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Dynamic Z-score Asset Allocation to Size, Value, and Industry Return Shocks

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Abstract

This study examines short-term diverging returns between popular asset classes such as value vs growth, small vs large, and significant industry return divergences to determine if switching strategies can take advantage of relative valuations. Findings show Z-scores based on 1 to 3-month cumulative returns relative to the previous year are positively related to the proceeding one-month excess return. For size, value, and growth, the asset class that significantly outperforms their counterpart over six months or longer mean reverts. Industries significantly outperforming from one to six months are found to continue to do so. These results hold up across various time frames from 1926 through 2022 and outperform a simple buy-and-hold strategy over multiple time periods. Practical application using ETFs over the last 20 years continue to show success for size and value, but industry switching does not outperform a simple buy-and-hold strategy.

Keywords: Market Forecasting, Dynamic Asset Allocation, Relative Valuation, Size and value premium

1. Introduction

Stock ownership by individual investors has fallen dramatically since the 1970s when institutions owned less than 20% of U.S. equity, (Fichtner, 2020). In fact, the first index fund wasn't introduced until 1976 via John Bogle of Vanguard fame. With the proliferation of mutual funds and the introduction of exchange traded funds (ETFs) in the early 1990s, the roles have reversed with institutional ownership exceeding 80%.

Fund growth has allowed investors to change their entire asset allocations with just a few

trades and to do so literally in seconds via on-line trading. Before the abundance of institutional funds, trying to take advantage of various anomalies pointed out in the literature was no trivial manner. Exposure to well-known anomalies such as the small firm effect (Banz 1981), and value often measured by low price/earnings (Nicholson, 1960; Basu, 1977), or price/book (Rosenberg, Reid, & Lanstein, 1985), can now be instantly attained through any number of mutual funds or ETFs.

However, many of the excess returns for the supposed anomalies mentioned above have been in short supply over the last 20 years as the size effect has generally disappeared since the late 1970s and growth has by far outperformed value, especially over the last 15 years. Standard portfolio theory suggests investors be exposed to all the asset classes as their returns often diverge dramatically over shorter periods of time. This logic holds even if on average, there may or may not be any excess return to be had from one broad asset class relative to another. Figure 1 below shows how small vs large capitalization stocks since 1980 have little difference in return since 1980, (large outperforms small by 0.4% annually) but often diverged significantly in any given year.

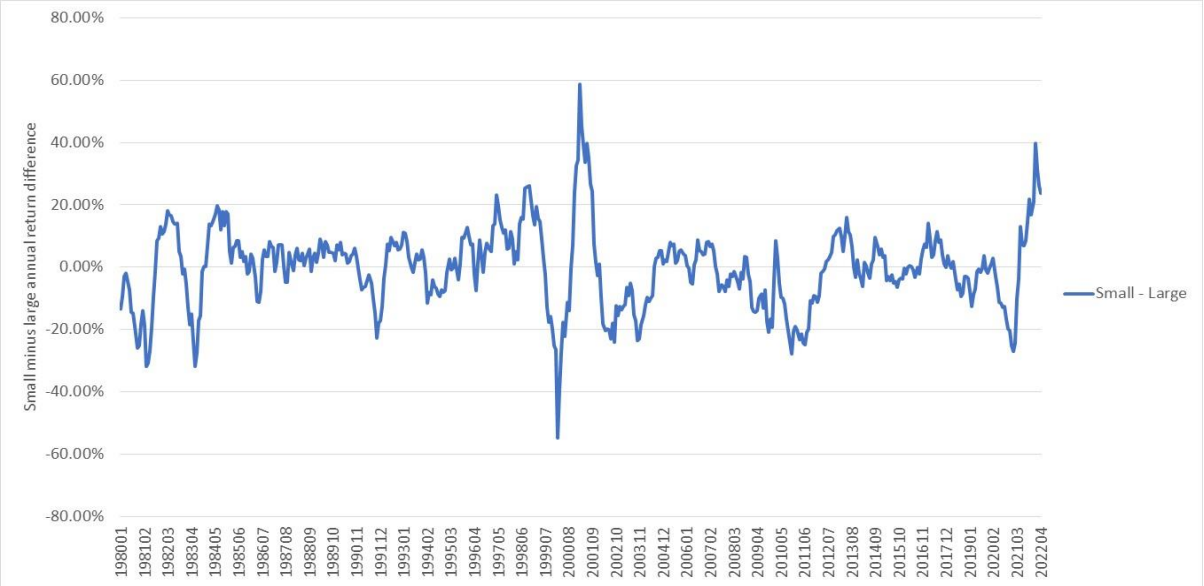

Figure 1. Small minus large stock monthly rolling annual returns, Jan.1980-April 2022

This study determines whether there is any value to increasing or decreasing exposure to value, growth, size, or industry/sector type funds when their returns begin to significantly diverge from their alternative, i.e., small relative to large. This study finds proceeding monthly returns are significantly related to the preceding monthly Z-scores. Additionally, investing in an asset class or industry that has significantly increased relative to another over the preceding 1 to 3 months is associated with higher returns over the following month. This generally holds through time, across anomalies, and across industries suggesting short-term momentum based on Z-scores might be used for profitable trading. This finding is tangentially related to Jegadeesh and Titman (1993) who demonstrate momentum is a major

phenomenon in individual stock returns. The findings above suggest this may be the case at a more macro level as well.

In contrast, this study also finds momentum is short-lived for the broader small vs large and value vs growth categories as the asset class with significant outperformance relative to its counterpart demonstrates mean reversion by six months. This result demonstrated remarkable consistency across all time periods from 1926 to 2022. However, for industry outperformance relative to the market, excess monthly returns remain even after six months of relative outperformance. This also remained consistent regardless of the period examined.

Historically, a switching strategy using Z-scores seemingly outperforms a buy-and-hold. A practical application using ETFs over the last 20 years show an increase in returns for size or value but did not result in increased returns for industry data over buy-and-hold investing.

2. Data & Methodology

For historical perspective, Table 1 contrasts the geometric annual returns for small, mid, and large cap, small value, small growth, large value, and large growth relative to the Center for Research in Security Price's value weighted index from June 1926 through April 2022. Asset class returns are taken from Ken French's (2022) data website.

Table 1. Geometric annual average returns for various asset classes from June 1926 to April 2022

	Market	Small	Mid	Large	Small Value	Small Growth	Large Value	Large Growth
1926-2022	10.2%	11.9%	11.8%	10.1%	14.6%	8.9%	12.1%	10.1%
1926-1946	6.0%	9.9%	9.1%	5.8%	10.9%	7.8%	6.9%	6.1%
1947-1979	10.9%	13.9%	12.6%	10.5%	16.7%	10.7%	15.1%	9.9%
1980-2022	11.5%	11.2%	12.2%	11.6%	14.5%	8.0%	12.2%	12.0%
2002-2022	8.9%	9.6%	10.0%	8.9%	10.1%	7.8%	7.1%	10.0%
2012-2022	13.4%	11.6%	11.3%	13.9%	11.9%	11.6%	13.4%	15.6%

While the market has a geometric annual return of 10.2%, small stocks have outperformed large by 1.8%, small value over small growth by 5.7%, and large value over large growth by 2.0%. However, most of these premiums were attained pre-1980. Since 1980, large stocks have outperformed small by 0.4% and large value over large growth by only 0.2%. The only consistent anomaly appears to be small value over small growth. Over the last 10 to 20 years, large growth has been the outperformer calling into question both the size and value anomaly just when investors were able to invest in these asset classes with relative ease.

Thus, even if one is still convinced of size and value anomalies, the last 20 years suggest an investor may not have the investing time horizon to profit from them. Strictly from a diversification standpoint, there is a case for small, large, value, and growth to be in a portfolio, but there is no certainty that greater than market weight holdings of small cap or value stocks will lead to anomalous excess returns after accounting for risk. This study examines if it is possible to underweight or overweight asset classes when their returns begin to significantly diverge from their counterparts.

As an example of the performance differences, Figure 2 shows the rolling 5-year geometric annual returns for large value vs large growth since 1952. Before 1985, always holding value would almost always win over any 5-year period. Since then, the value "anomaly" has been harder to come by and has often resulted in lagging returns.

Figure 2. 5-year cumulative annualized returns for value minus growth stocks

One obvious idea is to determine when return differences are significantly different and trade appropriately. An individual investor can easily see these differences using typical Bollinger Bands. Bollinger Bands simply create bands based on the standard deviation of historical prices or returns. Figure 3 shows a typical graph using Bollinger Bands that create a 90% confidence interval around the small minus large cap return differential. The idea is a return outside this interval is a signal of either momentum or valuation (over or under) depending on one's point of view. As Warren Buffett once quipped, "I realized that technical analysis didn't work when I turned the chart upside down and didn't get a different answer."

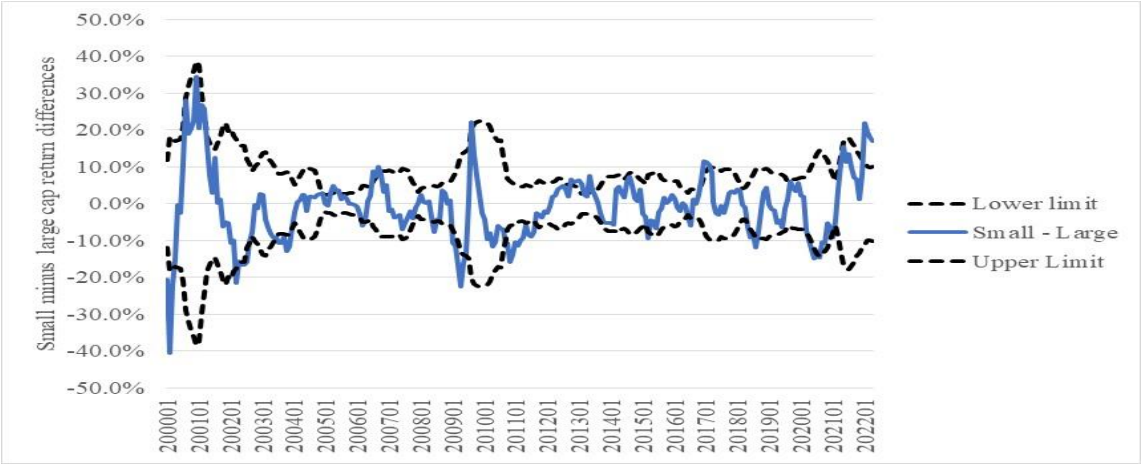

Figure 3. Small minus large cap stock 6-month return differences with 90% Bollinger Bands

Alternatively, more robust type models could be used to identify significant return differences which account for non-stationary volatility such as Engle's (1982) GARCH model. This could improve identifying "real" return differences due to underlying fundamentals as opposed to possible statistical artifacts from volatility itself changing. Guo (2019) further demonstrates how the GARCH model itself can be improved based on underlying distribution assumptions, especially with it comes to indexes. However, these models require the need to estimate several parameters and are outside the scope of this paper. Thus, all results derived in this study are based on simple regressions and standard Z-scores.

This study separates monthly returns into deciles following Z-scores of +/- 0.0 to 0.39, 0.39 to 0.67, 0.67 to 1.28, 1.28 to 1.65, and greater than +/- 1.65. This corresponds to 65%, 75%, 90%, and greater than 90% confidence intervals. For trading, +/- 1.28 or 1.65 standard deviation bands based on the previous 12 months of returns are used to signal excess return possibilities. When return differences between two asset classes falls outside these bands, the investor can determine whether a change in portfolio allocation is advisable.

3. Results

3.1 Size and Value

An investor can either buy momentum or assume mean reversion and buy the underperforming asset class while selling the outperforming one. To determine the relationship, Table 2 shows the proceeding average monthly return based on the previous month's Z-score relative to the preceding 12 months. When it comes to value or size, momentum appears to be the determining factor and this result held for Z-scores calculated on the previous 1, 2, or 3-month cumulative returns.

Table 2. Average return difference in month following Z-values, Jan. 1926 to April 2022

Z-value	Small Cap – Large Cap	Mid Cap – Large Cap	Small Value – Small Growth	Big Value – Big Growth
< -1.65	0.16%	-0.30%	-0.21%	-0.04%
-1.65 to -1.28	0.48%	0.74%	-0.21%	-0.07%
-1.28 to -0.67	-0.15%	0.17%	-0.09%	-0.23%
-0.67 to -0.39	-0.59%	-0.39%	0.19%	0.07%
-0.39 to 0.0	-0.57%	-0.38%	0.33%	-0.03%
0.0 to 0.39	0.08%	0.37%	0.26%	0.48%
0.39 to 0.67	1.02%	0.02%	0.30%	0.15%
0.67 to 1.28	1.00%	0.45%	1.13%	0.63%
1.28 to 1.65	1.40%	0.81%	0.80%	1.63%
>1.65	2.30%	1.22%	1.51%	0.77%
Regression Slope	0.50%*	0.26%*	0.41%*	0.34%*
R-square	53.58%	36.88%	85.65%	60.74%

Notes: Z-values calculated on previous 12-months of returns.
*Significant at 5% level or better.

Lower Z-scores are generally associated with smaller and negative return differences while higher values show return differences up to 2.30%. Regressions based on average Z-score values in each decile and the proceeding monthly return all have significant t-stats with

r-squares ranging from 37% to 86%.

Profitable trading appears to be possible after identifying a return that is significantly greater than the previous 12 months. The lower the Z-score, the smaller the difference and using just the previous month's return does better than using the preceding two months, which does better than using the preceding 3-month cumulative return. Although not shown, mean reversion appears to be the predominant result when using the previous 6 or 12-month return.

Since the standard anomalies appear to be time dependent, Table 3 shows decile Z-scores for the last 20 and last 42 years (1980 to 2022). The relationship over the last 20 and 42 years remains positive but weakened, especially in the last 20 years.

Table 3. Average return difference in month following Z-values, Jan. 1980 to April 2022

Z-value	Small Cap – Large Cap 1980-2022: 2002-2022	Mid Cap – Large Cap 1980-2022: 2002-2022	Small Value – Small Growth 1980-2022: 2002-2022	Big Value – Big Growth 1980-2022: 2002-2022
< -1.65	-0.07%	-0.57%	-0.22%	0.55%
-1.65 to -1.28	-0.35%	0.75%	0.83%	0.67%
-1.28 to -0.67	0.02%	0.62%	-0.03%	-0.26%
-0.67 to -0.39	-0.37%	-0.24%	-0.04%	0.58%
-0.39 to 0.0	-0.45%	-0.10%	-0.43%	-0.40%
0.0 to 0.39	-0.06%	0.08%	0.27%	0.15%
0.39 to 0.67	0.49%	0.88%	-0.06%	0.44%
0.67 to 1.28	0.09%	-0.26%	0.20%	0.12%
1.28 to 1.65	1.63%	-0.41%	0.87%	1.11%
>1.65	0.86%	0.17%	3.14%	-0.08%
Regression Slope	0.35%*	0.16%*	0.05%	-0.11%
R-square	49.54%	8.52%	2.05%	5.99%

Notes: Z-values calculated on previous 12-months of returns.
*Significant at 5% level or better.

Table 4 shows the 1, 3, and 6-month results across multiple time periods for Z-scores following +/- 1.65. As an example, small cap is held for a Z-value greater than 1.65 and large cap is held when the Z-score is less than -1.65. Regardless of the period, the results from Table 3 are qualitatively consistent across time suggesting short-term momentum through 3-months with longer-term reversal starting around 6-months.

Table 4. Monthly return difference following a 1.645 Z-value difference in previous month

	Small Cap – Large Cap	Mid Cap – Large Cap	Small Value – Small Growth	Big Value – Big Growth
Time period	Monthly Return Following Significant Difference Previous Month			
1926-2022	1.32%	0.85%	1.03%	0.45%
1926-1946	2.60%	2.26%	0.56%	0.53%
1947-1979	1.57%	0.92%	0.45%	0.67%
1980 -2022	0.41%	0.12%	1.69%	0.25%
2002-2022	1.11%	-0.63%	0.81%	-0.10%
2012-2022	1.10%	-0.82%	0.42%	0.46%
	Monthly Return Following Significant Difference Previous 3-Months			
1926-2022	0.50%	0.21%	0.87%	0.51%
1926-1946	1.76%	0.96%	0.50%	0.28%
1947-1979	0.21%	0.19%	0.56%	0.49%
1980 -2022	0.17%	-0.12%	1.31%	0.63%
2002-2022	0.85%	0.14%	1.25%	0.43%
2012-2022	1.06%	0.14%	1.26%	0.85%
	Monthly Return Following Significant Difference Previous 6-Months			
1926-2022	-0.31%	-0.05%	0.44%	-0.71%
1926-1946	-0.90%	0.21%	-0.28%	-1.32%
1947-1979	0.00%	0.15%	0.00%	-0.21%
1980 -2022	-0.38%	-0.36%	1.09%	-0.78%
2002-2022	-0.10%	-0.15%	0.71%	-0.37%
2012-2022	0.35%	-0.05%	0.47%	-0.70%

3.2 Industry Results

With sector ETFs available, allocation can be made at an even more granular level. To determine if there is any value in under or overweighting industries based on significant return differentials, industry minus market return is calculated and the above methodology is applied. Table 5 shows results for 5 of the 10 industries along with the industry average. Consistent to the more general asset classes shown in Table 2, there is a generally monotonically increasing relationship between Z-scores and the proceeding monthly return with a 0.46% average slope and 36% r-square. Although not shown, the only negative slope is utilities.

Table 5. Average return difference in month following Z-values, Jan. 1926 to April 2022

Z-value	Industry Average	Non-Durables	Durables	Manufacturing	Energy	Technology
< -1.65	-0.44%	-0.19%	-0.03%	-0.26%	-0.68%	-0.02%
-1.65 to -1.28	-0.44%	-0.72%	-1.29%	0.09%	-1.02%	-0.08%
-1.28 to -0.67	-0.14%	-0.13%	-0.67%	0.20%	-0.67%	0.12%
-0.67 to -0.39	-0.20%	-0.39%	0.24%	-0.20%	0.02%	-0.34%
-0.39 to 0.0	0.06%	-0.23%	0.09%	-0.16%	0.28%	0.37%
0.0 to 0.39	0.18%	0.32%	0.28%	0.11%	0.22%	0.11%
0.39 to 0.67	0.37%	0.19%	0.92%	0.21%	0.53%	0.36%
0.67 to 1.28	0.30%	-0.06%	0.92%	0.07%	0.78%	0.08%
1.28 to 1.65	0.51%	0.95%	0.28%	0.69%	0.87%	0.55%
>1.65	0.38%	0.78%	0.81%	0.06%	0.53%	0.64%
Regression Slope	0.46%*	0.33%*	0.38%*	0.11%*	0.45%*	0.17%*
R-square	36.06%	65.63%	51.43%	27.54%	78.51%	53.76%

Notes: Z-values calculated on previous 12-months of returns.
*Significant at 5% level or better.

Based on the +/-1.645 Z-score, Table 6 shows the monthly return following a significant return difference. Returns following significant Z-scores based on 1 to12-month cumulative returns are almost always positive showing momentum in industry returns. This positive return difference generally declines for longer periods of excess returns.

Table 6. Monthly return difference following 1.65 Z-score based on previous 1 to 12-month cumulative returns

Industry	1-month	2-months	3-months	6-months	12-months
Overall Average	0.48%	0.33%	0.26%	0.21%	0.24%
Non-Durables	0.47%	0.47%	0.37%	0.48%	0.43%
Durables	0.38%	0.53%	0.50%	0.31%	0.37%
Manufacturing	0.16%	0.21%	0.09%	0.15%	0.08%
Energy	0.61%	0.66%	0.55%	0.19%	0.37%
Technology	0.47%	0.17%	0.10%	0.25%	0.39%
Telecom	0.91%	0.60%	0.32%	0.16%	0.30%
Shops	0.37%	0.47%	0.23%	0.04%	0.20%
Health	-0.15%	0.10%	0.43%	0.22%	0.27%
Utilities	0.94%	-0.16%	-0.13%	0.18%	-0.06%
Other	0.60%	0.22%	0.11%	0.18%	0.09%

Table 7 shows to what extent the results from Table 6 are time dependent. Although there are a few exceptions, the results are surprisingly robust for all industries across all time periods.

Table 7. Monthly returns following significant positive difference for prior month

Industry	1926-2022	1926-1946	1947-1979	1980 -2022	2002-2022	2012-2022
Overall Average	0.48%	0.65%	0.45%	0.43%	0.22%	0.65%
Non-Durables	0.47%	0.90%	0.50%	0.26%	0.03%	0.37%
Durables	0.38%	1.18%	-0.14%	0.31%	0.65%	2.71%
Manufacturing	0.16%	1.13%	0.17%	-0.26%	0.09%	-0.02%
Energy	0.61%	0.52%	0.98%	0.36%	-0.82%	-0.12%
Technology	0.47%	0.85%	-0.16%	0.84%	0.79%	0.36%
Telecom	0.92%	0.78%	0.87%	1.04%	0.80%	0.31%
Shops	0.37%	0.75%	0.04%	0.42%	0.12%	0.67%
Health	-0.15%	-0.75%	0.34%	-0.21%	-0.11%	0.38%
Utilities	0.94%	0.25%	1.09%	1.25%	0.66%	1.65%
Other	0.60%	0.90%	0.83%	0.31%	-0.03%	0.24%

4. Application: Buy-and-Hold vs Switching

4.1 Size and Value

Although it appears excess returns can be attained, by definition, significant differences will only be found 10% or 25% of the time using +/- 1.65 or 1.28 standard deviations. In addition, the probability of a successful trade is also a key determining factor as to whether one can outperform a simple buy-and-hold strategy. Bauer and Dahlquist (2001, 2012) show investors need to be able switch correctly 66% of the time to outperform a buy-and-hold strategy, although in 2000-2011 this hurdle falls to 57%. Drew (2006) finds a similar high hurdle rate of 70% using Australian data. Thus, a signal needs a high success rate to outperform. The average success rate for using the above Z-scores is 61%, suggesting it is borderline for profitable implementation.

To determine if the switching strategy outperforms buy-and-hold, Table 8 shows the return for various time periods by moving 100% of an investor's equity portfolio into the asset category only when there is a significant difference between the asset classes, otherwise, one remains equally invested in both asset classes. In practice, only a portion of a portfolio would be moved from a more diversified market type portfolio, but these results show what the absolute difference in return could be. Results in Table 5 are for switching based on previous month only, although the results for longer previous periods of outperformance are qualitatively similar.

Table 8. Geometric annual average returns for various asset classes from June 1926 to April 2022 based switching strategy using +/- 1.28 or 1.65 Z-score

	50/50 Small/Large	50/50 Mid/Large	50/50 Small Value/ Small Growth	50/50 Large Value/ Large Growth
1926-2022	11.4%	11.1%	11.9%	10.1%
1926-1946	8.6%	7.7%	9.7%	6.0%
1947-1979	12.4%	11.6%	13.8%	10.2%
1980 -2022	11.6%	12.0%	11.4%	11.8%
2002-2022	9.4%	9.5%	9.1%	9.4%
2012-2022	13.0%	12.7%	12.0%	14.8%
	Switching result based on +/- 1.28 Z-score			
1926-2022	11.4%*	12.5%*	10.2%	13.1%*
1926-1946	9.3%*	9.5%*	6.0%	9.8%*
1947-1979	10.9%	13.9%*	10.9%	14.8%*
1980 -2022	12.5%*	12.6%*	11.5%*	13.2%*
2002-2022	9.0%	9.7%*	8.9%	10.1%*
2012-2022	14.2%*	12.6%	13.4%*	11.7%*
	Switching result based on +/- 1.65 Z-score			
1926-2022	10.7%	12.2%*	10.2%	12.8%*
1926-1946	6.6%	9.6%*	6.0%	9.7%*
1947-1979	10.6%	13.9%*	10.9%	14.3%*
1980 -2022	12.4%*	12.0%*	11.5%*	12.9%*
2002-2022	9.3%*	10.0%*	8.9%	9.8%*
2012-2022	15.3%*	13.6%*	13.4%*	12.3%*

*Greater than 50/50 buy-and-hold strategy

Although the results above are based on moving to 100% in the outperforming asset class when the Z-score is greater than +/-1.28 or +/-1.65, returns for the entire period exceed 50/50 holdings by up to 2.0% annually for large value vs growth using a +/-1.65 Z-score. The large value vs growth also was the most consistent strategy being successful in every period and using either Z-score. The main exception was the small value vs small growth where the switching strategy generally did not work except over the last 10 years.

4.2 Industry Results

The same buy-and-hold test is performed using industry data relative to the market portfolio. Results shown in Table 9 are for using a Z-score of +/- 1.65 and are promising as the switching strategy appears to outperform by approximately 0.6% annually. It should be noted that before 2000, the practical application of this strategy would have been difficult if not impossible for individual traders. However, over the last 10, 20, and 40 years, the strategy on average still outperforms by approximately 0.5% annually.

Table 9. Annual returns using a switching strategy based on 1.65 Z-scores

Industry	1926-2022	1926-1946	1947-1979	1980 -2022	2002-2022	2012-2022
Market	10.2%	6.0%	10.9%	11.5%	8.9%	13.4%
Industry Average	10.8%*	6.8%*	11.5%*	12.0%*	9.1%*	14.2%*
Non-Durables	11.0%*	7.2%*	11.8%*	11.9%*	9.1%*	14.2%*
Durables	10.6%*	7.7%*	10.7%	11.6%*	9.4%*	17.4%*
Manufacturing	10.4%*	7.4%*	11.1%*	11.0%	9.1%*	13.4%
Energy	11.0%*	6.7%*	12.3%*	11.8%*	7.6%	13.1%
Technology	10.8%*	7.2%*	10.6%	12.5%*	9.8%*	13.6%*
Telecom	11.3%*	6.6%*	11.9%*	12.8%*	9.8%*	13.8%
Shops	10.7%*	7.0%*	10.9%*	12.0%*	9.0%*	14.3%*
Health	9.9%	4.7%	11.4%*	11.1%	8.7%	13.9%*
Utilities	11.4%*	5.9%	12.6%*	13.0%*	9.6%*	14.9%*
Other	11.1%*	7.3%*	12.1%*	11.9%*	8.9%	13.8%*

*Significantly greater than buy-and-hold strategy at the 5% level.

4.3 ETF Application

To see if asset or industry switching is practically effective, returns using Vanguard's size and value ETFs (2004 to 2022) along with nine of State Street's sector ETFs (1999 to 2022) are examined. Results for the asset class switching relative to 50/50 show excess returns for both size and value with the difference being between 0.3% and 1.4% annually for the 2004 to 2022 period. In the last 10 years, switching between large value and large growth slightly underperformed.

To calculate the returns for industry switching, the industry is only purchased with a Z-score greater than 1.65, it is not shorted if the Z-score falls below -1.65. Otherwise, the investor simply remains in the market portfolio. The industry data also shows the switching strategy does not outperform buy-and-hold, and in fact underperforms over the last 22 years by 0.2% annually. The last 10 years met with similar results.

Table 10. Geometric annualized returns for switching following significant difference based on +/- 1.65 Z-score

Asset Classes	2004-2022	2012-2022
Small (VB) – Large (VV) vs 50/50	10.0%* vs 9.7%	13.6%* vs 13.2%
Small Value (VBR) – Small Growth (VBK) vs 50/50	10.6%* vs 9.2%	12.9%* vs 11.8%
Large Value (VTV) – Large Growth (VUG) vs 5/50	10.8%* vs 10.5%	14.7% vs 14.8%
Industry (ETF)	2000-2022	2012-2022
S&P 500 (SPY)	6.9%	14.3%
9 Sector Average	6.7%	14.3%*
Energy (XLE)	5.0%	14.8%*
Utilities (XLU)	7.2%*	15.0%*
Technology (XLK)	7.0%*	13.6%
Materials (XLB)	7.0%*	13.5%
Consumer Staples (XLP)	7.2%*	14.4%*
Consumer Discretionary (XLY)	6.9%	14.5%*
Industrials (XLI)	6.2%	13.5%
Health Care (XLV)	7.1%*	14.4%*
Financials (XLF)	6.6%	14.8%*

*Greater than 50/50 buy-and-hold strategy or market portfolio

5. Discussion

With the advent of ETFs in the 1990s and more recently free equity trades, moving in and out of the market or any of its various sectors is easier than ever. Cashing in on stock market anomalies reported in the academic literature over the last 50 years can now be taken advantage of by everyone. Just like the gold rush, once everyone knows about something, there may not be any great wealth to be found. This study suggests this is indeed the case when it comes to chasing historical anomalies as the small size anomaly has not been apparent for the last 40+ years and large growth has been the best asset class for the last 15 years.

Regardless of whether the anomalies are true anomalies or historical artifacts, this study examines whether Z-scores are related to future size, value, and industry returns. If the "anomalies" are time sensitive, is there a way to overweight asset classes at the right time? Results suggest future return differences between size, value, or industries are positively related to Z-scores calculated over the previous 12 months. Specifically, there is 1 to 3-month momentum in asset classes and across industries based on significant Z-scores. For asset classes, mean reversion appears to be the norm after six months, although industry data shows continued momentum.

Relative to buy-and-hold, a switching strategy based on significant Z-scores appears to add value. Applying the results using practically traded ETFs over the last 22 years shows outperformance using size or value. However, using Z-scores to trade ETFs for sector rotation did not outperform a simple buy-and-hold strategy. With all due caution, this may be yet another finding that worked historically but going forward may lead to results no better than buy-and-hold.

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