	0.12* (0.07)	0.55*** (0.07)	0.27*** (0.06)	0.69	0.69	105.00
Value on the Move PEG With Est. Growth	Growth/Value/Price MOM	40	\$ 560.00	-0.46** (0.22)	0.98*** (0.05)	0.66*** (0.07)	0.39*** (0.08)	0.36*** (0.06)	0.76	0.76	148.68
Value on the Move PEG With Hist. Growth	Growth/Value/Price MOM	80	\$ 1,120.00	-1.91*** (0.16)	0.80*** (0.04)	0.52*** (0.05)	0.31*** (0.06)	0.36*** (0.04)	0.80	0.80	186.37
Piotroski High F-Score	Value	21	\$ 294.00	1.34** (0.55)	0.70*** (0.13)	0.87*** (0.18)	0.59*** (0.19)	-0.17 (0.15)	0.41	0.40	32.56
Piotroski: 9	Value	9	\$ 126.00	2.40*** (0.81)	0.38** (0.19)	0.76*** (0.26)	0.22 (0.28)	0.14 (0.21)	0.09	0.07	4.53
Price-to-Sales	Growth/Value	55	\$ 770.00	-1.13*** (0.19)	0.91*** (0.04)	0.79*** (0.06)	0.45*** (0.06)	0.17*** (0.05)	0.84	0.83	238.48
Return on Equity	Growth	32	\$ 448.00	-0.56*** (0.19)	0.97*** (0.04)	0.58*** (0.06)	0.15** (0.06)	0.13*** (0.05)	0.82	0.82	214.14
Templeton	Growth/Value	22	\$ 308.00	-0.18 (0.24)	0.82*** (0.06)	0.28*** (0.08)	0.12 (0.08)	-0.15** (0.06)	0.69	0.69	104.17
Weiss Blue Chip Div. Yield	Value	12	\$ 168.00	0.04 (0.24)	0.81*** (0.05)	0.25*** (0.08)	0.33*** (0.08)	-0.07 (0.06)	0.69	0.69	103.98
Stock Market Winners	Growth/Value/Price MOM	12	\$ 168.00	0.75* (0.46)	0.49*** (0.11)	0.50*** (0.15)	0.32** (0.16)	0.32*** (0.12)	0.19	0.18	11.05

Note: Standard errors are shown in parentheses; \* indicates significance at the 90% level, \*\* at 95%, and \*\*\* at 99%. Portfolios with statistically significant negative alphas are highlighted in red and portfolios with statistically significant positive alphas are highlighted in green. Transaction costs are calculated assuming 100% turnover rate and \$7 fee per trade for a hypothetical \$50,000 portfolio.

## Appendix VI. Top Performers

Top 10 Portfolios Outperforming the S&P 500	Top 10 Portfolios Outperforming the Best Fit Index
Piotroski: 9 Piotroski High F-Score Est. Rev: Up 5 Est. Rev. Top 30 Up O'Shaughnessy Tiny Titans MAGNET Simple O'Neil's CAN SLIM Graham Enterprising Investor Revised Price-to-Free Cash Flow Stock Market Winners	Piotroski: 9 Piotroski High F-Score Est. Rev: Up 5 Est. Rev. Top 30 Up O'Shaughnessy Tiny Titans O'Neil's CAN SLIM Graham Enterprising Investor Revised Stock Market Winners Neff Price-to-Free Cash Flow

Top 10 Portfolios Based on Sortino Ratios	Top 10 Portfolios Based on Sharpe Ratios
Piotroski: 9 MAGNET Complex O'Neil's CAN SLIM Kirkpatrick Growth MAGNET Simple Kirkpatrick Value O'Neil's CAN SLIM Revised Driehaus Foolish Small Cap 8 Graham Enterprising Investor	Piotroski: 9 Est. Rev: Up 5 Piotroski High F-Score Est. Rev. Top 30 Up Value on the Move PEG With Est. Growth Stock Market Winners O'Shaughnessy Tiny Titans O'Neil's CAN SLIM P/E Relative O'Shaughnessy Small Cap Growth and Value

<b>Top 10 - CAPM Alphas</b>	<b>Top 10 - Three Factor Alphas</b>
Piotroski: 9 Piotroski High F-Score O'Neil's CAN SLIM Est. Rev: Up 5 O'Shaughnessy Tiny Titans Est. Rev. Top 30 Up Stock Market Winners Graham Enterprising Investor Revised Graham Enterprising Investor Price to Free Cash Flow	Piotroski: 9 Piotroski High F-Score O'Neil's CAN SLIM Est. Rev: Up 5 Est. Rev. Top 30 Up Stock Market Winners O'Shaughnessy Tiny Titans Graham Enterprising Investor Revised Graham Enterprising Investor Kirkpatrick Growth

<b>Top 10 - Four Factor</b>	<b>Top Performers - Four Factor Model Adjusted for Transaction Costs</b>
Piotroski: 9 Piotroski High F-Score O'Neil's CAN SLIM Est. Rev: Up 5 Est. Rev. Top 30 Up Stock Market Winners Graham Enterprising Investor Revised O'Shaughnessy Tiny Titans Graham Enterprising Investor Neff	Piotroski: 9 O'Neil's CAN SLIM Piotroski High F-Score Graham Enterprising Investor Revised Stock Market Winners

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