Experiential Group Project 2:

Seasonal and Secular Stock

Market Trends

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Abstract

This project evaluates the validity of well-known seasonal investment patterns using 30 years of S&P500 and sector-level data (1995–2025). First, when assessing whether winter months (November–April) outperform summer months (May–October), it is found that although winter historically exhibits higher mean returns and slightly more favorable Sharpe ratios, the difference is not statistically significant at the 95% confidence level. Cumulative-return analysis further shows that a strict SMGA strategy underperforms a buy-and-hold S&P500 allocation over the long run, especially given changes to these patterns in the last ~10 years. The offense–defense sector rotation framework was evaluated by comparing seasonal performance in Consumer Discretionary and Consumer Staples, and data confirmed Discretionary outperforms in the winter and Staples provide more stable returns in summer months. However, like SMGA, this two-sector rotation does not consistently outperform the S&P500 over the full period, especially amid major macroeconomic dislocations.

When evaluating the Pacer Seasonal Rotation ETF (SZNE), significant drawdowns were seen during summer months due to insufficient defensive diversification, suggesting that SZNE could be improved by expanding its winter basket and enhancing its defensive diversification, adjusting rotation timing to mid-October and mid-April, and incorporating bond exposure during weaker months. Across all analyses, findings indicate that while seasonal patterns contain predictive signals about market sentiment, they are not robust as standalone investment strategies. Effective portfolio construction requires using seasonality as one input among many, complemented by diversification, factor awareness, macro sensitivity, and alignment with investor risk preferences.

In order to validate the concept of “Sell in May and go away” (SMGA), the overall S&P500 performance was evaluated over a 30-year span, from 1995 to 2025, to test the hypothesis that an investor could outperform the market if fully investing November through April and converting to cash from May through October. First, average performance on a month-to-month basis is compared, as seen in Exhibit 1.1, and generally, one can see that winter months outperform a majority of the summer months on average. When grouping these months into two seasons across the 30-year period, the market performed better in the winter season on average, with a mean return of 1.14% and standard deviation of 4.24%, compared to the summer season with a mean return of 0.53% and standard deviation of 4.43%. This data can be found in the seasonal pattern analysis table in Exhibit 1.2.

The difference in performance between the seasons can be visualized best in the box plot comparison in Exhibit 1.3, with a higher mean and tighter distribution in the winter compared to the summer. We also ran a t-test on the full time series. While there is a gap in returns with winter months outperforming summer months, it's not statistically significant (p value 0.178) at a 95% confidence level, as seen in Exhibit 1.2. It is important to note that while the SMGA strategy is seen as a traditional seasonal pattern, it appears that the trend has been ineffective during times of poor macroeconomics conditions, and specifically since the beginning of the COVID-19 pandemic in 2020. Exhibit 1.4 can show cumulative returns comparing the S&P500 versus the SMGA strategy, and it becomes clear how the SMGA returns dip below the S&P500 returns during a majority of pink highlighted sections, indicating high interest rates/inflation. Exhibit 1.5 demonstrates the direct difference in monthly returns pre- and post-COVID-19, showing a clear change in monthly performance and seasonality.

Taking this one step further, Sharpe ratios were analyzed across the entire timeframe to get a sense of the effectiveness of the SMGA strategy compared to alternatives. In addition to the S&P500 and SMGA strategy, a sector rotation strategy (Offense Defense) was evaluated, which specifically alternates between Consumer Discretionary in winter months and Consumer Staples in summer months. The S&P500 and these two strategies are compared as seen in Exhibit 1.6, as the yellow line representing the SMGA strategy provided a Sharpe ratio predominately above the blue line which represents the S&P500 for the first 20 years of the time range. However, this changes around 2016 as the S&P500 then proceeds to outperform based on the Sharpe ratio up until the end of 2024. Cumulative returns and Sharpe ratios for the S&P500 and other strategies increase again in 2025 while the SMGA strategy stays fall the others once again.

As seen in this analysis of Sharpe ratios and evaluating seasonal returns in the S&P500, it is easy to state that the SMGA strategy was an effective ideology historically to gauge market performance, though it doesn't provide a very strong investment approach, and the seasonal nature of the market is coming into question. While it cannot be stated with significant confidence that the winter season outperformed the summer season on average over the past 30 years, a portfolio that would have converted to cash every summer during that timeframe would have underperformed compared to staying in the market the whole time. This is seen when assessing cumulative returns of both the market and SMGA in Exhibit 1.4 and draws on the need for advancements to this SMGA strategy, which will be spoken to further below.

To quantify the conventional belief that Consumer Discretionary outperforms Consumer Staples during risk-on environments, monthly performance of both sectors was first analyzed over a 30-year period from 1995 to 2025. The objective was to determine whether the "wants or needs" framework aligns with seasonal market behavior, long-term risk-return characteristics,

and cyclical investor sentiment. Monthly sector returns were compared across winter and summer seasons. Exhibit 2.1 presents the distributional, box-plot, and violin-plot comparisons for Consumer Discretionary. In the winter months, Discretionary posted an average return of 1.52%, compared to 0.41% in the summer. Although standard deviations remained similar across seasons (5.49% vs. 5.36%), the higher mean and median returns in winter reflect meaningful seasonal asymmetry. A similar pattern emerges in Exhibit 2.2 for Consumer Staples. Winter months produced an average return of 0.81% compared to 0.51% in the summer. The seasonal return difference is smaller than in Discretionary, consistent with Staples' defensive nature, but still indicative of modest winter strength. Importantly, Staples' standard deviation remains low and stable across seasons (3.46% vs. 3.82%), reinforcing its role as a defensive sector during uncertain market periods.

To compare the two sectors more directly, Exhibit 2.3 displays the difference between Discretionary and Staples monthly returns. On average, Discretionary outperforms by 0.30%, but the difference is small looking from this view. In general, the difference in returns between Consumer Discretionary and Staples based on the season continues to support the historical belief of the market's seasonality with better performance in winter months compared to summer months. As indicated by the strategy, the market shifts to more offensive investing with the chance at higher returns in the winter months, which is resembled by the Discretionary sector demonstrating a 1.52% mean return during those months, compared to 0.81% by Staples. Then, as the market conditions worsen in the summer, the market shifts to more defensive investing through Staples, which has a mean return of 0.51% in the summer, compared to 0.41% by Discretionary. Therefore, the Offense Defense strategy can be seen as effective historically,

similar to SMGA, with evidence that through the comparison between these two sectors their performance can be a good indicator of market conditions in the past.

Their long-term risk-return profiles tell a similar story to the findings above. As shown in Exhibit 2.4, Discretionary and Staples had very similar Sharpe ratios, 0.44 and 0.40, respectively, which is expected given the differences in excess returns and standard deviation. Across the same time range the returns and risk-profile were in-line with the offense and defense ideology, with Discretionary demonstrating a 9.69% excess return with 22.24% standard deviation and Staples demonstrating a 4.12% excess return with 10.27% standard deviation. This highlights the different roles the sectors play: Discretionary performs better in risk-on environments, while Staples remains more stable and defensive, strengthening during down-swings. Overall, the underlying 'wants vs. needs' relationship still provides useful insight into shifts in market sentiment. This suggests that the Discretionary–Staples pattern is more effective as a market indicator than as a standalone strategy, highlighting the need to incorporate broader sector and factor signals. Other sectors that would work more effectively for a sector rotational strategy based on market conditions, outside of seasonality, would be offensive sectors such as information technology, industrials, and financials, with defensive sectors being utilities, real estate, and healthcare.

Of course, seasonality is only one factor that can impact the performance of an investment strategy along with the market and sector returns overall. These patterns discussed above can be evaluated on a deeper level as we look at cumulative returns of the different strategies during high and low interest rate periods, as seen in Exhibit 3.1. These periods were identified as any time in which the U.S. Federal Funds rate reached 4.0% or above. As one would expect, the seasonality of the market makes much less of an impact in drastic macroeconomic

conditions or black swan events such as the burst of the dot-com bubble, 2008 financial crisis, and COVID-19 pandemic. These periods of high interest rates were also used to resemble high inflation, given it is well agreed that these periods often overlap. In the late 1990's and early 2000's, during times of high interest rates, the Offense Defense strategy outperforms the SMGA strategy consistently. The Offense Defense strategy also largely matches the performance or outperforms the S&P500 throughout these times of high interest rates. More importantly, when looking at areas of lower interest rates, the Offense Defense strategy significantly outperformed the other strategies. Looking at the cumulative returns ramp from 2009 to 2023 in Exhibit 3.1, one can see the potential for significant returns by utilizing this strategy through very strong and weak periods.

Reflecting back to Exhibit 1.3, it can be helpful to also re-evaluate the Sharpe ratio for each strategy depending on the time period. Here, one can see that the Offense Defense strategy provides a competitive Sharpe ratio, often at or above of the S&P500 during periods of favorable macroeconomic conditions. However, in years around these black swan events, the Sharpe ratio for this Offense Defense strategy often dips much lower below the general market and SMGA strategy. Looking closely again at performance around COVID-19, cumulative returns in the lead up and following the immediate impact were evaluated in Exhibit 3.2. In this chart, the Pacer CFRA-Stovall Equal Weight Seasonal Rotation ETF (NYSE: SZNE) is introduced and is the subject for comparison in this paper as the fund seeks to rotate between sectors that have historically performed better during seasonal periods[1]. As all four of these strategies are evaluated in Exhibit 3.3, the historical patterns that have held true in the past are performing differently, as the S&P500 begins outperforming all other strategies entering 2022. The S&P500

[1] Pacer ETFs, *Pacer Seasonal Rotation ETF (SZNE) Prospectus* (January 2025), Pacer Advisors, Inc.

held a 0.659 Sharpe ratio, 0.3 higher than the next strategy (SMGA), with the broader market bringing a much higher mean return of 1.11% versus to a comparable standard deviation of 4.8% compared to the other strategies. Many economists believe that following COVID-19 and

with the implementation of artificial intelligence, the mixture of this black swan event and the market disruption from technological advancements have changes how companies and sectors are valued as well as how investment strategies need to be approached overall.

The seasonal data makes it clear that SZNE follows the familiar "Winter strong, Summer weak" pattern, but its weakness in the May–October period is much more pronounced than the S&P500. From November through April, SZNE performs slightly better than the market, averaging about 1.15% compared with the S&P's 1.10%, which aligns well with research on the Halloween Effect. The summer window, however, is where the ETF struggles: SZNE falls to -0.07%, while the S&P500 remains positive. This gap indicates that the ETF is not positioned correctly in the weaker half of the year, likely holding too much exposure to sectors that decline more sharply during summer months.

The sector-level breakdown helps explain the issue. Cyclical "offense" sectors, such as Technology, Industrials, Materials, and Financials, deliver strong returns in the winter but weaken noticeably from May to October. Meanwhile, classic defensive sectors like Staples, Healthcare, and Utilities remain stable and even produce modest gains in this period, with significantly smaller drawdowns. This mirrors the conclusion from existing academic research, which shows that seasonal anomalies cluster in April, November, and December[2], and that global markets often

[2] Valadkhani, A., & O'Mahony, B. (2024). *Sector-specific Calendar Anomalies in the US Equity Market*. International Review of Finacial Analysis.

experience excess returns during the May–October period.[3] In short, SZNE's current defense-season mix does not fully capture the sectors that historically offer the best protection in the summer.

Improving SZNE would involve shifting more heavily toward true defensive sectors during May–October and reducing or removing exposure to volatile cyclicals. Existing research supports this refinement, showing that sector rotation works best when the defensive basket is carefully selected rather than broadly defined.[4] Further evidence suggests that incorporating bond ETFs during the summer months can enhance returns, as bonds typically do not exhibit the same seasonal weakness observed in equities.[5] By reshaping the defensive allocation and integrating a modest bond sleeve, SZNE could reduce its summer drawdowns and better capture the seasonal patterns documented in both the dataset presented here and in academic literature.

Looking at SZNE's current seasonal rotation, the overall structure is logical, cyclicals in the winter and defensives in the summer, but the data suggests that the ETF is leaving performance on the table by relying on a narrow set of sectors. From November to April, SZNE restricts its "offense" basket to Consumer Discretionary, Industrials, Materials, and Technology. Our seasonal sector averages, however, show that Communication Services often behaves like a cyclical sector with strong winter seasonality, and Financials also tends to improve during the November–April window. Prior research shows that many sectors exhibit their strongest anomalies in April,

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[3] Zhang, C., & Jacobsen, B. (2021). *The Halloween Indicator, "Sell in May and Go Away": Everywhere and all the time*. Journal of International Money and Finance.

[4] Dolvin, S., & Foltice, B. (2024). *An Update on Sector Rotation in the Sell in May and Go Away Strategy*. Journal of Finance Issues, Vol. 22, No. 3.

[5] Hsu, C.-H., & Lien, D. (2025). *To Outperform: Sell-in-May Enhanced with Bond Investments*. Pacific-Basin Finance Journal.

November, and December, which aligns with our findings.[2] Expanding the winter basket to include Communication Services and Financials would give SZNE broader exposure to sectors that consistently benefit from the Halloween effect.

The summer allocation is where SZNE needs the most improvement. Right now, the ETF only rotates into Consumer Staples and Health Care from May through October, but our dataset shows that Utilities consistently deliver positive or stable returns across the summer months and experience far smaller drawdowns than most other sectors. Real Estate is another potential summer addition, but it should be weighted cautiously since its sensitivity to interest rates makes it more volatile. To strengthen the strategy, SZNE's summer basket should include, Consumer Staples, Health Care, Utilities, and optionally, Real Estate, at a modest weight. This aligns with prior research indicating that seasonal rotation tends to work more effectively when the defensive sleeve is diversified but concentrated in low-volatility sectors.[4]

A final improvement involves modifying the timing and incorporating adjustments due to macroeconomic conditions and momentum factors. While SZNE currently switches on May 1 and November 1, our data indicates that market strength often begins in late October and that weakness frequently starts before May. A more precise schedule would be moving into offense around mid-October, not November 1, and moving into defense around mid-April, not May 1.

Additionally, high inflation and rising interest rates tend to benefit Energy and Financials, while hurting long-duration growth sectors like Technology. During inflationary environments, SZNE could bring Energy into the winter basket or increase Financials' weight. During periods of rate cuts or low inflation, overweighting Tech and Communication Services makes more sense. Existing studies also indicate that adding a bond ETF sleeve during May–October window can improve summer performance and help stabilize returns because bonds do not display seasonal

weakness.[5] Incorporating even a small bond component would smooth SZNE's drawdowns and improve its Sharpe ratio.

For actionable changes to the strategy, we'd recommend broadening sector exposure beyond Discretionary and Staples by including additional cyclical sectors in winter (e.g., Technology, Industrials, Financials, Communication Services) and a more complete defensive basket in summer (Staples, Healthcare, Utilities, and optional Real Estate). Additionally, adjust rotation timing rather than relying strictly on the calendar. Move into offense in mid-October and into defense in mid-April to better align with observed market turning points. Also, incorporate macroeconomic conditions when rotating sectors. During high inflation or rising rate periods, overweight Energy and Financials; during low inflation or rate-cutting periods, increase exposure to Technology and Communication Services. Lastly, use seasonality as a market signal, not a standalone strategy. Seasonal indicators can help identify shifts in sentiment, but successful implementation requires combining seasonality with sector diversification, factor analysis, and macro adjustments.

Based on these insights we trialed and errored a modified SZNE strategy the was able to outperform SZNE post 2018 but still underperformed S&P 500 as a whole. Things that worked for the offensive strategy was overweight Communications alongside Tech and Discretionary (Exhibit xx). Adding utilities to the defensive strategy did help, but real estate hurt the portfolio more than it help. We believe, though real estate is a stable sector, periods of rising interest rates directly impacts the demand and lowers investment. The SZNE modified had average monthly returns of 0.838% followed by SZNE replicated of 0.758%. Note that these strategies still outperform S&P 500 in this period. Also, not that this is the best sharpe ratio we were able to attain.

To further validate our results, we also applied a regression model on each of our strategies on the following three time periods – 1995 – 2025, 1995 – 2006, 2008 – 2025, 2018 – 2025and got results that directionally made sense. For each period, the market beta for the S&P500, SMGA, Offense Defense, Pacer were close to 1, 0.5, close to 1 and close to 1 respectively (Exhitbit 4.5). While we understand the running, the regression on the whole model can lead to overfitting, unreliable alphas, ran it on these time periods to get a rough idea of the beta values for each factors, excess of market, SMB and HML. Since the Pacer ETF, was incepted in 2018, it does make sense to compare the alpha for these time periods, and we do it it negative across every strategy we tried. It makes sense directionally because it is a period of high interest rates and our portfolio are heavy on sectors that are negatively affectied by it. It worth noting that the top three alphas were S&P500, SMGA, and Pacer modified,

Conclusion

Our analysis shows that seasonal patterns—such as "Sell in May and Go Away" and the typical rotation between Consumer Discretionary and Consumer Staples—do contain meaningful signals about investor behavior and market sentiment. Historically, winter has produced higher returns and stronger Sharpe ratios than summer, and the "wants vs. needs" pattern between Discretionary and Staples aligns well with risk-on and risk-off environments. However, these advantages have weakened in recent years, especially during periods of unprecedented macroeconomic stress or structural market changes.

While seasonality can help identify shifts in market tone, neither SMGA nor a simple two-sector Offense–Defense rotation outperformed a long-term buy-and-hold investment in the S&P500 over the full 30-year sample. This highlights an important point: seasonal signals are

useful as indicators, but not as standalone strategies, because macroeconomic forces—such as inflation, interest rate cycles, and global shocks—often override historical seasonal behavior.

Our evaluation of SZNE reinforces this insight. Although the ETF follows a seasonal framework, its narrow sector allocations limit its effectiveness. Our findings suggest that SZNE could be improved by broadening its sector exposures, adjusting rotation timing, and adding defensive non-equity assets (such as bond ETFs) during weaker months.

From a portfolio management perspective, this project also offered important lessons. First, there is no single strategy that works in every market. Seasonal rules and sector rotation can be helpful, but they can quickly fail when market conditions rapidly change. Flexibility and regular review are essential. Second, diversification and consistent rebalancing remain the most reliable tools for long-term success. Relying on only two sectors increases risk, while spreading exposures helps protect the portfolio when individual strategies break down. Lastly, investors must consider their own risk tolerance and utility. A strategy with attractive historical returns may still be inappropriate if the risk level exceeds the investor's comfort. A good portfolio is not only about maximizing return. It must also match the investor's preferences, goals, and ability to withstand volatility.

Exhibits

Exhibit 1.1 - Average Returns by Month

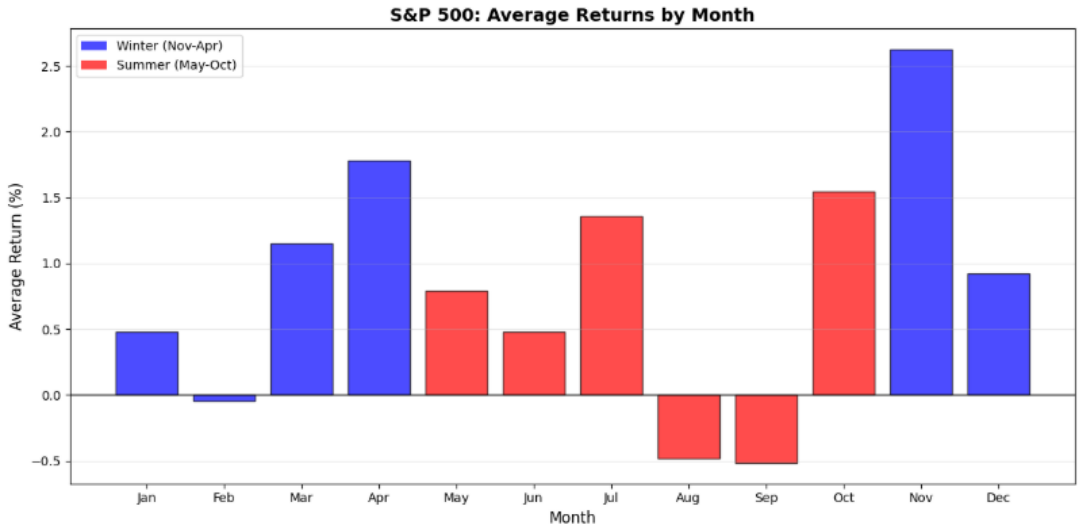

Exhibit 1.2 - Seasonal Pattern Analysis Table

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SEASONAL PATTERN ANALYSIS: Nov-Apr vs May-Oct
======================================================================

WINTER SEASON (Nov-Apr):
  Mean monthly return:  1.146%
  Median:               1.470%
  Std deviation:        4.243%
  % Positive months:    67.4%

SUMMER SEASON (May-Oct):
  Mean monthly return:  0.530%
  Median:               1.213%
  Std deviation:        4.433%
  % Positive months:    62.4%

DIFFERENCE (Winter - Summer):
  Mean difference:      0.616%
  Median difference:    0.257%
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================================================================================
STATISTICAL SIGNIFICANCE TEST
================================================================================

Two-sample t-test (Winter vs Summer):
t-statistic: 1.3625
p-value:     0.173872

✗ The difference is NOT statistically significant at 5% level
```

Exhibit 1.3 - Box Plot Comparison

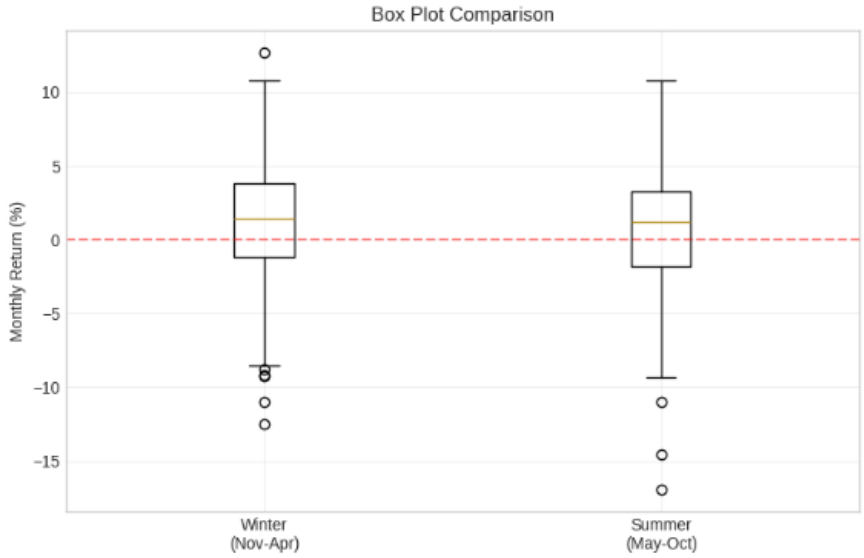


Exhibit 1.4 - S&P500 vs SMGA Cumulative Returns

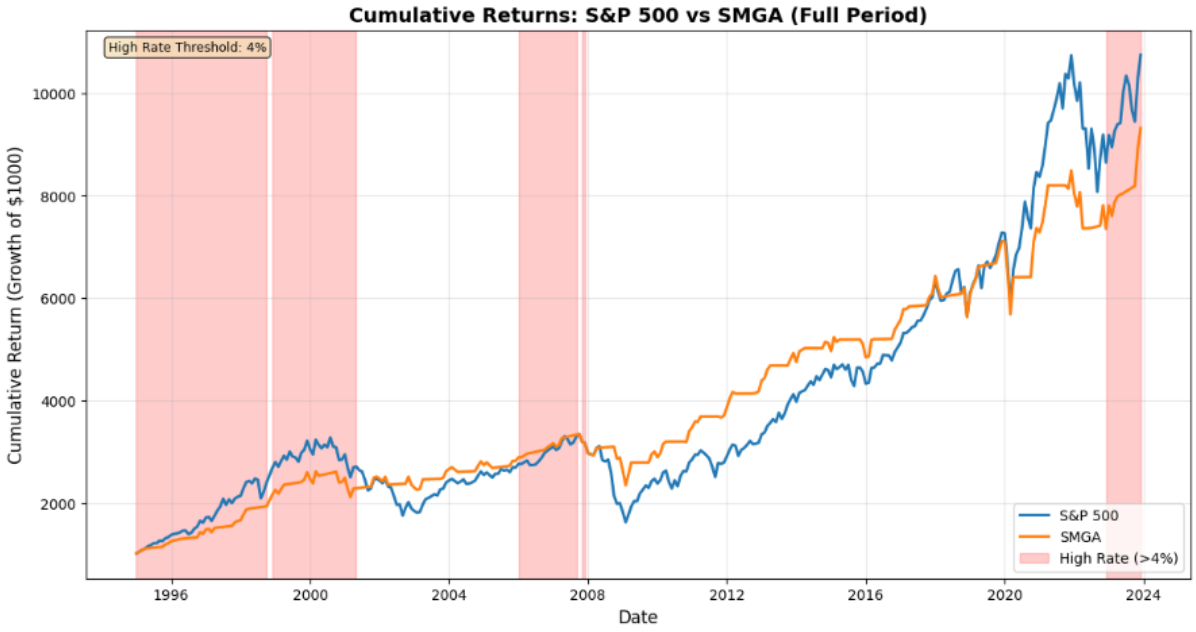
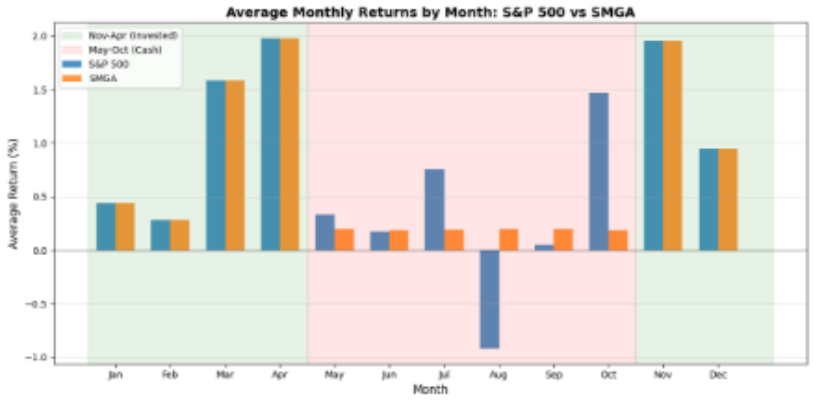


Exhibit 1.5 - Average Monthly Returns Pre- and Post-COVID-19

Pre Covid



Post Covid

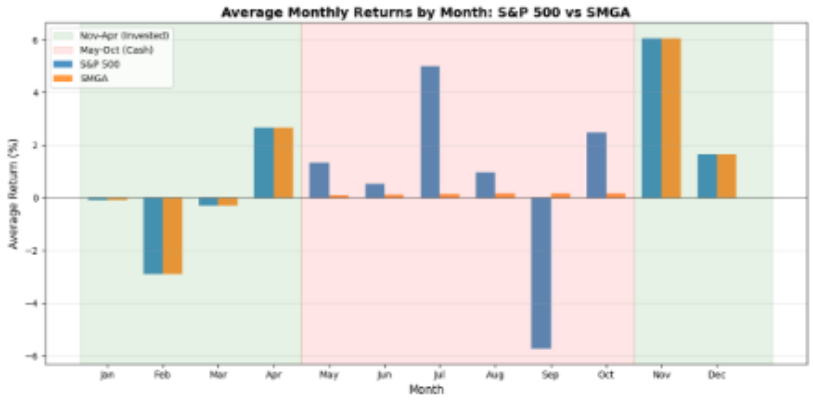
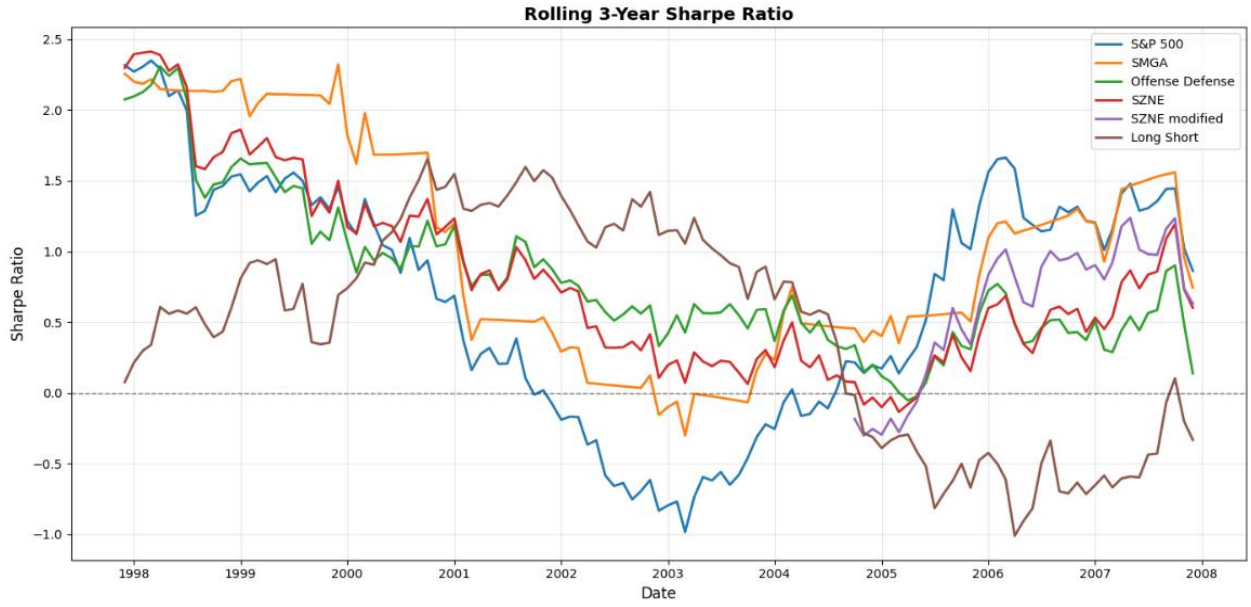


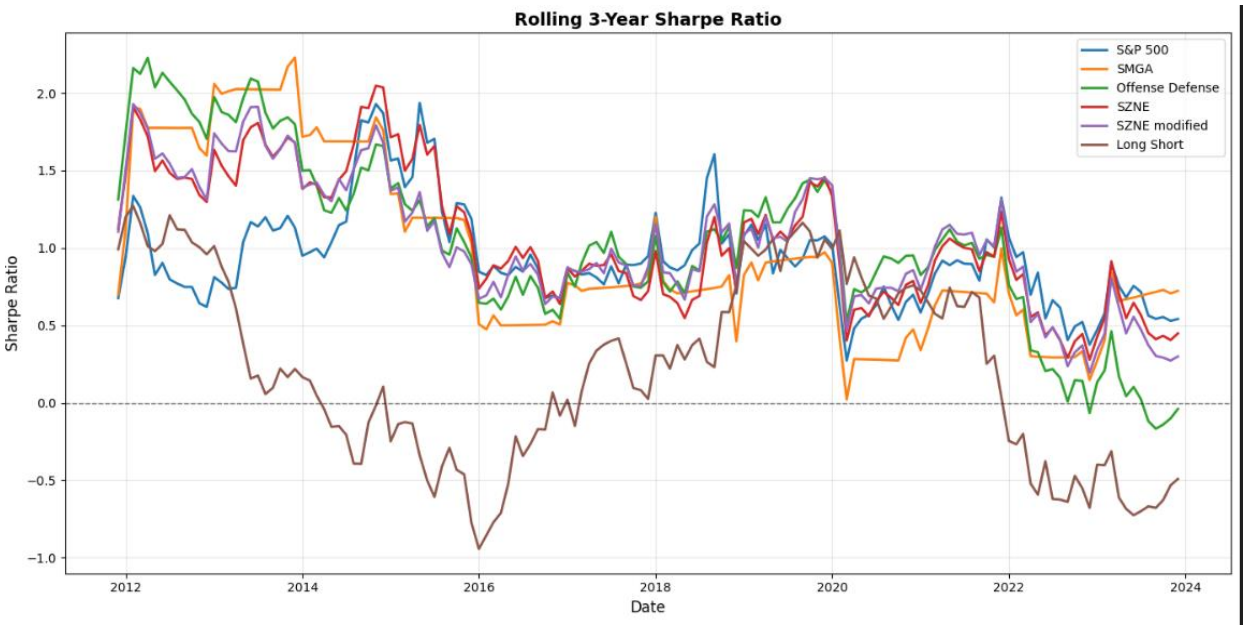
Exhibit 1.6 - Sharpe Ratio Comparisons

1995-2025

1995 – 2007



2009 - 2025



2018 - 2025

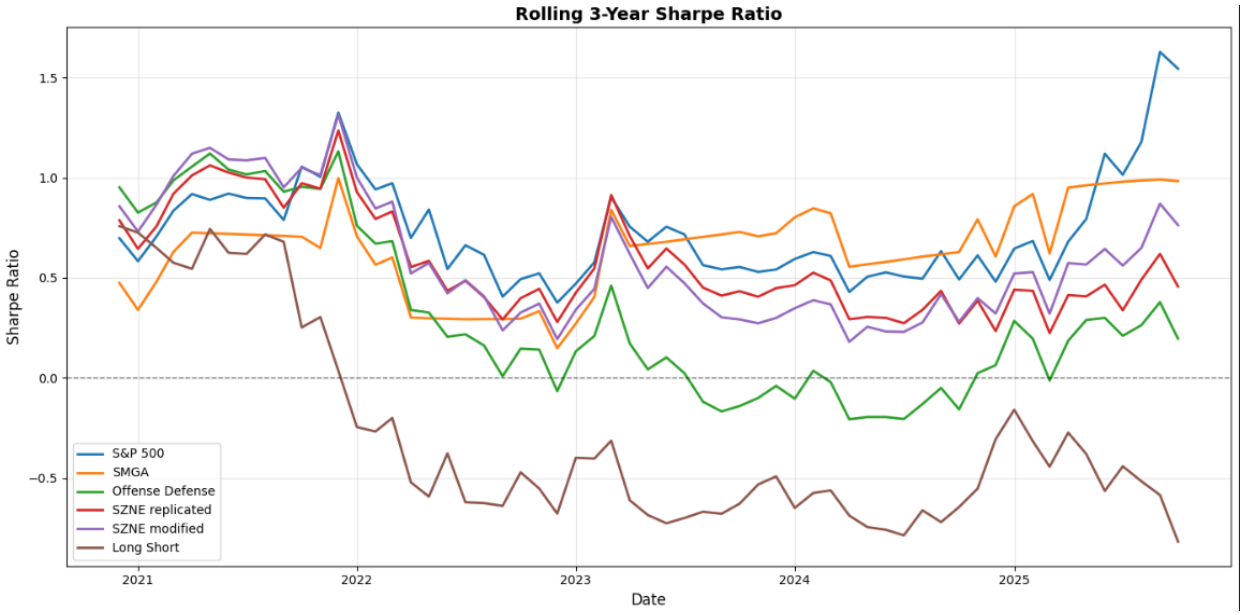
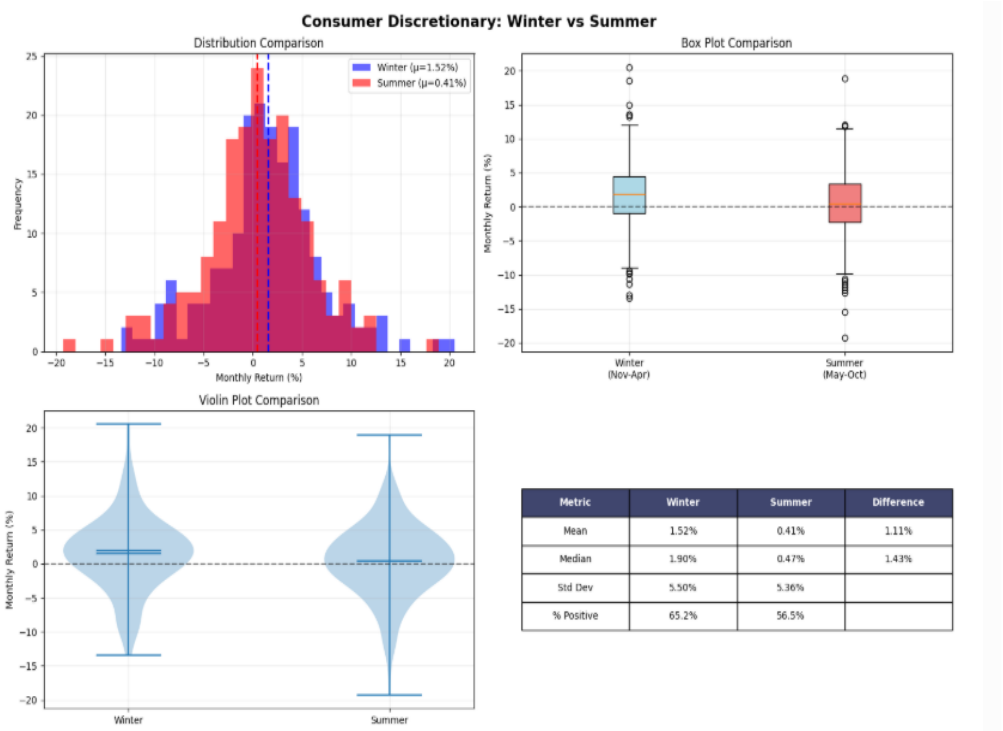
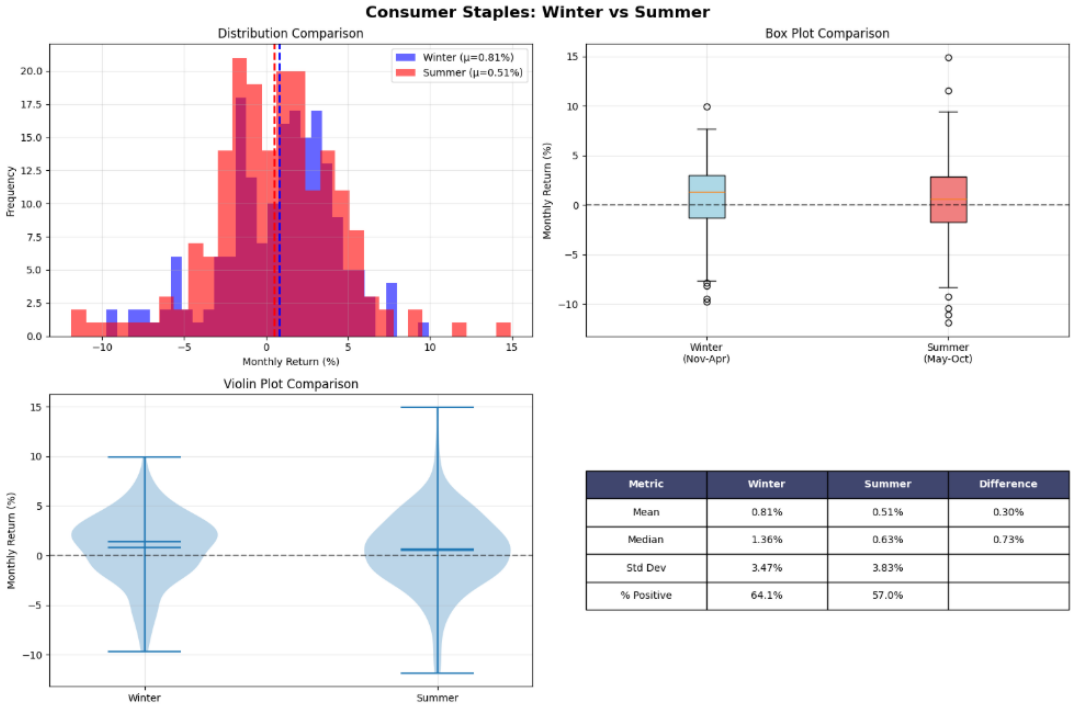


Exhibit 2.1 - Average Return of Consumer Discretionary



Metric	Winter	Summer	Difference
Mean	1.52%	0.41%	1.11%
Median	1.90%	0.47%	1.43%
Std Dev	5.50%	5.36%	
% Positive	65.2%	56.5%	

Exhibit 2.2 - Average Return of Consumer Staples



Metric	Winter	Summer	Difference
Mean	0.81%	0.51%	0.30%
Median	1.36%	0.63%	0.73%
Std Dev	3.47%	3.83%	
% Positive	64.1%	57.0%	

Exhibit 2.3 – Return Comparison between Consumer Discretionary and Consumer Staples

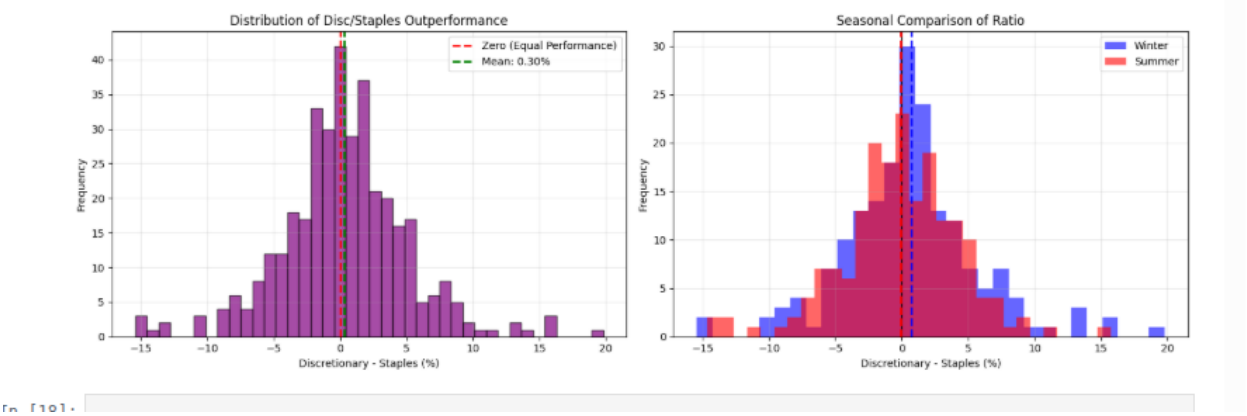


Exhibit 2.4 – Sharpe Ratio of Consumer Discretionary and Consumer Staples

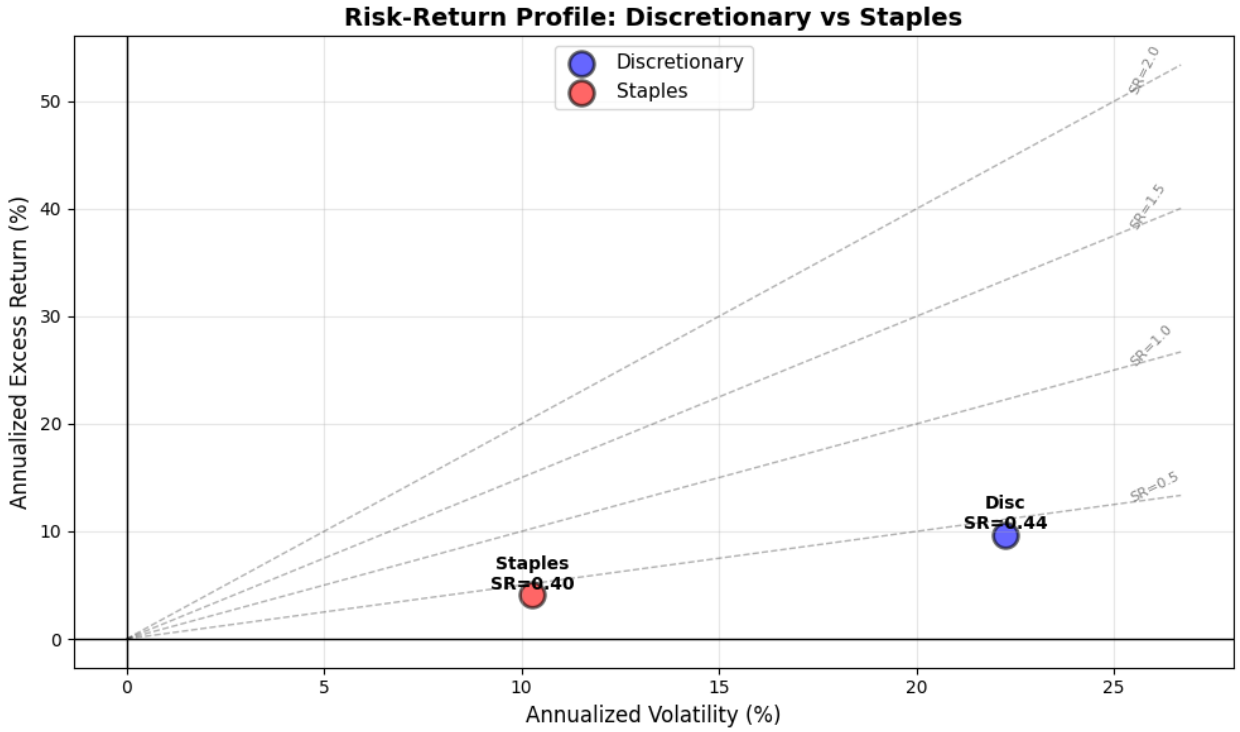


Exhibit 3.1 – Cumulative Returns with High Interest Rate Highlights

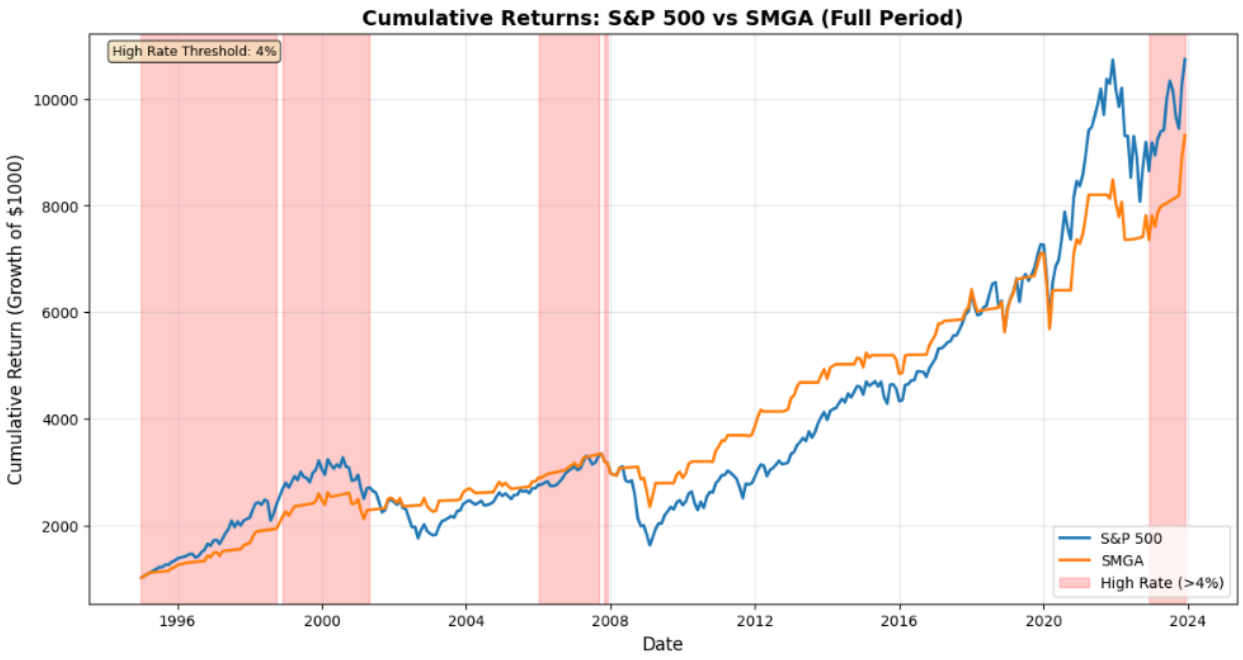
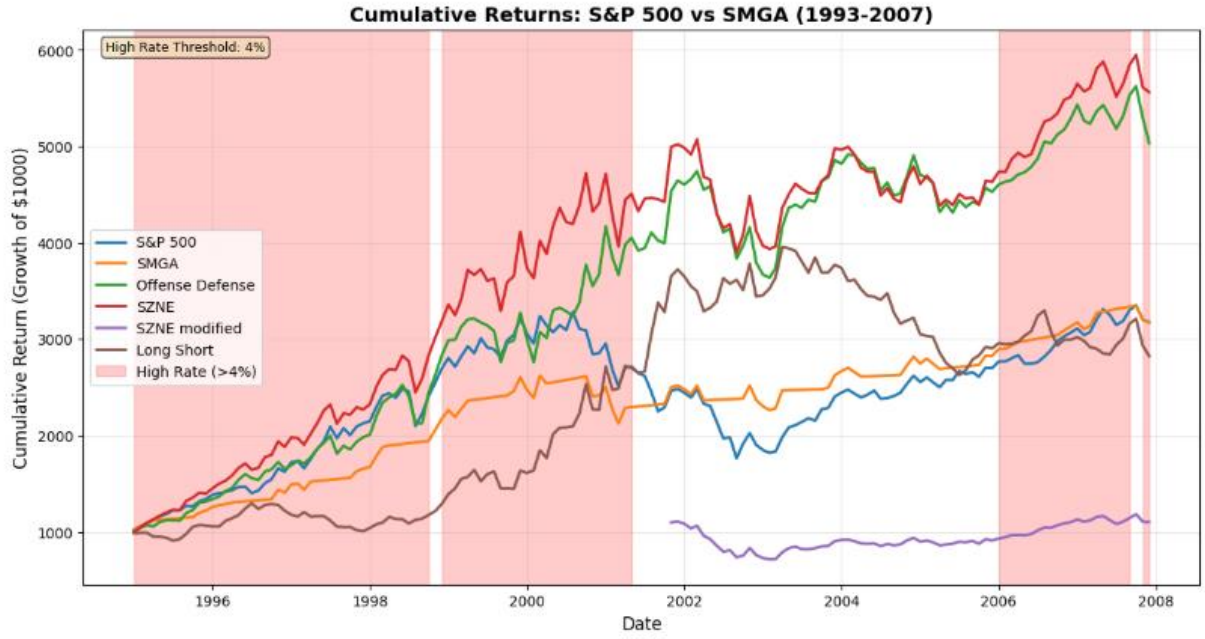
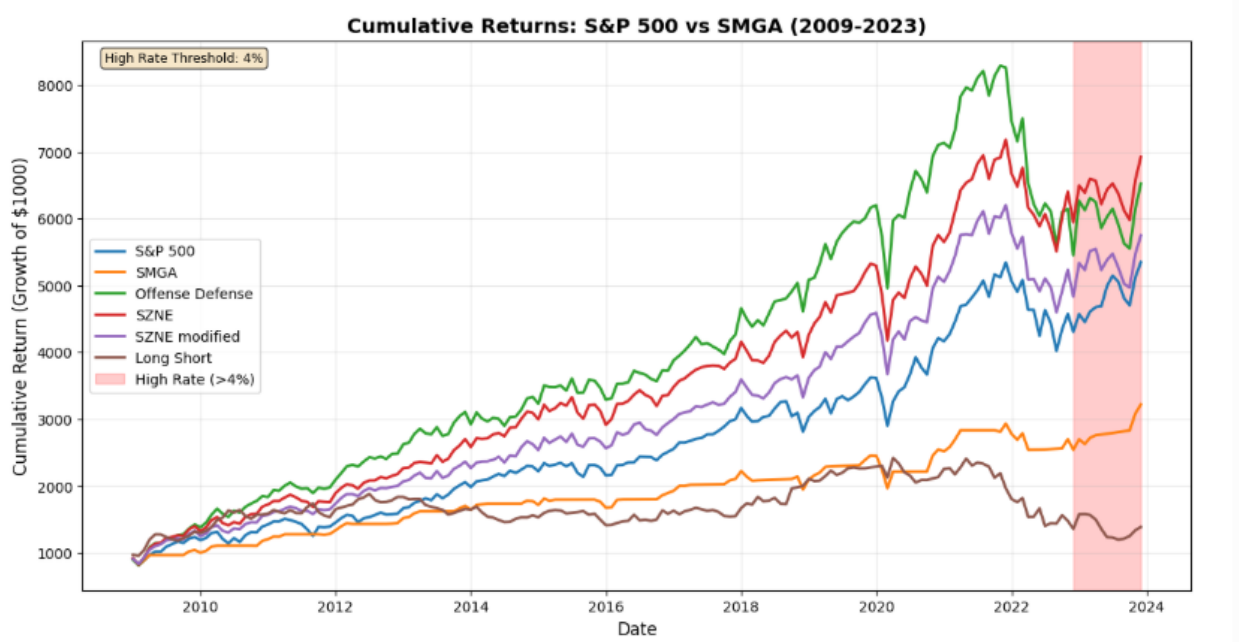


Exhibit 3.2 - Cumulative Returns for All Strategies





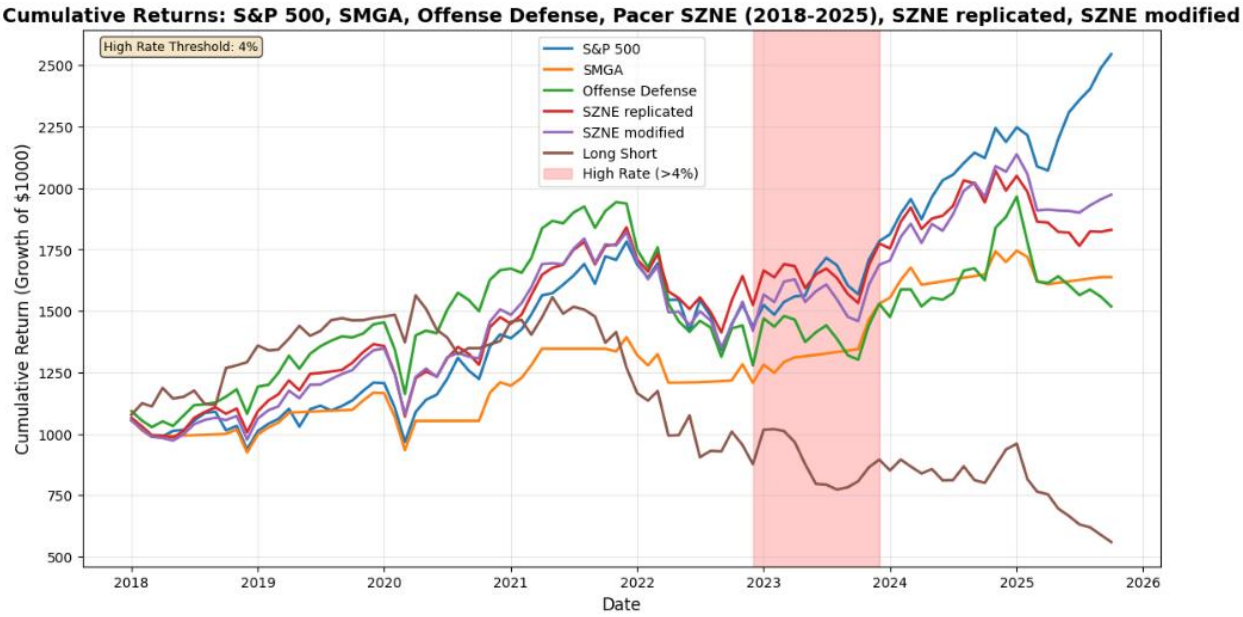


Exhibit 3.3: Statistics for all strategies

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================================================================================
PERIOD 3: 2018-2025 STATISTICS
================================================================================
                      Mean (%)  Median (%)  Std Dev (%)  Sharpe  Sortino   N  \
Strategy
S&P 500                  1.113       2.031        4.800   0.659    1.019  94
SMGA                     0.595       0.200        3.731   0.366    0.394  94
Offense Defence          0.602       0.730        5.659   0.245    0.387  94
Pacer SZNE               0.491       0.480        5.543   0.178    0.277  87
Pacer SZNE replicated    0.758       0.724        4.783   0.403    0.663  94
Pacer SZNE modified      0.838       1.273        4.760   0.464    0.678  94

                        Start      End
Strategy
S&P 500               2018-01  2025-10
SMGA                  2018-01  2025-10
Offense Defence       2018-01  2025-10
Pacer SZNE            2018-08  2025-10
Pacer SZNE replicated 2018-01  2025-10
Pacer SZNE modified   2018-01  2025-10
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Exhibit 4.1 – Monthly Return by Sectors

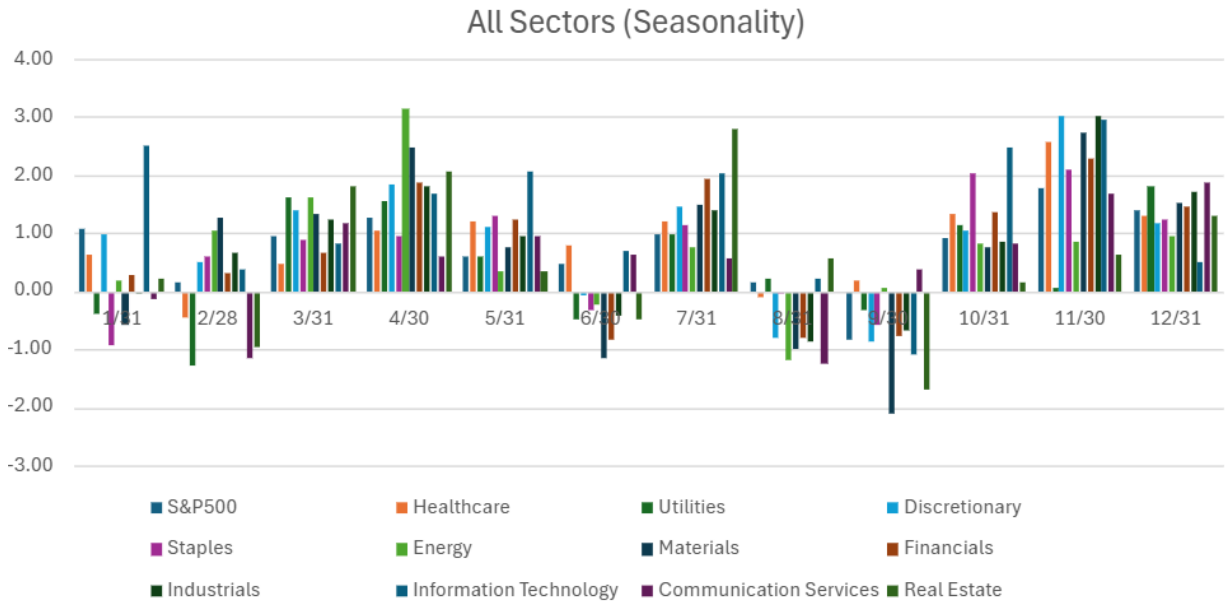

Exhibit 4.2 – SZNE Sector Rotation Strategy

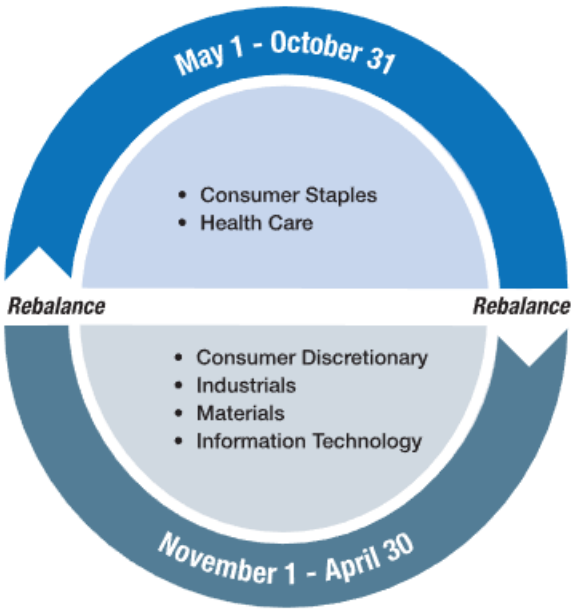

Exhibit 4.3 - Industry Weightage Logic for SZNE Modified

Offense logic

```
if in_offense:

    # if rate_regime == 'High':
    #     # HIGH RATES: Overweight Financials (benefit from rates), add Energy
    #     offense_weights = {
    #         'discretionary': 0.15,      # Keep reasonable - consumer spending
    #         'industrials': 0.20,        # OVERWEIGHT - capex benefits
    #         'tech': 0.15,               # Reduce but don't kill (Mag 7 too important)
    #         'materials': 0.20,          # OVERWEIGHT - commodities/inflation hedge
    #         'communication': 0.10,      # Underweight - rate sensitive
    #         'financials': 0.20,         # OVERWEIGHT - net interest margin benefits
    #         'energy': 0.00              # REMOVE - too volatile, doesn't help
    #     }

    if rate_regime == 'Low' or rate_regime == 'High':
        # LOW RATES: Overweight Tech, Communication (growth benefits)
        offense_weights = {
            'discretionary': 0.20,      # OVERWEIGHT - consumer confidence high
            'industrials': 0.15,        # Moderate weight
            'tech': 0.30,               # OVERWEIGHT - growth premium expands
            'materials': 0.10,          # Underweight - less inflation pressure
            'communication': 0.20,      # OVERWEIGHT - growth sector
            'financials': 0.05,         # Underweight - NIM compression
            'energy': 0.00              # REMOVE - doesn't fit low-rate regime
        }
```

Defense logic

```python
if rate_regime == 'Low' or rate_regime == 'High':
    # LOW RATES: Can increase Real Estate (benefits from low rates)
    if include_realestate:
        defense_weights = {
            'staples': 0.25,
            'healthcare': 0.25,
            'utilities': 0.20,      # Slightly underweight
            'realestate': 0.30      # OVERWEIGHT - benefits from low rates
        }
    else:
        defense_weights = {
            'staples': 1/3,
            'healthcare': 1/3,
            'utilities': 1/3,
            'realestate': 0.0
        }

else:  # Normal rates
    # NORMAL: Equal weight
    if include_realestate:
        defense_weights = {
            'staples': 0.25,
            'healthcare': 0.25,
            'utilities': 0.25,
            'realestate': 0.25
        }
    else:
        defense_weights = {
            'staples': 1/3,
            'healthcare': 1/3,
            'utilities': 1/3,
            'realestate': 0.0
        }
```

Exhibit 4.4

```
================================================================================
PERIOD 3: 2018-2025 STATISTICS
================================================================================
                       Mean (%)  Median (%)  Std Dev (%)  Sharpe  Sortino   N  \
Strategy
S&P 500                   1.113       2.031        4.800   0.659    1.019  94
SMGA                      0.595       0.200        3.731   0.366    0.394  94
Offense Defence           0.602       0.730        5.659   0.245    0.387  94
Pacer SZNE                0.491       0.480        5.543   0.178    0.277  87
Pacer SZNE replicated     0.758       0.724        4.783   0.403    0.663  94
Pacer SZNE modified       0.838       1.273        4.760   0.464    0.678  94

                         Start      End
Strategy
S&P 500                2018-01  2025-10
SMGA                   2018-01  2025-10
Offense Defence        2018-01  2025-10
Pacer SZNE             2018-08  2025-10
Pacer SZNE replicated  2018-01  2025-10
Pacer SZNE modified    2018-01  2025-10
```

Exhibit 4.5

Fama-French regression summary (coefficients, 1995-2025)

Strategy	Alpha (monthly %)	Alpha (annual %)	Alpha p-value
S&P500	-0.148	-1.781	0.000
SMGA	0.086	1.035	0.457
Rotation	0.137	1.649	0.384
Pacer	-0.620	-7.441	0.017
Pacer Repl	0.132	1.578	0.275
Pacer Modified	-0.121	-1.450	0.311
Long Short	0.168	2.016	0.508

Strategy	Beta (Market)	Beta (SMB)	Beta (HML)	R^2	Adj R^2	N
S&P500	0.988	-0.178	0.030	0.993	0.992	369
SMGA	0.483	-0.118	0.065	0.484	0.480	369
Rotation	0.853	-0.202	0.100	0.612	0.609	369
Pacer	0.940	0.131	0.257	0.841	0.836	86
Pacer Repl	0.888	-0.191	0.067	0.747	0.745	369
Pacer Modified	0.859	-0.149	0.014	0.779	0.777	287
Long Short	0.068	0.006	0.001	0.004	-0.004	369

Skipping Pacer: no data in this period

Fama-French regression summary (coefficients, 1995-2006)

Strategy	Alpha (monthly %)	Alpha (annual %)	Alpha p-value
S&P500	-0.139	-1.670	0.001
SMGA	0.308	3.691	0.096
Rotation	0.302	3.628	0.269
Pacer Repl	0.403	4.834	0.088
Pacer Modified	-0.544	-6.527	0.056
Long Short	0.784	9.408	0.067

Strategy	Beta (Market)	Beta (SMB)	Beta (HML)	R^2	Adj R^2	N
S&P500	0.987	-0.195	0.036	0.988	0.988	144
SMGA	0.417	-0.209	-0.096	0.479	0.468	144
Rotation	0.838	-0.295	0.164	0.567	0.558	144
Pacer Repl	0.892	-0.290	-0.018	0.686	0.679	144
Pacer Modified	1.017	-0.220	0.149	0.778	0.766	62
Long Short	0.014	-0.265	-0.335	0.055	0.034	144

Fama-French regression summary (coefficients, 2008-2025)

Strategy	Alpha (monthly %)	Alpha (annual %)	Alpha p-value
S&P500	-0.149	-1.785	0.000
SMGA	0.070	0.837	0.663
Rotation	0.063	0.755	0.757
Pacer	-0.620	-7.441	0.017
Pacer Repl	0.053	0.636	0.708
Pacer Modified	0.012	0.147	0.930
Long Short	0.077	0.925	0.817

Strategy	Beta (Market)	Beta (SMB)	Beta (HML)	R^2	Adj R^2	N
S&P500	0.987	-0.142	0.016	0.996	0.996	213
SMGA	0.479	-0.057	0.099	0.503	0.496	213
Rotation	0.853	0.011	-0.012	0.662	0.657	213
Pacer	0.940	0.131	0.257	0.841	0.836	86
Pacer Repl	0.852	-0.071	0.071	0.799	0.796	213
Pacer Modified	0.824	-0.125	0.018	0.786	0.782	213
Long Short	-0.015	0.283	0.076	0.027	0.013	213

Fama-French regression summary (coefficients, 2018-2025)

Strategy	Alpha (monthly %)	Alpha (annual %)	Alpha p-value
S&P500	-0.136	-1.632	0.000
SMGA	-0.185	-2.221	0.476
Rotation	-0.508	-6.098	0.161
Pacer	-0.620	-7.441	0.017
Pacer Repl	-0.345	-4.140	0.145
Pacer Modified	-0.272	-3.260	0.257
Long Short	-0.609	-7.306	0.331

Strategy	Beta (Market)	Beta (SMB)	Beta (HML)	R^2	Adj R^2	N
S&P500	0.982	-0.138	0.018	0.996	0.996	93
SMGA	0.578	-0.016	0.064	0.598	0.585	93
Rotation	0.915	0.028	-0.061	0.662	0.651	93
Pacer	0.940	0.131	0.257	0.841	0.836	86
Pacer Repl	0.874	-0.108	0.088	0.800	0.793	93
Pacer Modified	0.867	-0.116	0.050	0.792	0.785	93
Long Short	0.077	0.304	0.011	0.035	0.002	93

Plot regression

References

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