
Invited Editorial

An examination of alternative portfolio rebalancing strategies applied to sector funds

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Introduction

It is a widely recognised tenet of finance that investors must rebalance their portfolios at regular intervals to prevent becoming over invested in one type of security. There are different rebalancing strategies that investors can follow. These include rebalancing at regular intervals of time, say annually, or rebalancing based on waiting until a particular type of security grows to some threshold that triggers action. In this study, we investigate these alternative strategies when applied to investing in sector funds.

A properly diversified investor will not want to hold a disproportionate share of wealth in any one type of security. So as a particular type of stock, say growth stocks, increases in value and begins to dominate the portfolio, conventional finance wisdom suggests that some of it be sold and that a different type of security be purchased. Sector fund investing is another example where rebalancing could be beneficial. If the investor does not rebalance at regular intervals, one sector fund could end up being overly represented and the investor poorly diversified.

While few investment advisors will argue the logic of the above, there is little research or theory to guide investors as to what specific rebalancing strategy will lower risk most efficiently. In this study, we closely examine two alternatives. In the first, we look at the benefits of rebalancing at regular calendar intervals. This portion of the study compares monthly, quarterly, semi-annual

and annual strategies. We next examine whether basing rebalancing on a trigger prompts rebalancing when a particular sector fund exceeds various percentages of total investment. We first locate the most effective trigger and then compare this to rebalancing based on calendar intervals.

Data

Sector funds are a relatively recent innovation in mutual fund investing. A few sectors were available in the late 1980s and more have been added since. By 1995 a full spectrum of sector funds was available to investors. In this paper, we use a sample composed of 19 sector funds. This represents a reasonably comprehensive sample of sectors now available to the public. We obtained monthly index values for each fund and converted these values to monthly returns. Table 1 shows summary statistics for each sector.

The average annualised return on the 19 sector funds between December 1995 and December 2002 was 12.5 per cent. By comparison, the S&P 500 average return was 10.9 per cent and the DOW was 11.8 per cent. The Wilshire 5000 fell slightly behind at 9.5 per cent.

The internet sector stands out as having the highest average annualised return over this interval (42.1 per cent). This return is about twice as high as any other sector. Since this performance is unlikely to be repeated in other sectors in the future, we performed our

Table 1 Data summary

Sector name	Cumulative return 12/95 to 12/2001 (%)	Annualised return (%)	Rank over period
1. S&P 1500 SUPER COMPOSITE — Energy (Sector)	68.9	9.1	12
2. S&P 1500 SUPER COMPOSITE — Materials (Sector)	13.4	2.1	18
3. S&P 1500 SUPER COMPOSITE — Consumer Staples (Sector)	62.5	8.4	13
4. S&P 1500 SUPER COMPOSITE — Health Care (Sector)	139.9	15.7	6
5. S&P 1500 SUPER COMPOSITE — Financials (Sector)	142.3	15.9	5
6. S&P 1500 SUPER COMPOSITE — Information Technology (Sector)	155.8	16.9	4
7. S&P 1500 SUPER COMPOSITE — Utilities (Sector)	22.7	3.5	17
8. S&P 1500 SUPER COMPOSITE — Transportation (Industry Group)	51.5	7.2	15
9. S&P 1500 SUPER COMPOSITE — Retailing (Industry Group)	217.3	21.2	2
10. S&P 1500 SUPER COMPOSITE — Banks (Industry Group)	95.8	11.8	9
11. S&P 1500 SUPER COMPOSITE — Technology Hardware & Equipment (Industry Group)	125.9	14.5	7
12. S&P 1500 SUPER COMPOSITE — Energy Equipment & Services (Industry)	61.5	8.3	14
13. S&P 1500 SUPER COMPOSITE — Biotechnology (Industry)	215.6	21.1	3
14. S&P 1500 SUPER COMPOSITE — Internet Software & Services (Industry)	727.8	42.1	1
15. S&P 1500 SUPER COMPOSITE — Consumer Discretionary (Sector)	89.0	11.2	11
16. S&P 1500 SUPER COMPOSITE — Communications Equipment (Industry)	44.3	6.3	16
17. S&P 1500 SUPER COMPOSITE — Metals & Mining (Industry)	-15.6	-2.8	19
18. S&P 1500 SUPER COMPOSITE — Capital Goods (Industry Group)	107.9	12.9	8
19. Wilshire — REIT	95.2	11.8	10
Average	127.5	12.5	

Cumulative returns, annualised returns and rank of each sector fund over the period 12/1995 to 12/2002. Internet stocks had the highest average returns and metals and mining had the lowest average returns over this period.

analysis both including and excluding this sector.

Several other sectors performed substantially better than the rest. These include health care, financials, information technology, retailing and biotechnology. The worst performing sectors included materials, utilities and metals and mining.

Table 2 reports the correlation in returns between the 19 sectors. Not surprisingly, the correlation between the financial services industry and banks is 96 per cent, and the correlation between the technology sector and the electronics sector is 99 per cent. The

leisure and the retail sector are also highly correlated.

Methodology

Rebalancing based on trigger

We initially looked at the returns investors could realise if they invested equally in all 19 of the available sectors (5.26 per cent of their portfolio invested in each sector) over the period for which data was available. We then analysed the returns they could achieve by rebalancing their portfolios when any one

Table 2 Correlation matrix

Correlation matrix for 19 sector funds 12/94 to 10/01																		
Energy	Material	Consumer	Health	Finserve	Tech	Utilities	Trans	Retail	Banks	Electron	Enerserv	Biotech	Precmeta	Internet	Telecomm	Leisure	Capigood	Realesta
1.00																		
0.40	1.00																	
0.36	0.47	1.00																
0.34	0.65	0.65	1.00															
0.32	0.54	0.56	0.56	1.00														
0.16	0.32	0.20	0.34	0.49	1.00													
0.41	0.31	0.43	0.36	0.39	0.12	1.00												
0.27	0.62	0.41	0.41	0.61	0.44	0.29	1.00											
0.26	0.50	0.47	0.49	0.62	0.46	0.26	0.54	1.00										
0.30	0.51	0.54	0.51	0.96	0.41	0.37	0.56	0.55	1.00									
0.15	0.31	0.18	0.31	0.47	0.99	0.11	0.43	0.44	0.39	1.00								
0.77	0.30	0.19	0.23	0.24	0.18	0.25	0.21	0.19	0.22	0.17	1.00							
0.17	0.24	0.26	0.55	0.42	0.52	0.22	0.33	0.37	0.37	0.50	0.17	1.00						
0.38	0.76	0.29	0.23	0.32	0.24	0.21	0.42	0.30	0.31	0.24	0.31	0.16	1.00					
0.10	0.21	0.16	0.28	0.32	0.59	0.05	0.29	0.33	0.27	0.56	0.12	0.37	0.23	1.00				
0.24	0.33	0.40	0.40	0.53	0.47	0.30	0.41	0.45	0.47	0.45	0.11	0.35	0.23	0.31	1.00			
0.32	0.58	0.49	0.54	0.72	0.61	0.31	0.65	0.90	0.63	0.58	0.25	0.45	0.38	0.45	0.56	1.00		
0.38	0.65	0.54	0.55	0.73	0.61	0.36	0.65	0.65	0.65	0.59	0.29	0.44	0.45	0.39	0.51	0.77	1.00	
0.26	0.43	0.29	0.35	0.49	0.33	0.24	0.47	0.39	0.45	0.32	0.27	0.29	0.28	0.21	0.27	0.49	0.46	1.00

fund grew to a trigger threshold. After looking at a range of triggers to rebalancing, we determined that optimal portfolio returns were achieved when the portfolio was rebalanced when any fund grew to a level of 9 per cent of the total portfolio value. The average annualised return was 3.676 per cent higher when rebalancing occurred when any sector's fund rose to 9 per cent of its portfolio's total value than if there was no rebalancing. These results are reported in Table 3. The average annual return increased from 7.575 to 9.519 per cent without a significant increase in the standard deviation of the returns. This strategy would have required the investor to rebalance their portfolio seven times over the seven-year interval.

The selection of the 9 per cent threshold for rebalancing is somewhat arbitrary. A slightly higher return could be earned with a 10 per cent threshold; however, this comes with a higher standard deviation. Nine per cent was chosen because it had the highest Sharpe ratio. The Sharpe ratio considers both the return and the risk and provides a measure of the return per unit of risk. Certainly, the optimal threshold for rebalancing will change from period to period. Our data suggest relatively little difference in the Sharpe ratios between 8, 9 and 10 per cent thresholds.

Another issue to be noted from Table 3 is that it is possible to rebalance too often. The 5 per cent rebalance trigger is included to show the affect of daily rebalancing. When the portfolio is rebalanced too often, the investors are prevented from capturing the gains from any sector that establishes momentum.

Figure 1 demonstrates graphically the affects of rebalancing. We see that the internet sector triggered rebalancing more often than any other sector.

Figure 2 reports the risk return trade-off achieved by rebalancing at various thresholds. We see that very frequent rebalancing puts the portfolio at the bottom

Table 3 Summary of all years

Rebalance trigger	5%	5.50%	6%	7%	8%	9%	10%	11%
Mean	0.03%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%
Std	0.57%	0.57%	0.56%	0.57%	0.58%	0.59%	0.62%	0.62%
CV	16.36	16.11	15.68	15.36	14.93	14.31	14.95	16.47
Min	-7.97%	-7.95%	-7.95%	-8.09%	-7.99%	-8.04%	-7.83%	-7.80%
Max	5.03%	5.03%	5.01%	4.99%	4.99%	4.99%	4.98%	4.82%
Num pos	927	925	925	937	925	934	923	920
Num neg	779	780	780	768	780	771	782	785
Avg annual	7.575%	7.695%	7.884%	8.314%	8.774%	9.519%	9.548%	8.442%
Annl. std	9.056%	9.022%	8.921%	9.094%	9.211%	9.423%	9.902%	9.902%
Gain w/Reb	1.732%	1.852%	2.042%	2.471%	2.932%	3.676%	3.706%	2.600%
Num of Reb	1,707	456	75	20	9	7	3	2

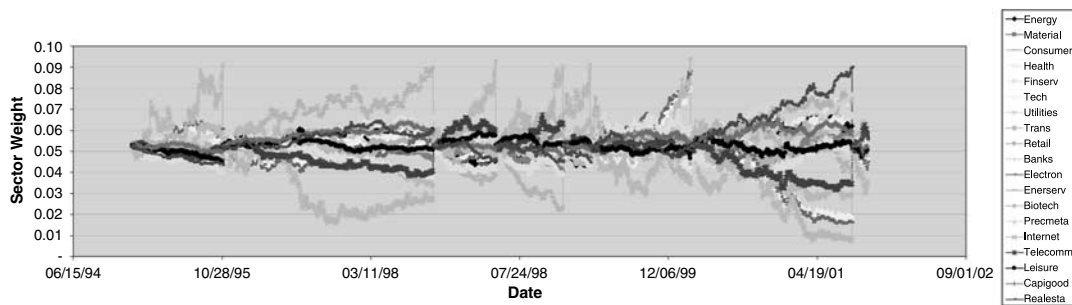


Figure 1 Sector weights in portfolio rebalancing at 9 per cent

of the efficient frontier. As the rebalancing interval increases, the risk return trade-off improves.

To further investigate how the rebalancing strategy increased returns, we looked at the increased returns by year to rebalancing at the 9 per cent trigger. The results are shown in Figure 3. We see that the gains are mostly due to reducing our exposure to the internet sectors when they dropped in 2000. This is, of course, the point of rebalancing. When any one sector expands to occupy a larger percentage of the portfolio than desired, rebalancing returns it to its original level. The value of this strategy was spectacularly demonstrated during 2000.

Rebalancing based on calendar intervals

Most investors are advised to rebalance their portfolios at least annually. Since this is a

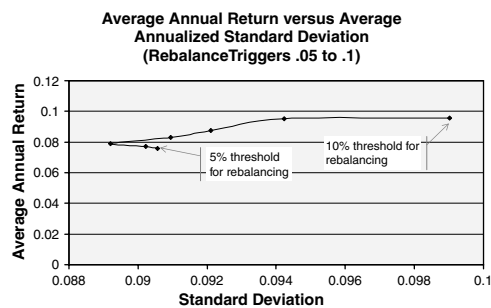


Figure 2 Average annual return versus average annualised standard deviation (rebalance triggers 0.50 to 0.1)

common and popular alternative to our strategy of rebalancing based on a fund exceeding a threshold trigger, we looked at the returns from various interval-based rebalancing options. Figure 4 compares the gains from rebalancing at a 9 per cent trigger with rebalancing at various intervals

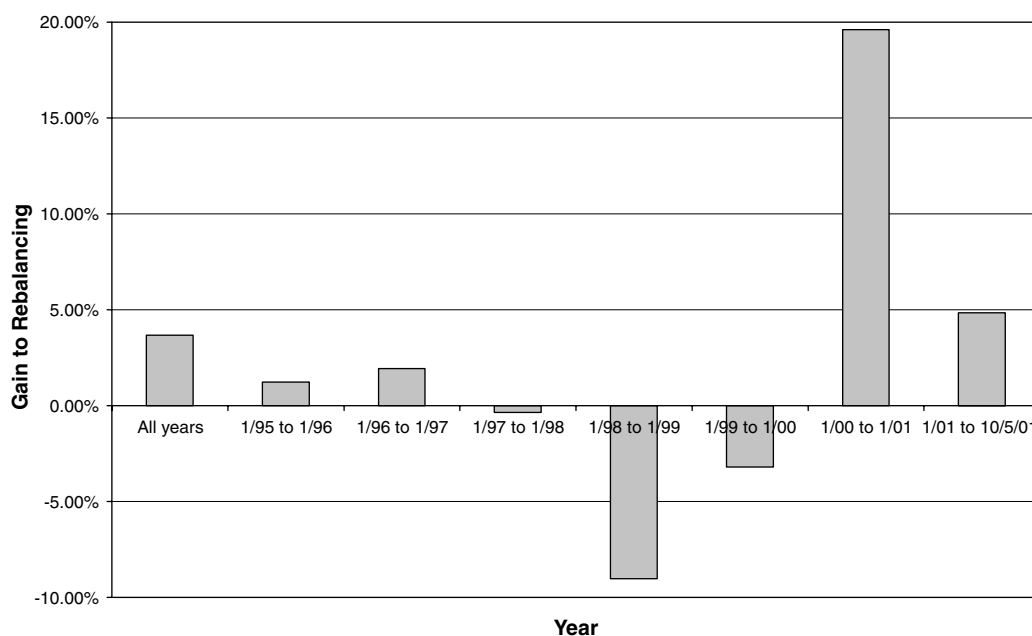


Figure 3 Gains from rebalancing at 9 per cent shown by year

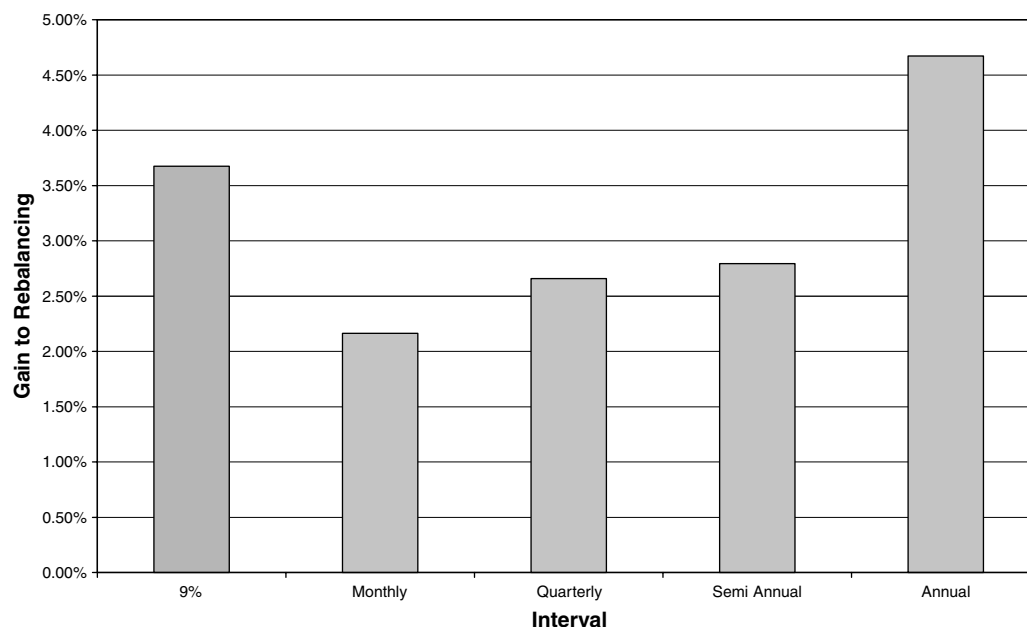


Figure 4 Gains to rebalancing at fixed intervals

(monthly, quarterly, semi-annually and annually). We see that the traditional annual rebalancing strategy provided the greatest

gains. About 1 per cent additional average annual return was earned with the annual rebalancing strategy as compared with the 9

per cent trigger. Note that the 9 per cent trigger provided greater returns than either the monthly, quarterly or semi-annual rebalancing strategies.

To further investigate the annual rebalancing strategy, we looked at the gains (over not rebalancing) by year in Figure 5. We again see that the gains are all due to reducing exposure to the internet and tech sectors when they fell in value during 2000. The conclusion is that no matter how the investors maintained a diversified portfolio, they were protected from these sectors by rebalancing.

Note that rebalancing caused the investors to do less well in 1998 and 1999 than had they let their portfolios become over-weighted with tech and internet sectors stock. During these two years, these sectors were yielding very high returns. By rebalancing, the investors were shut out of a portion of these returns. This is the cost of avoiding the much larger losses that they would have incurred in 2000. Table 4 reports the results of rebalancing annually when the

internet sector is eliminated. In this case, the investor would have been better off not rebalancing at all. The gains from other sectors overwhelmed the losses incurred in the downturn in 2000 and 2001. Of course, the internet sector did exist and rebalancing was valuable.

Rebalancing over longer time periods

The data set used for this study began in 1996. This was the earliest date we could use and still include the broad spectrum of sector funds available to investors today. It is, however, interesting to look at longer data series to see if our results are robust over time. Four sector funds were available beginning in January 1992. We evaluated alternative rebalancing strategies through July 2001. The results are presented in Table 5. The sectors included in this analysis are banking, consumer products, energy and leisure. For these funds, rebalancing at a predetermined threshold was preferred over calendar-based strategies. The more frequent the rebalancing, the better the performance.

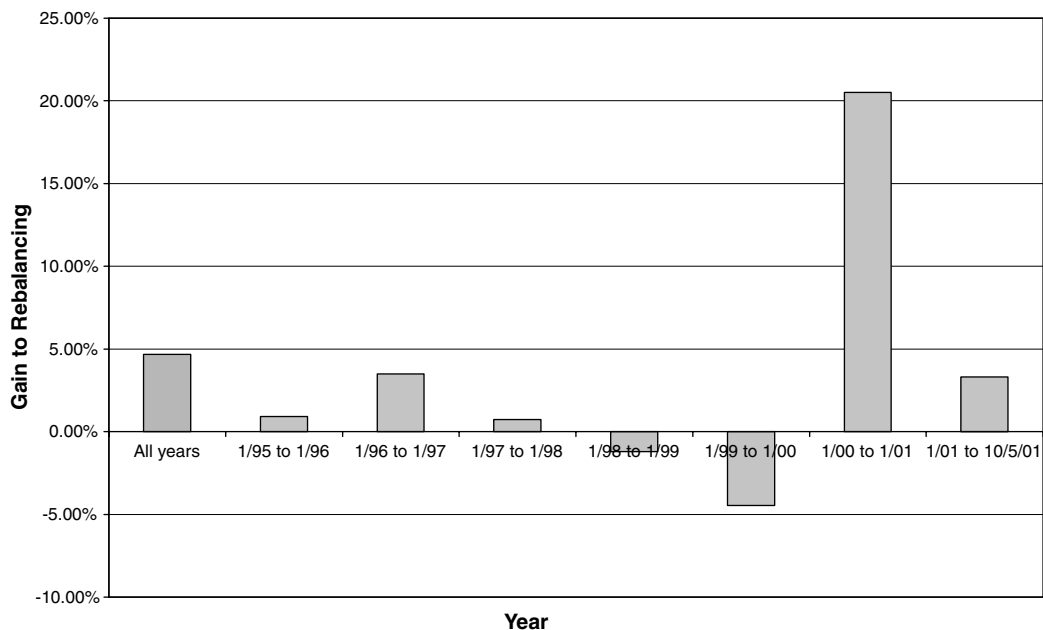


Figure 5 Annual rebalancing by year

Table 4 Gains to rebalancing with the internet sector eliminated

	All years	1/95 to 1/96	1/96 to 1/97	1/97 to 1/98	1/98 to 1/99	1/99 to 1/00	1/00 to 1/01	1/01 to 10/5/01
Mean	0.0112%	0.07%	0.03%	0.06%	0.03%	0.04%	-0.04%	-0.15%
Std	0.7024%	0.7028%	0.7752%	1.0604%	1.2784%	1.0203%	1.2475%	1.2659%
CV	62.77	10.44	22.94	17.98	48.02	27.66	-31.89	-8.23
Min	-8.4318%	-5.5287%	-5.3404%	-7.5404%	-6.9160%	-4.3684%	-8.4318%	-6.0248%
Max	5.0283%	1.5409%	1.7752%	4.0819%	4.5265%	2.5754%	5.0283%	3.5109%
Num pos	923	156	142	140	138	132	123	93
Num neg	782	96	112	113	114	121	130	96
Avg annual	1.39%	17.74%	10.60%	14.44%	4.77%	8.35%	-11.20%	-26.37%
Annl. std	11.20%	11.16%	12.35%	16.87%	20.29%	16.23%	19.84%	17.40%
Gain w/Reb	-3.95%	-16.39%	0.66%	-9.51%	-26.90%	-11.42%	18.91%	9.18%
Num of Reb	7							

Table 5 Portfolio summary statistics for sector funds beginning in 1992 with various rebalancing strategies — sectors are banking, consumer products, energy and leisure

	No rebalancing	29% trigger	Daily	Monthly	Quarterly	Semi- annual	Annual
Mean	0.0469%	0.0489%	0.0487%	0.0483%	0.0456%	0.0450%	0.0443%
Std	0.9145%	0.8783%	0.8801%	0.8786%	0.8927%	0.9018%	0.8989%
CV	127.4111%	115.8895%	116.5161%	117.6056%	127.9855%	131.4553%	133.4810%
Min	-6.3576%	-6.3235%	-6.2946%	-6.2982%	-6.2995%	-6.3226%	-6.3214%
Max	5.6021%	5.4441%	5.3588%	5.3825%	5.2509%	5.2364%	5.2335%
Num pos	1290	1301	1297	1294	1293	1296	1298
Num neg	1115	1106	1111	1114	1115	1112	1109
Avg annualised return	11.42%	12.05%	12.02%	11.88%	11.09%	10.91%	10.71%
Annl. std	14.545%	13.970%	14.000%	13.975%	14.199%	14.344%	14.299%
Annual Gain from rebalancing	0	0.6382%	0.5990%	0.4671%	-0.3217%	-0.5046%	-0.7041%
Number of rebalancing instances	0	12	2408	114	38	19	9

It is important that these results do not receive too much emphasis as the four sectors do not represent the real investment alternative currently available to investors, but they do point out the results presented earlier and specific to a particular time period. The conclusions may not generalise accurately to other time periods.

Conclusions

This study examines two alternative methods of portfolio rebalancing. In the first, we look at the gains achieved by rebalancing when the value of any sector exceeds various thresholds that trigger the rebalancing. We find that over the period December 30th, 1994 to October 1st, 2001 optimal returns were achieved when the portfolio was rebalanced when any sector grew to occupy

9 per cent of the total value of the portfolio. By examining the Sharpe ratio, we found that the results were not very sensitive to the specific threshold used to trigger rebalancing. We also found that the return rose faster than the risk resulting in an increased Sharpe ratio from rebalancing.

We next looked at the result of rebalancing at various calendar intervals, including monthly, quarterly, semi-annually and annually. We found that annual rebalancing outperformed both the 9 per cent threshold trigger and the other calendar intervals.

In an effort to examine how robust our results may be to other time periods, we looked at the affect of dropping the internet sector. Without this sector there were no gains from rebalancing. We also looked at four sectors we could track from 1992. We

found that rebalancing based on a threshold trigger was better than simple annual rebalancing.

The conclusion we must draw from these results is that rebalancing reduced investor exposure to sectors that have grown rapidly and may experience reduced performance. The specific method used to rebalance is not as important as the consistency with which it is done. A much longer time series will be

needed to draw firmer conclusions as to which strategy will surface as superior in the long run.

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