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A Comparative Analysis on Performance of Seven All Star Investment Models

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Abstract

An examination of the performance of All Star Investment models namely: Joseph Piotroski, Margin Zweig, Joel Greenblatt, Benjamin Graham, William O'Neil, Peter Lynch, and Warren Buffett was undertaken. Using financial statement data in Compustat, the relative performance on these models was studied based on a start date of 1/2/1999 and an end date of 12/31/2012. Various holding periods for different frequencies were used for this examination: one year, six months, three months, and four weeks. In addition to the annualized returns for each period, other statistics such as the standard deviation, correlation with benchmark, the R-squared and beta were also documented. The results showed that the Piotroski model had the highest average return while ONeil model had the lowest return. The most volatile model was the Zweig mode with an average standard deviation of 31.025%. The Buffett model recorded the highest beta score.

JEL classification: G11/G34

Keywords: all star investment models, holding periods, trading frequencies

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1. Introduction

In the past, there have been a number of competing investing models that claimed to have beat market indices; and their market beating results have been documented in various academic and practitioner journals. Yet, because of various resource limitations (e.g., computing resources), researchers in these studies often examined only the efficacy of such systems on a single investment time horizon --- typically, one year. Furthermore, researchers often overlooked how stable such systems are over investment horizons. Some of investment systems may not be as stable as others.

When investors try to replicate the published investing strategies, they often did not get expected returns. There could be many reasons for underperformance of well-publicized investment systems. Some pundits contributed the underperformance to psychology of investors who lack discipline and fortitude to follow through a particular investment system. Those are distinct possibilities. In this paper, however, we argue that there are other reasons for investors' inability to replicate published investment systems; and stability of investment systems over investment horizons and trading frequency play a crucial role in this underperformance.

Therefore, we examine these two components by using seven star investment systems featured in Portfolio123 (hereafter P123). P123 is an investment service for investors; and P123 chose seven well-known investment systems as their star systems. Because publicized investment returns by these systems often relied on a particular holding period, and returns from such systems are assumed to be stable --- regardless of when (e.g., which particular day or month) they buy stocks --- investors are typically surprised to find that their actual returns are much different from what they expected.

In this study, using star systems in P123, we examined these issues. In P123, seven star investment systems are showcased. In the following paragraphs, we briefly discuss each star system and its creator. The following brief summary on creators of star systems came from Wikipedia (http://www.wikipedia.org/). Because there is plenty of information on each of the creators on Internet, below, we discuss information only relevant to this paper.

(1) Joseph Piotroski is an accounting professor at Stanford University and his publication (Piotroski, 2000) on value investing approach based on several accounting-based criteria;
(2) Martin Zweig was an investment manager; and his investment methodology was based on a combination of fundamental analysis and market timing in picking growth stocks;
(3) Joel Greenblatt is a hedge fund manager; and he also teaches at Columbia University; and he is a value investor (Greenblatt, 2006);
(4) Benjamin Graham is considered the father of value investing; and he mentored Warren Buffett;
(5) William O'Neil founded Investor's Business Daily; and his investment methodology is a combination of fundamental and technical analysis;
(6) Peter Lynch is well-known for his investment principle: "Invest in what you know," and popularized the economic concept of "local knowledge"; and he encourages investors to spot good investments in their day-to-day lives before Wall Street; and
(7) Warren Buffett attributes much of his investment success to his professor and mentor, Benjamin Graham, who was a well-known value investor.

The investment systems listed above are well-known in investment community. In the following section, we discuss methodologies of the star investment systems. The methodologies

section is followed by sections on empirical results, and findings and implications. We conclude this paper with some remarks in the last section.

2. Methodology

In P123, ranking and screening processes are used for implementing each star model. All of the star systems are designed to choose 15 best companies in each star screening criteria and ranking system. In the following, we discuss the methodology for each star model.

P123 implements these star systems with both filtering process called screening and ranking systems. In addition, P123 uses liquidity filter for all of the star models that bars OTC stocks. In the following, we provide information on items used in both screening rules and ranking systems.

In Piotroski model's screening process, the model uses the following factors in 10 screening rules: business income, cash flow operation per share, gross margin, earnings per share, debt to assets, current ratio, asset turnover, return on assets, and shares outstanding. Once companies pass these screening criteria, then P123 uses a ranking system to sort out companies to pick the 15 best companies, using its ranking system. The ranking system uses accounting information; and the information used in the ranking system include price to book, gross margin, cash flow from operation, debt to asset, current ration, asset turnover, return on assets, and average shares outstanding.

Zweig model's screening rules uses P/E ratio, EPS growth, sales growth, consensus analyst estimates, stock price moving averages, and market index. Once companies pass these screening criteria, then P123 uses a ranking system to sort out companies to pick the 15 best companies, using its ranking system. The ranking system uses various growth items such as EPS growth and sales growth. Furthermore, Zweig model's ranking system considers each stock price's relative performance to S&P 500.

Greenblatt model's screening rules are much simpler than either of Piotroski's or Zweig's. The model restricts stocks only with the market capital of at least $50 million and excludes any ADRs, finance stocks or real estate stocks. Besides these, the screening rules use only one rule: Five-year return on investment has a percentile rank of at least 65. Once companies pass these screening criteria, then p123 constructs a ranking system based on the following two components: (1) return on capital and (2) earnings yield.

Benjamin Graham's screening rules are also relatively simple. The model uses current ratio, EPS, and common dividends as variables in its screening rules. Once companies pass these screening criteria, then P123 constructs a ranking system based on the following two components: (1) valuation and (2) EPS growth and stability.

William O'Neil model screens stocks based on the various components such as institutional share ownership, EPS growth and stock price change. Once companies pass these screening criteria, then P123 constructs a ranking system based on the following five components: (1) EPS growth relative to industry, (2) sales growth, (3) institutional share ownership, (4) various items for company quality, and (5) earnings quality.

Peter Lynch model screens exclude utilities, communication services, and ADRs that do not meet certain market capitalization conditions; and uses two components of PE ratio and EPS growth. Once companies pass these screening criteria, then P123 constructs a ranking system based on the following four components: (1) PE and PEG, (2) institutional ownership and number of analysts, (3) liabilities to assets ratio, and (4) company stature relative to industry.

Warren Buffett model screening process excludes companies that have market capitalization less than $250 million, and uses six criteria that include current ratio, long-term debt, EPS, return on equity, and sustainable growth rate. Once companies pass these screening criteria, then P123 constructs a ranking system based on the following three components: (1) book value, (2) valuation, (3) earnings quality. In the following section, we discuss detailed empirical results.

3. Empirical Results

3.1 Piotroski Investment Model

Table 1 summarizes the statistics of the performance of the portfolio based on the Piotroski model. It shows that the increase in the average return of the portfolio is associated with the frequency of rebalancing. When the portfolio is rebalance yearly the average return for the period 1/2/1999 to 12/31/2012 is 15.346%, the average returns continue to increase and reaches maximum of 26.034% when the portfolio is rebalanced every 4 weeks. It is to be noted that the highest single maximum return of 28.21% is associated with the 4 weekly rebalancing period which also has the highest average beta of 0.625 for the period. When the portfolio is rebalanced annually the average return is 15.346% which is the lowest, but it has the highest element of risk and volatility as shown by the standard deviation of 27.647%. The yearly rebalancing strategy also yields the lowest single minimum return of 9.89% and also has the lowest average beta of 0.596

Table 1 Piotroski Model

Holding Period	Average returns (%)	Maximum returns (%)	Minimum returns (%)	Average std. dev.(%)	Average R-squared	Average Beta
1 Year	15.346	24.50	9.89	27.647	0.301	0.596
6 Months	17.250	21.14	14.35	26.890	0.323	0.606
3 Months	21.758	26.22	19.00	26.840	0.335	0.614
4 Weeks	26.034	28.21	24.18	26.847	0.348	0.625

Tables 2, 3, 4, and 5 show the comparison of the portfolio performance with that of the market using the Piotroski model for varying start and end periods based on rebalancing strategies of 1 year, 6 months, 3 months and 4 weeks. It can be seen that there was no significant difference between the performance of the portfolio and the market in the first two to three years that is during 1999 to 2002 for example in the Tables. The portfolio started to outperform the market after 2003 and this continued thereafter. There was a general level of volatility over the period with respect to all the rebalancing strategies; however the period between 2007 and 2009 experienced significant downturn in the portfolio and this which was not reflected in the market.

Table 2

Graph with start date 1/2/1999 and end date 12/31/2012. Holding period of 1 year. (Piotroski model)

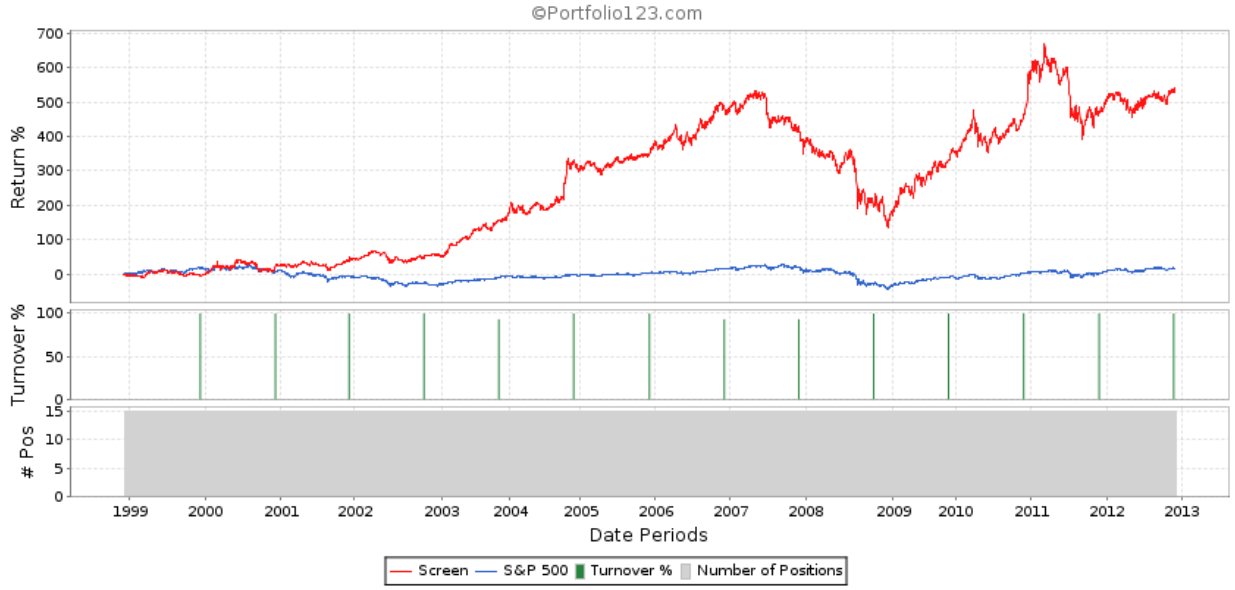


Table 3

Graph with start date 1/2/1999 and end date 12/31/2012. Holding period of 6 months. (Piotroski model)

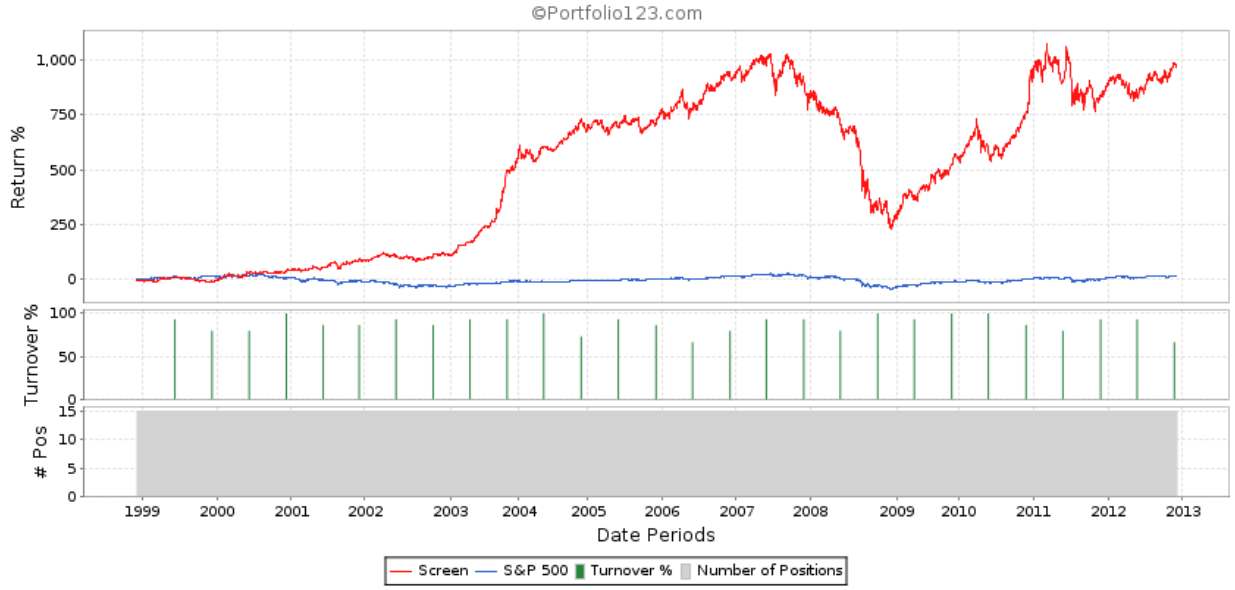


Table 4

Graph with start date 1/2/1999 and end date 12/31/2012. Holding period of 3 months. (Piotroski model)

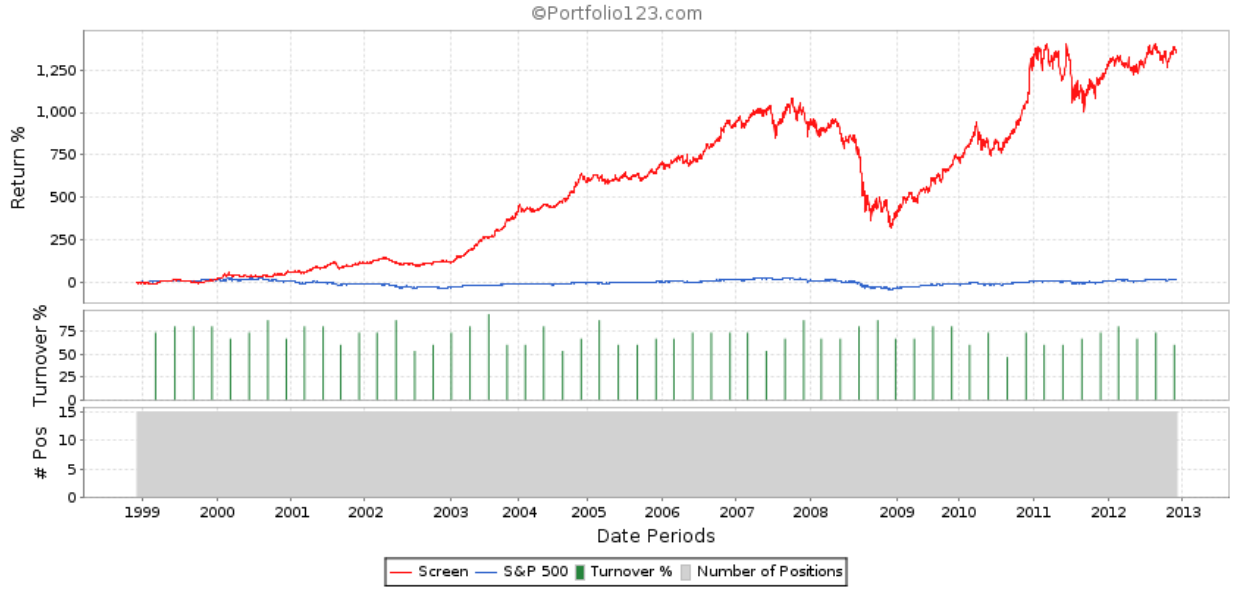
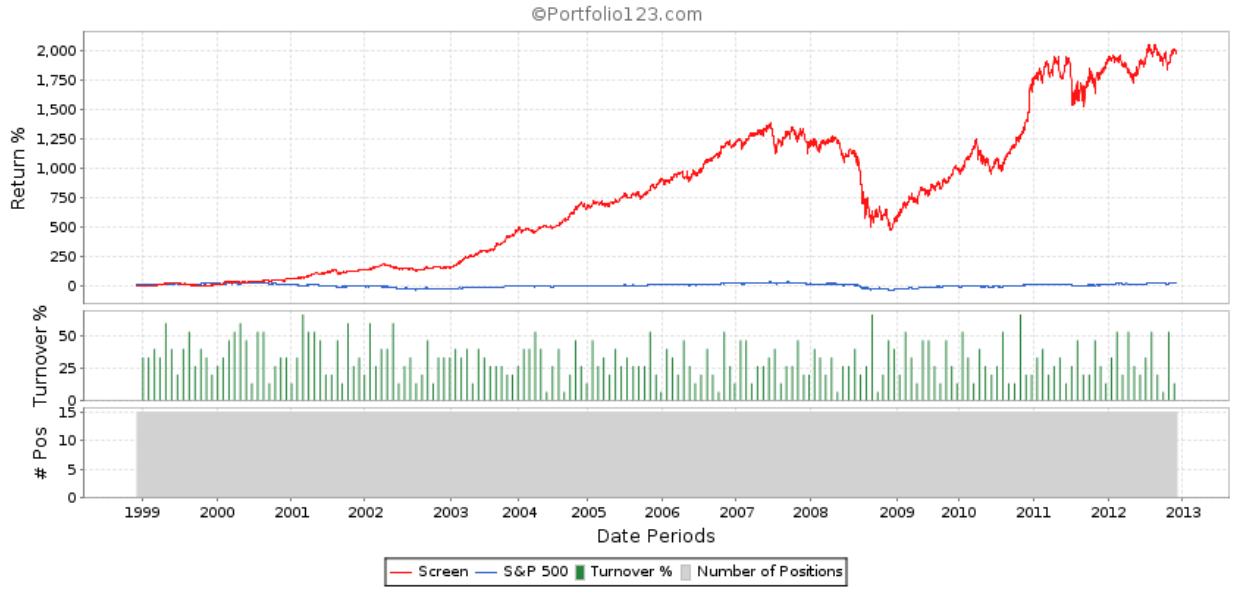


Table 5

Graph with start date 1/2/1999 and end date 12/31/2012. Holding period of 4 weeks. (Piotroski model)



3.2 Zweig Investment Model

Table 6 summarizes the statistics of the portfolio based on the Zweig model for the period 1/2/1999 to 12/31/2012. The average returns of the portfolio fluctuate based on the

holding periods. The lowest average return of 6.950% is achieved when the portfolio is rebalanced every 3 months; however, this leads to the highest single one-off maximum return of 25.15% but has a lower average standard deviation of 29.341% when compared with the portfolio when rebalanced every 6 months which yields an average return of 14.026% and an average standard deviation of 30.396% which indicates a higher level of volatility. Rebalancing every 4 weeks yields the highest average return of 22.012%, but interestingly it has the lowest average standard deviation of 28.526% and also the lowest average beta of 0.711 and almost the lowest R-squared of 0.397. An interesting observation is that when the portfolio is rebalanced every year it gives the second lowest average return of 9.971%, but has the highest element of volatility as shown by a standard deviation of 31.025%, this could be partly explained by the spread between the one-off single maximum return of 15.86% and one-off single minimum return of 2.24%.

Table 6 Zweig Model

Holding Period	Average returns (%)	Maximum returns (%)	Minimum returns (%)	Average std. dev. (%)	Average R-squared	Average Beta
1 Year	9.971	15.86	2.24	31.025	0.423	0.794
6 Months	14.026	20.43	7.82	30.396	0.408	0.768
3 Months	6.950	25.15	6.95	29.341	0.396	0.730
4 Weeks	22.012	24.30	20.12	28.526	0.397	0.711

3.3 Greenblatt Investment Model

Table 7 presents the statistics for the performance of the portfolio based on the Greenblatt model. The average returns increase as the frequency of rebalancing increases. The lowest average return of 15.706% is associated with a yearly rebalancing, however this gives the lowest volatility in returns with a standard deviation of 27.555%. The highest average return of 25.138% is achieved when the portfolio is rebalanced every 4 weeks but this gives the highest level of volatility with an average standard deviation of 29.65%. Rebalancing every 4 weeks gives the highest average beta of 0.762 and an R-squared of 0.422. Rebalancing every 3 months yields the second highest average return of 19.368% however, it results in the second highest level of volatility with an average standard deviation of 28.635% and also the second highest average beta of 0.737.

Table 7 Greenblatt Model

Holding Period	Average returns (%)	Maximum returns (%)	Minimum returns (%)	Average std. dev. (%)	Average R-squared	Average Beta
1 Year	15.706	20.22	12.10	27.555	0.403	0.690
6 Months	17.594	22.00	14.21	28.063	0.417	0.716
3 Months	19.368	23.94	15.39	28.635	0.424	0.737
4 Weeks	25.138	27.41	22.65	29.668	0.422	0.762

3.4 O'Neil Investment Model

Table 8 provides the statistics for the performance of the portfolio based on the O'Neil model. When rebalancing is done every 4 weeks it results in the highest average returns of 18.228%, which also give the highest single one off maximum return of 20.12%, these results are associated with the lowest R-squared (0.2280 and average beta (0.526). The one year rebalancing strategy gives the lowest average return of 7.998%; it also results in the lowest one-off maximum and minimum returns of 12.47% and 2.26% respectively. This could possible explain why the yearly rebalancing strategy has the lowest level of volatility in returns as shown by an average standard deviation of 26.964%. The three month rebalancing strategy yields the second highest average return of 12.152% and the second highest maximum single return of 18.54%, but this is associated with the second highest level of volatility as indicated by an average standard deviation of 27.880%.

Table 8 O'Neil Model

Holding Period	Average returns (%)	Maximum returns (%)	Minimum returns (%)	Average std. dev. (%)	Average R-squared	Average Beta
1 Year	7.998	12.47	2.26	26.964	0.251	0.531
6 Months	8.583	15.28	2.69	27.833	0.249	0.550
3 Months	12.152	18.54	8.32	27.880	0.235	0.534
4 Weeks	18.228	20.12	16.71	27.883	0.228	0.526

3.5 Graham Investment Model

Table 9 provides the statistics for the performance of the portfolio using the Graham model. The highest average return of 19.853% is achieved with the 4 week rebalancing strategy, this also gives the highest single one-off maximum return of 22.47% but this is linked to the highest level of volatility as measured by an average standard deviation of 27.254%. Interestingly, the 4 week rebalancing strategy gives the highest average R-squared and average beta of 0.443 and 0.716 respectively. The lowest average return of 14.043% was achieved with a yearly rebalancing strategy; this also resulted in the lowest level of volatility (average standard deviation of 24.715%) and also lowest R-squared of 0.395. There was no major significant difference in the average returns of the 6 month and 3 month holding strategies, nether were their average R-square materially different (0.411 and 0.427 respectively).

Table 9 Graham Model

Holding Period	Average returns (%)	Maximum returns (%)	Minimum returns (%)	Average std. dev. (%)	Average R-squared	Average Beta
1 Year	14.043	17.45	11.27	24.715	0.395	0.615
6 Months	17.102	18.85	15.20	25.242	0.411	0.638
3 Months	17.790	21.91	15.09	26.010	0.427	0.679
4 Weeks	19.853	22.47	18.20	27.254	0.443	0.716

3.6 Lynch Investment Model

Table 10 summarizes the statistics based on the performance of the portfolio using the Lynch model for various rebalancing strategies. There is generally an increase in average returns

as the frequency of rebalancing increases, except for the decline when using the 3 month strategy (15.723%). The 4 week rebalancing strategy gave the highest average return of 19.034%, and which also had the highest level of volatility (standard deviation equal 26.760%) and also highest average beta of 0.638. The lowest average return of 15.103% is achieved from the yearly rebalancing strategy which also gives the single lowest one-off minimum return of 7.25%. There is no significant difference in the level of volatility for all four rebalancing strategies and also the R-squared for all rebalancing periods was just about 0.34.

Table 10 Lynch Model

Holding Period	Average returns (%)	Maximum returns (%)	Minimum returns (%)	Average std. dev. (%)	Average R-squared	Average Beta
1 Year	15.103	22.66	7.25	25.918	0.332	0.593
6 Months	16.831	21.28	13.12	25.947	0.335	0.595
3 Months	15.723	17.81	13.88	26.241	0.339	0.603
4 Weeks	19.034	20.43	17.72	26.760	0.363	0.638

3.7 Buffett Investment Model

Table 11 shows the statistics for the performance of the portfolio using the Buffett model based on various rebalancing strategies. The 4 week rebalancing strategy yields the highest average return of 16.551%; in addition it has the highest degree of volatility measured by the standard deviation of 30.751%. The 4 week rebalancing strategy also gives the second highest single one-off maximum return of 18.08% (the highest is the 6 month strategy of 18.35%), and also has the highest average R-squared and average beta of 0.515 and 0.871 respectively. The lowest average return of 12.224% is associated with the yearly rebalancing strategy which also yields the lowest level of volatility given by an average standard deviation of 28.967%.

Table 11 Buffett Model

Holding Period	Average returns (%)	Maximum returns (%)	Minimum returns (%)	Average std. dev. (%)	Average R-squared	Average Beta
1 Year	12.244	16.78	6.89	28.967	0.515	0.814
6 Months	14.873	18.35	8.12	29.425	0.510	0.831
3 Months	13.802	15.53	12.82	30.025	0.512	0.848
4 Weeks	16.551	18.08	15.29	30.751	0.516	0.871

4. Findings and Implications

Based on the results of the performance of each model as shown in Tables 12, 13 and 14, and the various rebalancing strategies, the Piotroski model had the highest average return of 26.034% when the 4 week rebalancing strategy is used, this was followed by the Greenblatt model with the second highest average return of 25.138% for the 4 weekly rebalancing strategy and the third highest was the Zweig model with an average return of 22.012% using the 4 weekly rebalancing strategy. The lowest average return of 6.950% was recorded by Zweig model using the 3 month rebalancing strategy; the second lowest return of 7.998% was obtained using the ONeil model with a yearly rebalancing strategy.

With respect to the volatility, the highest level of volatility is present in the Zweig model as measured by an average standard deviation of 31.025% for the one year rebalancing strategy, the second highest is seen in the Greenblatt model which shows an average standard deviation of 29.668% for a 4 week rebalancing strategy. The Graham model shows the lowest level of volatility based on an average standard deviation of 24.715% using the one year rebalancing strategy, the second lowest was the Lynch model which shows an average standard deviation of 25.918% for the one year rebalancing strategy.

Table 12

Comparison of Investment Model Performances: *Average Returns* (%)
Over Different Holding Periods

Investment Model	One-year		6-months		3-months		4-weeks		Average Ranking
	Returns	Rank	Returns	Rank	Returns	Rank	Returns	Rank	
Piotroski	15.346	2	17.205	2	21.758	1	26.034	1	1.5
Zweig	9.971	6	14.026	6	6.950	7	22.012	3	5.5
Greenblatt	15.706	1	17.594	1	19.368	2	25.138	2	1.5
ONeil	7.998	7	8.583	7	12.152	6	18.228	6	6.5
Graham	14.043	4	17.102	3	17.790	3	19.853	4	3.5
Lynch	15.103	3	16.831	4	15.723	4	19.034	5	4.0
Buffet	12.244	5	14.873	5	13.802	5	16.551	7	5.5
Average	12.916		15.173		15.363		20.979		

Table 13

Comparison of Investment Model Performances: *Average Standard Deviations* (%)
Over Different Holding Periods

Investment Model	One-year		6-months		3-months		4-weeks		Average Ranking
	Std. Dev.	Rank	Std. Dev.	Rank	Std. Dev.	Rank	Std. Dev.	Rank	
Piotroski	27.647	5	26.890	3	26.840	3	26.847	2	3.25
Zweig	31.025	7	30.396	7	29.341	6	28.526	5	6.25
Greenblatt	27.555	4	28.063	5	28.635	5	29.668	6	5.00
ONeil	26.964	3	27.833	4	27.880	4	27.883	4	3.75
Graham	24.715	1	25.242	1	26.010	1	27.254	3	1.50
Lynch	25.918	2	25.947	2	26.241	2	26.760	1	1.75
Buffet	28.967	6	29.425	6	30.025	7	30.751	7	6.50
Average	27.542		27.685		27.853		28.241		

The single highest one-off maximum return of 28.21% was achieved by the Piotroski model based on the 4 week rebalancing option, the second highest of 27.41% was for the Greenblatt model using the 4 weekly rebalancing strategy.

The implications resulting from these findings could be far reaching for investors and the academic community. Both the highest and second highest average returns were achieved when the 4 weekly rebalancing strategies were adopted. This therefore opens the debate as to whether there is a direct association between the frequency of rebalancing and the average returns

achieved on a portfolio. Therefore with respect to the Piotroski and the Greenblatt models which achieved the highest and second highest average respectively, can it be said that these models are superior to the other five models? This is an issue that requires further research. The lowest average returns were achieved when the 3 month and 1 year rebalancing strategies were used. This may further strengthens the argument of some association between return and rebalancing strategy.

Table 14

Comparison of Investment Model Performances: *Average Beta*
Over Different Holding Periods

Investment Model	**One-year**		**6-months**		**3-months**		**4-weeks**		**Average Ranking**
	Beta	Rank	Beta	Rank	Beta	Rank	Beta	Rank	
Piotroski	0.596	5	0.606	5	0.614	5	0.625	6	5.25
Zweig	0.794	2	0.768	2	0.760	2	0.711	4	2.5
Greenblatt	0.690	3	0.716	3	0.737	3	0.762	2	2.75
ONeil	0.531	7	0.550	7	0.534	7	0.526	7	7
Graham	0.615	4	0.638	4	0.679	4	0.716	3	3.75
Lynch	0.593	6	0.595	6	0.603	6	0.638	5	5.75
Buffet	0.814	1	0.831	1	0.848	1	0.871	1	1
Average	0.662		0.672		0.682		0.693		

The issue of volatility has implication for selecting a rebalancing strategy. Both the lowest and the second lowest levels of volatility were achieved when the one year rebalancing strategy was used. These results were achieved by the Graham and the Lynch models respectively. One may need to examine if there are any unique similarities between the Lynch and Graham models which allow these models to register low levels of volatility when using a yearly rebalancing strategy. The implications for investors who used the Zweig model are far reaching. The Zweig model achieved the lowest average returns of all the models, but it had the highest level of volatility. This type of performance is inconsistent with the theory of risk and return, therefore there needs to be further research as to why the Zweig model behaves in the manner and can we therefore conclude by saying that investors should approach this model with caution.

5. Concluding Remarks

As we discussed in Findings and Implications section, among seven star investment systems that we analyzed, it appears that models proposed by Piotroski and Greenblatt are found to have done better than other models --- in terms of returns. It was however somewhat surprising to find that Buffett's model portfolio has the highest beta among all of the seven models in all different trading frequencies; yet, its returns were not as high as it would be expected for carrying high risk stocks relative to stocks in other models.

Nevertheless, one caveat that readers may like to beware is that all of the star models in P123 were not implemented by the actual star creators but by computer programs that were

designed to duplicate the main ideas known to be proposed or used by star system creators. Thus, what we found in this research may not accurately reflect the true performance of each star investment system creator in actual investment activities.

Among these star system creators, Buffett particularly is known as a businessman as much as an investor in buying, selling, and managing large corporations. Initially, Buffett started as an investor; but over decades, he has evolved into becoming an investor-businessman that manages a multinational conglomerate holding company; and he is also known for engaging in risk arbitrage (Buffett and Clark, 2010) and derivatives (Buhayar and Tracer, 2013). Therefore, what is currently being implemented in the P123's Buffett model may capture a small portion of what Buffett actually does as an investor. Graham (Graham and Buffett, 1986) and Greenblatt (1999) are known to have engaged in risk arbitrage operations.

To some extent, a similar caution could be applied to other star models. Yet, except for Buffett's model, other models may be less opaque in duplicating their star systems. For instance, implementation details by Piotroski are thoroughly laid out in his academic research paper published in *Journal of Accounting Research* (2000).

As a result, readers are cautioned that what is being discussed here is used as a starting point --- not as a terminal point --- for furthering their own research and deepening their understanding of complex stock investment processes than selecting an investment system --- purely, based on what's being discussed. Yet, what has been discovered in this research will be valuable to investors who are willing to further explore the issues of stability of various investment systems and topics related to trading frequencies.

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