Wednesday, July 15, 2020

This document displays the benefits of layering a tail hedge product with an existing portfolio. It is divided into two parts.

Part 1: Decomposes the Pension portfolio into a combination of various factor exposures. This will enable students to understand how the returns of many distinct factor portfolios contribute to the portfolio return. Within the portfolio they will find an over exposure to profitability and safety factors and a lower exposure to the value factor, relative to the S&P 500. These findings are consistent with the pension's mandate of finding industry leading companies that generate strong cash flows, with solid capital bases, less downside volatility and better capital preservation. Students will also find a significant exposure to the size factor (higher weight in smaller companies) relative to the S&P 500. This may be an unintended consequence of the equal weighting portfolio construction methodology; however, it is likely not a concern given the investment universe is the S&P 500, and all components are relatively large companies.

Part 2: Describes how a tail hedge product that can improve the risk-adjusted return of the Pension portfolio. The tail hedge consists of a suite of short portfolios that draw down more than the market and profit during times of crises. In this example, 35 cents are invested in the tail hedge for every dollar long. The resulting product reduces beta by half and increases the Sharpe Ratio by 0.3. With modest increase in leverage, the resulting portfolio would have a beta of 1 and could outperform the market significantly in terms of returns.

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In-Class Framework as applied to Pension Fund Portfolio

Part 1: Factor Exposure of Portfolio Holdings

This section explores how the Pension Fund investment portfolio can be broken down into a combination of various factor exposures. These factor exposures provide insight into the types of risk the portfolio takes in order to derive its return. As an example, an investor with a larger exposure to the size factor (holding smaller companies vs larger companies) relative to the market has a larger risk allocation to small cap stocks. Based on this factor exposure, the investor is expected to outperform the market when smaller companies outperform larger companies.

To create a factor, an investor takes a cross-sectional view of the stock universe and ranks every stock by their corresponding factor value. The stocks with the best factor values become the constituents of the long factor portfolio and the stocks with the worst become the constituents of the short factor portfolio. This process is then repeated at every rebalancing date.

In order to create the factors discussed below, two different stock universes were used: the RNFC Universe and the S&P 500 Universe. The RNFC Universe is defined as all US public companies with market capitalization greater than $1B and share price greater than $5. The S&P 500 Universe is defined as the 500 component stocks of the S&P 500 Index.

1.1 Factor Ranking for Current Holdings

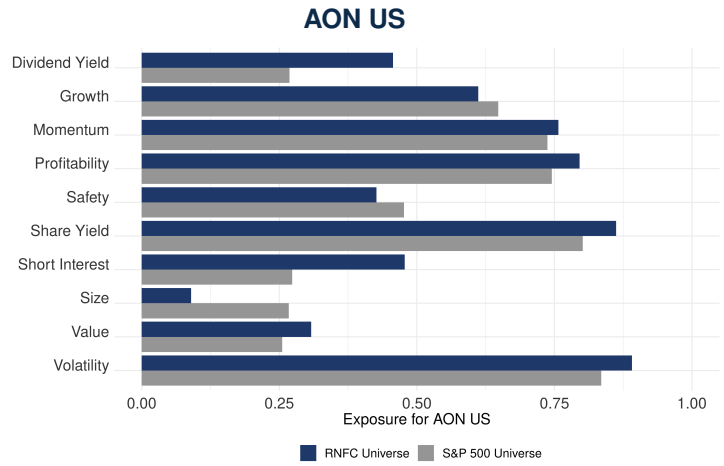
We will begin by analyzing the factor exposures of individual stocks in the Pension Fund portfolio. To do this, we rank each stock's factor value relative to all other stocks in the universe. For the purpose of this analysis, the stock is first ranked relative to the RNFC universe and then again relative to the S&P 500 universe. These rankings are then converted into percentiles to arrive at the final factor exposure value.

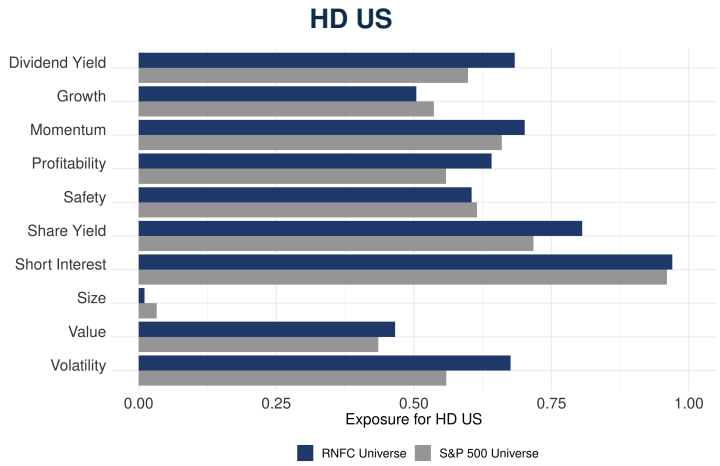
For each factor, we have outlined the corresponding meaning of the percentile rank in the following table.

Factor	Direction
Dividend Yield	Higher ranking = higher yield
Growth	Higher ranking = higher growth
Momentum	Higher ranking = higher momentum
Profitability	Higher ranking = higher profitability
Safety	Higher ranking = safer
Share Yield	Higher ranking = higher yield
Short Interest	Higher ranking = lower short interest
Size	Higher ranking = smaller size
Value	Higher ranking = cheaper
Volatility	Higher ranking = less volatile

In-Class Framework as applied to Pension Fund Portfolio

Below are examples of two stocks and their associated factor exposures. For a full breakdown of each holding in the current portfolio, please see Appendices A and B.

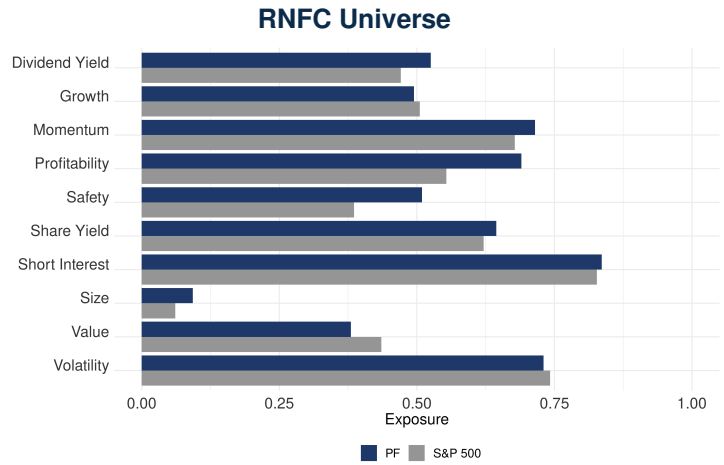


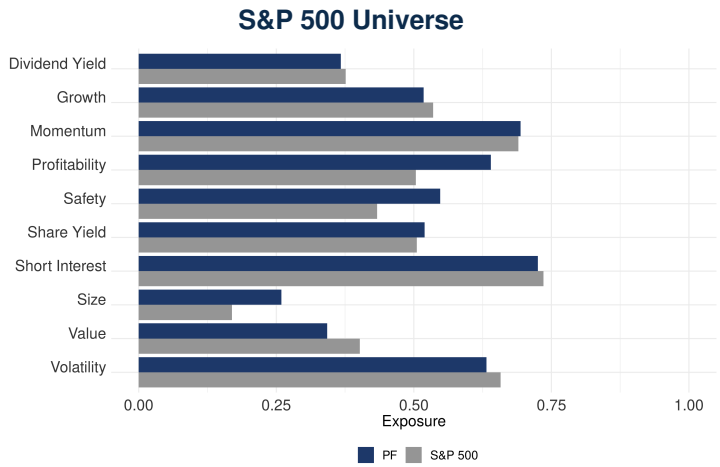


1.2 Current Factor Ranking for Overall Portfolio

Next, we look at the overall factor exposure of the entire Pension Fund portfolio vs the S&P 500. The factor exposure for each portfolio is calculated as the weighted average of the individual holding's factor exposure. We assume equal weight across stocks for the Pension Fund portfolio, implying that each stock contributes equally to the final factor exposures. In contrast, for the S&P 500, we use each stock's market cap to weight the factor exposure contribution.

The results are shown in the charts below.

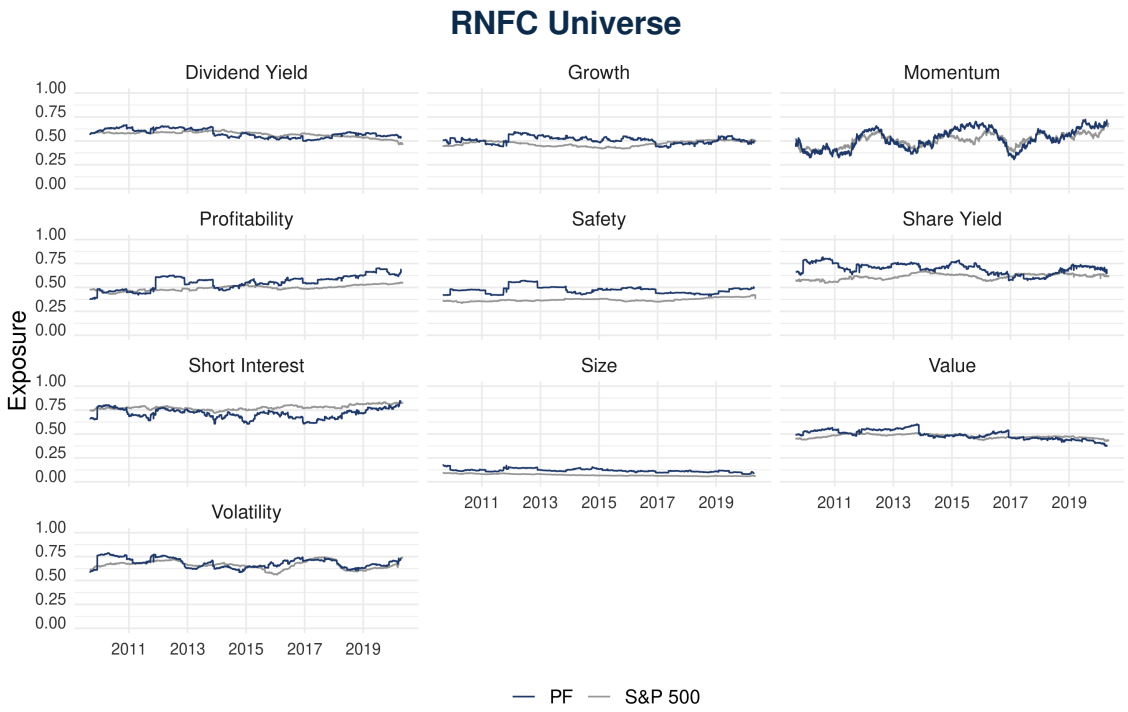


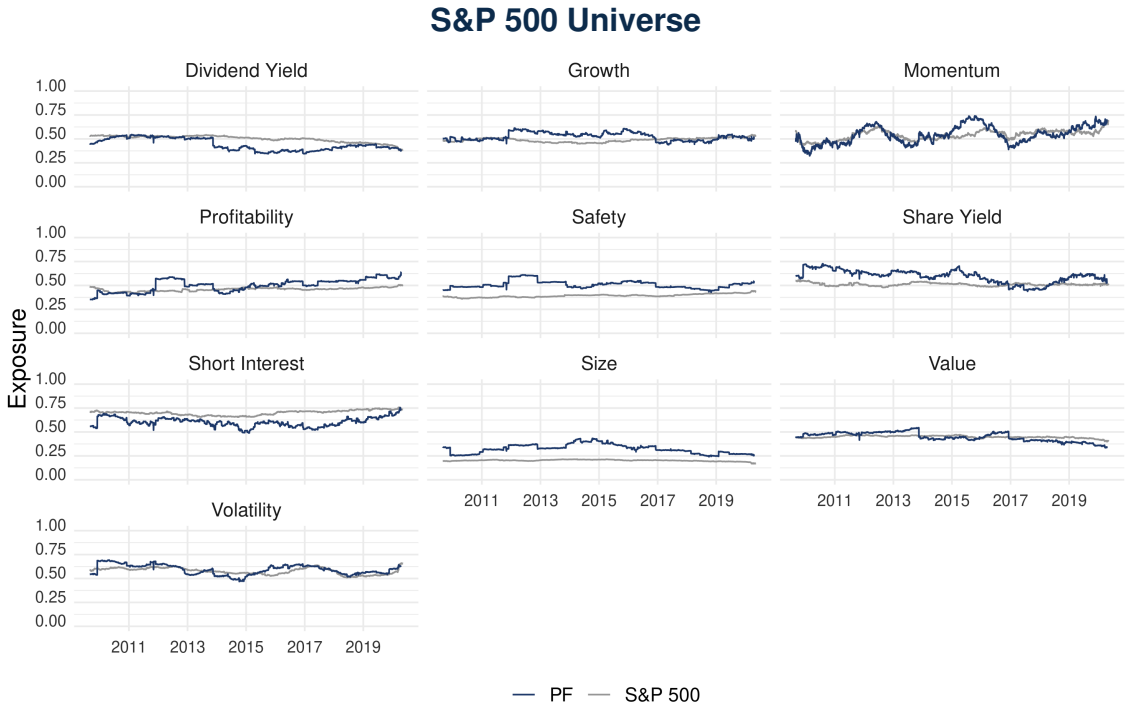


In-Class Framework as applied to Pension Fund Portfolio

1.3 Historical Factor Percentile Rankings

Finally, we can use the historical holdings of the Pension Fund portfolio to show how factor exposures have changed over time. The chart below shows the historical over/under-exposure of the portfolio for each of the factors against the S&P 500.





In-Class Framework as applied to Pension Fund Portfolio

1.4 Analysis of the Pension Fund portfolio factor exposure

In this section, we provide a high-level commentary on the Pension Fund portfolio's factor exposure.

We begin by reviewing the fund mandate:

"The Fund is designed to provide investors both income growth and capital appreciation with less market risk over time. The Fund invests in companies within the S&P 500 Index that are typically leaders in their markets, have solid capital bases, generate strong cash flows and possess the ability to significantly increase their annual dividend. This results in a portfolio of 22 highly predictive businesses that exhibit less downside volatility, better capital preservation and faster recovery in market declines."

Now, let's compare actual factor exposures with this mandate.

By examining the chart in *1.2 Current Factor Ranking for Overall Portfolio*, it is evident that the Pension Fund portfolio's largest factor exposure discrepancies relative to the S&P 500 come from the Profitability and Safety factors.

These exposures make sense in context with their fund mandate of *generating strong cash flows* (profitability) and investing in companies with *solid capital bases* that exhibit *less downside volatility* and better *capital preservation* (safety).

Another significant factor exposure discrepancy against S&P 500 is the Value factor. In this case, however, the Pension Fund portfolio is less exposed to value versus the S&P 500. Again, given the mandate of investing in companies that are leaders in their markets, it is logical that there would be less of a value tilt.

One point of caution could be made when examining the Pension Fund portfolio's relative over-exposure to the size factor. This is likely due to Pension Fund's decision to allocate capital equally across stocks, whereas the S&P 500 is market cap weighted. While this may not be a concern given Pension Fund's investment universe is large cap companies in the S&P 500, the exposure does imply that the portfolio has a greater weighting in smaller companies relative to the S&P 500.

Part 2: Tail Hedged Portfolio

In this section, we demonstrate the benefits of the In-Class Tail Hedge product as applied to the SPXT portfolio and the Pension Fund portfolio. The tail hedge consists of a suite of short portfolios that draw down more than the market and profit during market crises. For purposes of this analysis the size of the tail hedge is set at 35% of the gross market value of the long portfolio, resulting in a total gross exposure of 135% and a net exposure of 65%.

As demonstrated below, the addition of the tail hedge product enhances the overall portfolio by both reducing drawdowns and increasing the Sharpe ratio. With modest increase in leverage, the resulting portfolio would have a beta of 1 and could outperform the market in terms of returns.

In-Class Framework as applied to Pension Fund Portfolio

2.1 SPXT vs. Tail Hedged SPXT (SPXTH)

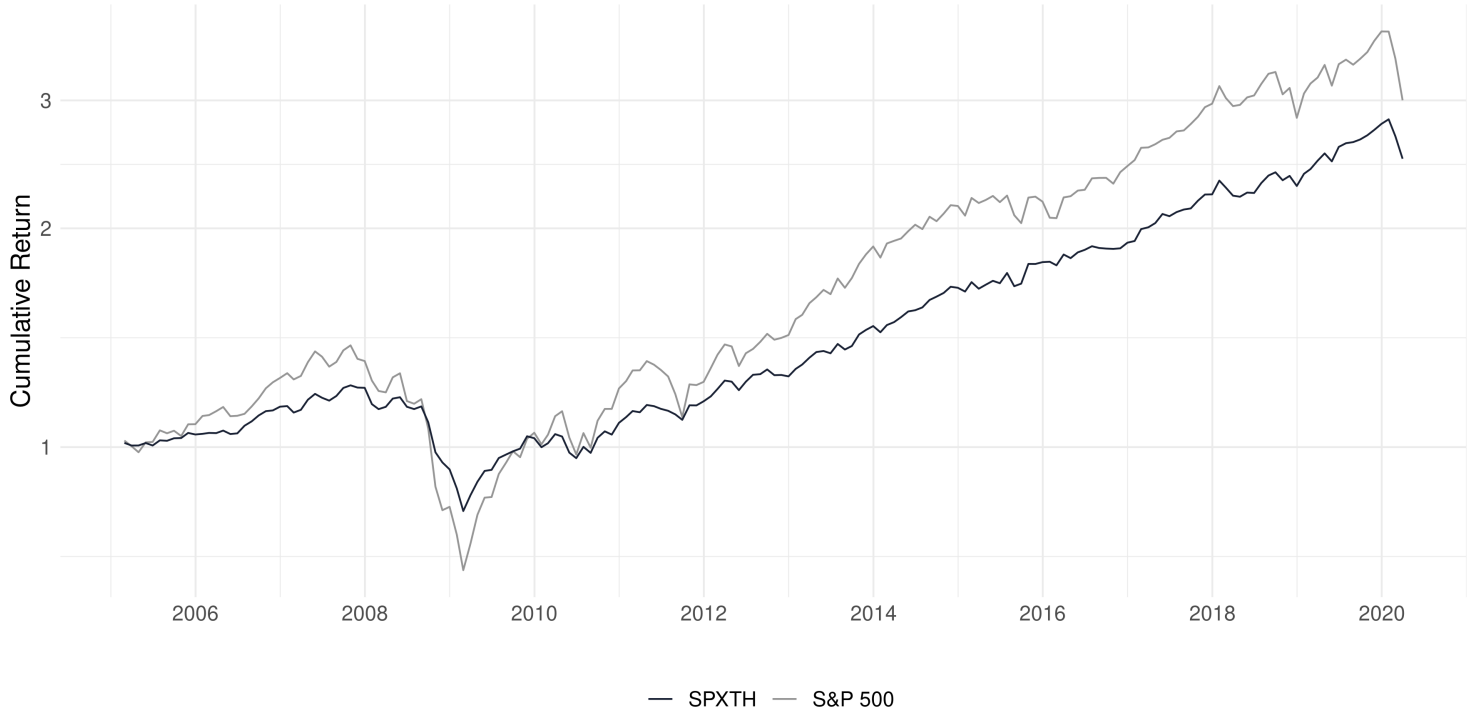
Performance Summary

	1 Year		2 Years		5 Years		10 Years		Since Inception	
Metric	**S&P 500**	**SPXTH**	**S&P 500**	**SPXTH**	**S&P 500**	**SPXTH**	**S&P 500**	**SPXTH**	**S&P 500**	**SPXTH**
Sharpe Ratio	-0.28	0.11	0.14	0.67	0.55	1.07	0.83	1.22	0.58	0.79
Beta	1	0.57	1	0.52	1	0.53	1	0.51	1	0.52
Max Drawdown	19.6%	11.75%	19.6%	11.75%	19.6%	11.75%	19.6%	11.75%	50.95%	32.86%
Annualized Return	-6.98%	0.6%	0.92%	6.03%	6.73%	8.58%	10.53%	9.12%	7.52%	6.21%

Top 5 Max Drawdown Date Range

Max Drawdown Dates	S&P 500	SPXTH
2008-11-30	40.68%	21.68%
2009-02-28	50.95%	32.86%
2010-06-30	29.23%	20.61%
2011-09-30	20.34%	10.35%
2020-03-31	19.6%	11.75%

Cumulative Returns



In-Class Framework as applied to Pension Fund Portfolio

2.2 Pension Fund vs. Tail Hedged Pension Fund (PFTH)

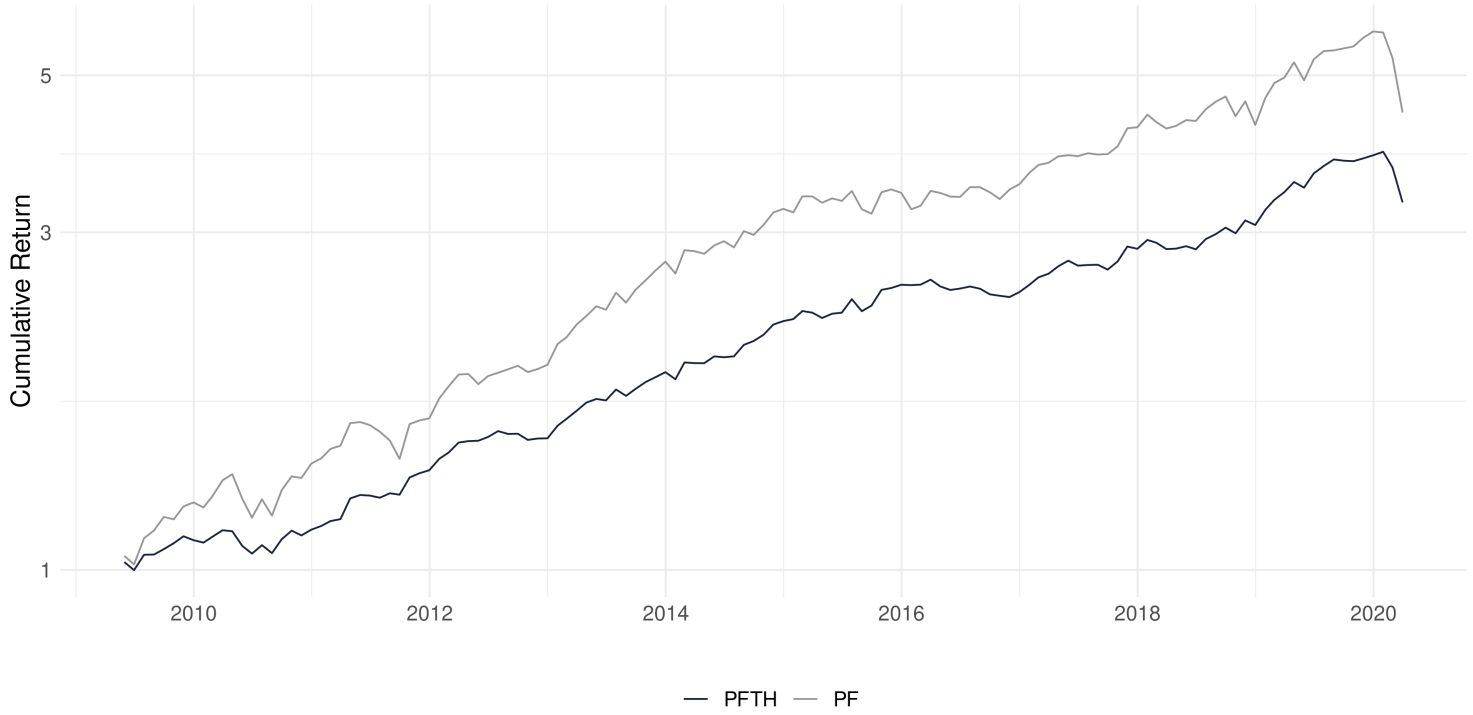
Performance Summary

	1 Year		2 Years		5 Years		10 Years		Since Inception	
Metric	**PF**	**PFTH**	**PF**	**PFTH**	**PF**	**PFTH**	**PF**	**PFTH**	**PF**	**PFTH**
Sharpe Ratio	-0.42	-0.17	0.24	0.72	0.46	0.83	0.95	1.32	1.08	1.37
Beta	1.09	0.66	1.05	0.57	0.98	0.51	0.98	0.48	0.97	0.47
Max Drawdown	23.18%	15.19%	23.18%	15.19%	23.18%	15.19%	23.18%	15.19%	23.18%	15.19%
Annualized Return	-10.74%	-3.3%	2.64%	7.89%	5.61%	7.43%	12.71%	11.25%	14.61%	11.58%

Top 5 Max Drawdown Date Range

Max Drawdown Dates	PF	PFTH
2010-06-30	13.18%	7.32%
2011-09-30	11.3%	0.46%
2015-09-30	7.12%	2.05%
2018-12-31	8.82%	1.48%
2020-03-31	23.18%	15.19%

Cumulative Returns



In-Class Framework as applied to Pension Fund Portfolio

Appendix A

RNFC Universe										
Ticker	**Dividend Yield**	**Growth**	**Momentum**	**Profitability**	**Safety**	**Share Yield**	**Short Interest**	**Size**	**Value**	**Volatility**
A US	0.50	0.42	0.69	0.56	0.51	0.80	0.83	0.16	0.32	0.86
ALLE US	0.48	0.57	0.71	0.82	0.68	0.77	0.41	0.34	0.39	0.78
AMT US	0.52	0.50	0.90	0.77	0.47	0.45	0.97	0.03	0.40	0.69
AON US	0.46	0.61	0.76	0.80	0.43	0.86	0.48	0.09	0.31	0.89
APH US	0.48	0.53	0.44	0.77	0.64	0.65	0.95	0.15	0.42	0.84
ATVI US	0.40	0.18	0.95	0.85	0.50	0.35	0.64	0.08	0.33	0.84
AVGO US	0.81	0.47	0.52	0.90	0.34	0.31	0.87	0.03	0.43	0.42
BR US	0.58	0.51	0.66	0.75	0.68	0.66	0.90	0.26	0.30	0.91
CTAS US	0.50	0.58	0.61	0.78	0.63	0.62	0.73	0.19	0.39	0.61
DHR US	0.40	0.37	0.84	0.68	0.63	0.81	0.95	0.04	0.34	0.93
EFX US	0.50	0.39	0.68	0.20	0.31	0.58	0.77	0.23	0.15	0.87
HD US	0.68	0.50	0.70	0.64	0.61	0.81	0.97	0.01	0.47	0.68
HON US	0.66	0.53	0.50	0.82	0.61	0.82	0.94	0.04	0.51	0.80
INTU US	0.43	0.55	0.69	0.86	0.58	0.38	0.94	0.06	0.30	0.62
MA US	0.40	0.76	0.74	0.48	0.57	0.77	0.99	0.01	0.26	0.64
MCO US	0.44	0.70	0.87	0.94	0.46	0.67	0.85	0.09	0.30	0.56
MSFT US	0.47	0.66	0.94	0.85	0.50	0.67	0.98	0.00	0.33	0.74
ROP US	0.41	0.50	0.56	0.93	0.71	0.21	0.78	0.12	0.32	0.81
ROST US	0.53	0.65	0.58	0.53	0.62	0.84	0.88	0.13	0.54	0.53
SBUX US	0.61	0.59	0.68	0.54	0.31	0.92	0.83	0.04	0.43	0.71
SHW US	0.45	0.59	0.79	0.71	0.70	0.68	0.89	0.09	0.33	0.72
TSN US	0.65	0.48	0.54	0.37	0.52	0.57	0.75	0.14	0.68	0.68
TXN US	0.70	0.25	0.69	0.91	0.47	0.63	0.69	0.04	0.45	0.71
UNH US	0.52	0.48	0.91	0.20	0.59	0.70	0.98	0.01	0.37	0.55
UNP US	0.67	0.41	0.55	0.64	0.33	0.93	0.92	0.04	0.58	0.75
V US	0.43	0.44	0.72	0.99	0.38	0.78	0.76	0.01	0.32	0.75
WEC US	0.64	0.23	0.90	0.31	0.37	0.56	0.79	0.11	0.54	0.74
ZTS US	0.40	0.40	0.88	0.75	0.36	0.23	0.95	0.07	0.29	0.82

In-Class Framework as applied to Pension Fund Portfolio

Appendix B

S&P 500 Universe										
Ticker	**Dividend Yield**	**Growth**	**Momentum**	**Profitability**	**Safety**	**Share Yield**	**Short Interest**	**Size**	**Value**	**Volatility**
A US	0.32	0.44	0.64	0.46	0.55	0.71	0.67	0.43	0.26	0.81
ALLE US	0.30	0.61	0.67	0.77	0.73	0.65	0.20	0.82	0.35	0.67
AMT US	0.34	0.52	0.92	0.73	0.47	0.28	0.97	0.10	0.37	0.55
AON US	0.27	0.65	0.74	0.75	0.48	0.80	0.27	0.27	0.26	0.84
APH US	0.30	0.56	0.39	0.72	0.70	0.49	0.92	0.43	0.39	0.80
ATVI US	0.21	0.16	0.99	0.81	0.54	0.19	0.42	0.25	0.28	0.73
AVGO US	0.76	0.50	0.47	0.89	0.36	0.17	0.75	0.10	0.41	0.27
BR US	0.42	0.51	0.62	0.70	0.75	0.50	0.81	0.69	0.25	0.87
CTAS US	0.33	0.63	0.58	0.73	0.70	0.46	0.52	0.51	0.36	0.46
DHR US	0.20	0.37	0.85	0.62	0.67	0.73	0.93	0.11	0.27	0.91
EFX US	0.32	0.41	0.63	0.13	0.39	0.40	0.58	0.62	0.10	0.82
HD US	0.60	0.54	0.66	0.56	0.61	0.72	0.96	0.03	0.44	0.56
HON US	0.57	0.54	0.45	0.78	0.64	0.74	0.91	0.13	0.51	0.73
INTU US	0.24	0.59	0.65	0.82	0.67	0.22	0.91	0.18	0.25	0.50
MA US	0.21	0.82	0.71	0.48	0.59	0.67	0.99	0.03	0.21	0.54
MCO US	0.25	0.76	0.89	0.93	0.52	0.52	0.72	0.28	0.26	0.46
MSFT US	0.28	0.73	0.98	0.81	0.48	0.53	0.98	0.00	0.28	0.68
ROP US	0.22	0.52	0.53	0.91	0.77	0.10	0.60	0.33	0.27	0.76
ROST US	0.36	0.67	0.54	0.44	0.76	0.76	0.78	0.36	0.52	0.37
SBUX US	0.46	0.62	0.64	0.44	0.30	0.88	0.67	0.13	0.39	0.60
SHW US	0.26	0.63	0.78	0.64	0.75	0.53	0.79	0.25	0.28	0.59
TSN US	0.54	0.50	0.50	0.28	0.54	0.38	0.54	0.40	0.68	0.54
TXN US	0.61	0.24	0.65	0.89	0.50	0.47	0.49	0.12	0.43	0.60
UNH US	0.35	0.51	0.94	0.15	0.60	0.56	0.98	0.02	0.34	0.39
UNP US	0.58	0.42	0.51	0.57	0.32	0.91	0.85	0.11	0.55	0.64
V US	0.23	0.46	0.68	0.99	0.38	0.69	0.56	0.02	0.28	0.69
WEC US	0.52	0.21	0.93	0.23	0.42	0.37	0.61	0.32	0.50	0.60
ZTS US	0.21	0.40	0.90	0.70	0.39	0.12	0.92	0.20	0.23	0.74