Are Factor Returns Really Sector Returns?

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In an published paper entitled "*Developing Equity Screens From Factors for Long Portfolios*" we described a methodology of applying research into the performance of factors in various market environments to the construction of long RIA, mutual fund, and other institutional portfolios. That paper described the need to understand factor performance in various market environments and to be able to attribute performance to the sector weights resulting from grouping factors (quintiles) versus the factor itself. This paper revisits this issue with a more targeted focus on whether factor returns are more a function of sector or factor. **We conclude that sector is a larger determinant of a factor's return than the portion that is not explained by its sector weights.**

We have studied an extensive set of factors across the disciplines of valuation, profitability, efficiency, size, momentum, and price behavior. The list of factors is detailed in Appendix A. We have analyzed the performance of this set of factors relative to the market as well as to benchmarks that are sector-neutral to each factor quintile to evaluate the influence of sector on factor returns.

The Research Universe

Our research universe includes all US common stocks with market capitalizations greater than the 25th percentile of traded companies. We utilize the time period January 1, 2000 – March, 15, 2019 to capture multiple bull, bear, flat, and early recovery market environments. To address the problem of survivorship bias we identify companies meeting the market capitalization criteria as of each quarter-end during this time period. Acquired or delisted securities remain in the research universe. In total, the universe consists of 1,350 active companies today and 1,385 inactive companies for a total of 2,735 unique identifiers over the 20 year period. This highlights the tremendous challenge of survivorship bias in quantitative finance. For purposes of this research aimed at long investment portfolios we have further filtered the universe with a cutoff at the median market capitalization. This results in a minimum market cap that fluctuates in a range of $4 – 8 billion over the 20 year time period. On average, there are between 500-600 companies in the research universe at all times when factor quintiles are calculated. All prices are adjusted for splits and dividends to create total return time series.

Building Quintiles and Measuring Performance

Each quarter we winsorize each of the 23 factors at the 1st and 99th percentile. We then create quintiles for each factor and join forward monthly total returns for the coming quarter for each stock.

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We then build equally weighted portfolios for each factor quintile[1]. Since factor quintiles can have large differences in sector weights we build for each factor quintile a corresponding benchmark portfolio using sector returns weighted the same as the factor quintile portfolios. This ensures we have a sector-neutral benchmark against which to compare a factor quintile's performance. This benchmark methodology is particularly useful when comparing the performance of factors that are not available for all sectors and sub-industry groups. Valuation metrics based on Enterprise Value to EBIT, EBITDA, or Free Cash Flow, for example, are not calculated for most banks, REITS, and utilities. Comparing factor quintiles that exclude banks against a universe that includes banks would be misleading. The end result is a set of factor quintile total return time series and their corresponding sector-neutral benchmarks, both rebalanced quarterly. We utilize quarterly rebalancing in support of our focus on long portfolios that seek a lower (not low, but lower) turnover than typical hedge fund implementations.

An Example Of A Factor Quintile
A factor included in this research is 'Return on Invested Capital' ("ROIC"), a fundamental metric that measures the efficiency with which a company is achieving profitability given the assets at management's disposal. We will utilize the factor and its quintiles throughout this paper for consistency and depth of analysis on a single factor. The chart below shows the performance of its five quintiles for the period January 1, 2007 – March 15, 2019.

Exhibit 1
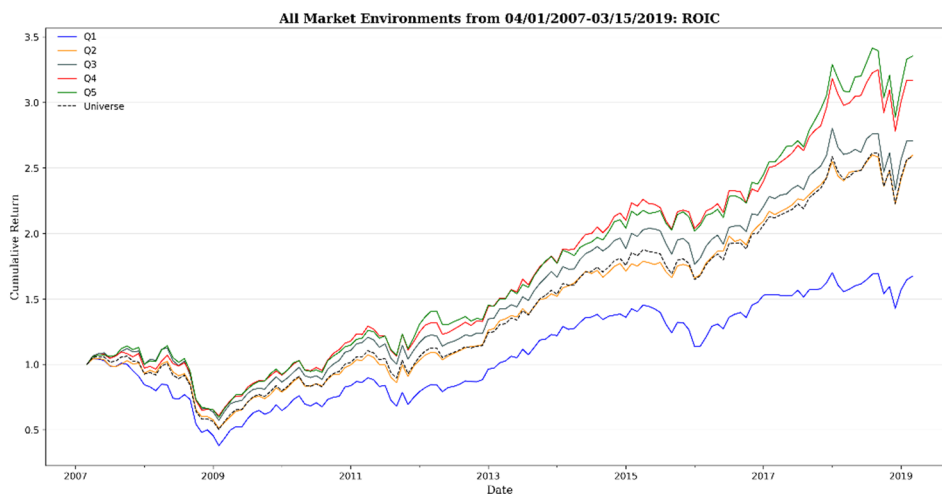
Companies that generate the highest ROIC outperform companies generating a lower return on capital. The quintiles line up sequentially as one might expect. Capital efficiency matters over time. At this point, the standard implementation for a hedge fund would be to be long the top performing

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[1] *The definition of a 'factor quintile': "Free Cash Flow – 5th Quintile' is a time series of monthly forward returns for a portfolio of the top quintile companies for the factor Free Cash Flow Margin as rebalanced quarterly. It has a corresponding sector-neutral benchmark that is built using the identical methodology. This factor quintile is identified as FCF_Q5 and its sector-neutral benchmark as FCF_Q5_Idx.*

quintile (Q5) while short the bottom (Q1). This is often referred to as "UMD" (Up minus Down). The implementation in an RIA or mutual fund long portfolio would be to avoid Q1 names while emphasizing those in the higher, more profitable or efficient, quintiles.

One would reasonably expect divergent returns from the quintiles of this factor as they naturally consist of different types of securities. Low ROIC companies include unprofitable companies, perhaps in very different sectors of the economy than higher ROIC companies. Quintile differences may also reflect industry conditions, the current point in the economic cycle, and interest rate sensitivity as well. The sector weights for the quintiles of ROIC are shown below with a few significant differences highlighted.

Exhibit 2: Sector Weights For ROIC Quintiles (as of December 31, 2018)

|	Quintile				
Sector	**1**	**2**	**3**	**4**	**5**
Discretionary	7.6%	3.9%	14.6%	15.5%	20.2%
Energy	11.4%	10.8%	8.7%	2.9%	1.0%
Financials	13.3%	27.5%	14.6%	12.6%	6.7%
Healthcare	20.0%	7.8%	13.6%	11.7%	9.6%
Industrials	3.8%	4.9%	10.7%	19.4%	21.2%
Materials	2.9%	2.9%	7.8%	6.8%	2.9%
Real Estate	9.5%	16.7%	2.9%	1.9%	0.0%
Staples	2.9%	3.9%	3.9%	11.7%	10.6%
Technology	15.2%	6.9%	11.7%	10.7%	21.2%
Telecom	4.8%	1.0%	9.7%	5.8%	6.7%
Utilities	8.6%	13.7%	1.9%	1.0%	0.0%

These weights intuitively explain Q5's outperformance over the remaining quintiles to some degree. It is reasonable to assume a portfolio heavily weighted in consumer discretionary, industrials, and technology would outperform one comprised of utilities and real estate in the 2007-2019 time period. What is not clear is how much of that outperformance is explained by these sector differences versus some other quality captured as the universe of securities is split into quintiles. This paper will explore the degree to which factor returns are explained by sector weight differences versus the factor itself. We will dissect a factor quintile's alpha, its return over its universe return, into that attributable to sector ("Due To Sector") and that which remains. We will consider that which remains to be due to the dynamics of the factor itself ("Due To Factor").

The Distribution of ROIC Values and Sector Weight Differences
The distribution of raw ROIC values follows a common pattern seen across most factors. The distribution features a wide range of values and fat tails. Kurtosis values post-winsorization of 4-6 are common and above the normal distribution value of 3.

We expect a factor divided into quintiles from this distribution to produce very different types of companies at the extreme 1st and 5th quintiles. Q1 companies are unprofitable or highly inefficient users of capital whereas Q5 companies are the opposite.

EXHIBIT 3 : Histogram of ROIC Values as of December 31, 2018.
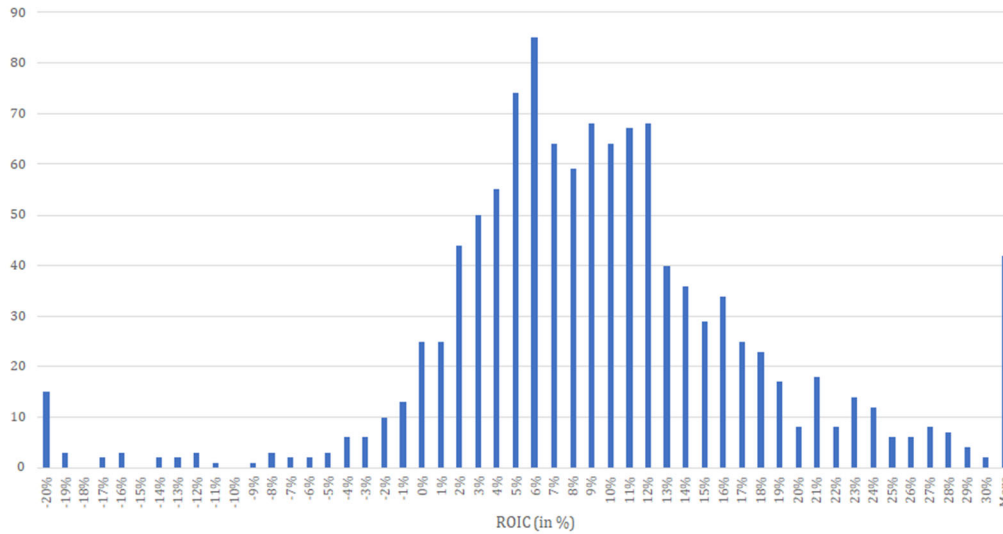
Examples of ROIC_Q1 companies as of December 31, 2018 are Tableau Software (DATA), Tesla (TSLA), Halliburton (HAL), eBay (EBAY), and First Solar (FSLR). Examples of ROIC_Q5 companies for the same time period are Boeing (BA), Accenture (ACN), Mastercard (MA), TJX (TJX), and Verisign (VRSN).

How Different Are Q1 and Q5 With Regards to Sector?
A common criticism directed at factor-driven asset managers is that the discipline drives managers towards sector-concentrated portfolios. We strongly disagree with this generalization. While individual managers may choose this behavior the opportunity set of investable names does not dictate it. Exhibit 4 below shows broad representation across sectors for both Q1 and Q5 at every semi-annual date between 2007-2019.

EXHIBIT 4 : Sector Weights for ROIC Q1 and Q5 semi-annually from 12/31/2006 - 12/31/2018.

Upcoming charts will more clearly emphasize specific sector levels in detail but observe below that both quintiles (i) have broad sector exposure and (ii) no unrealistc sector concentrations.
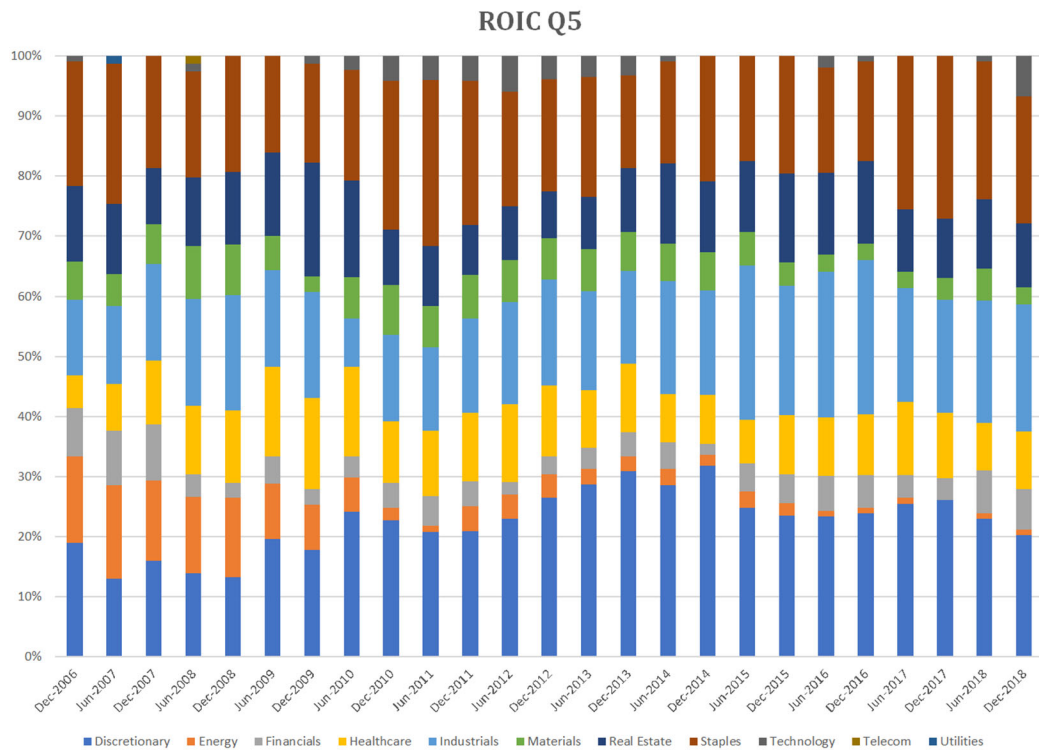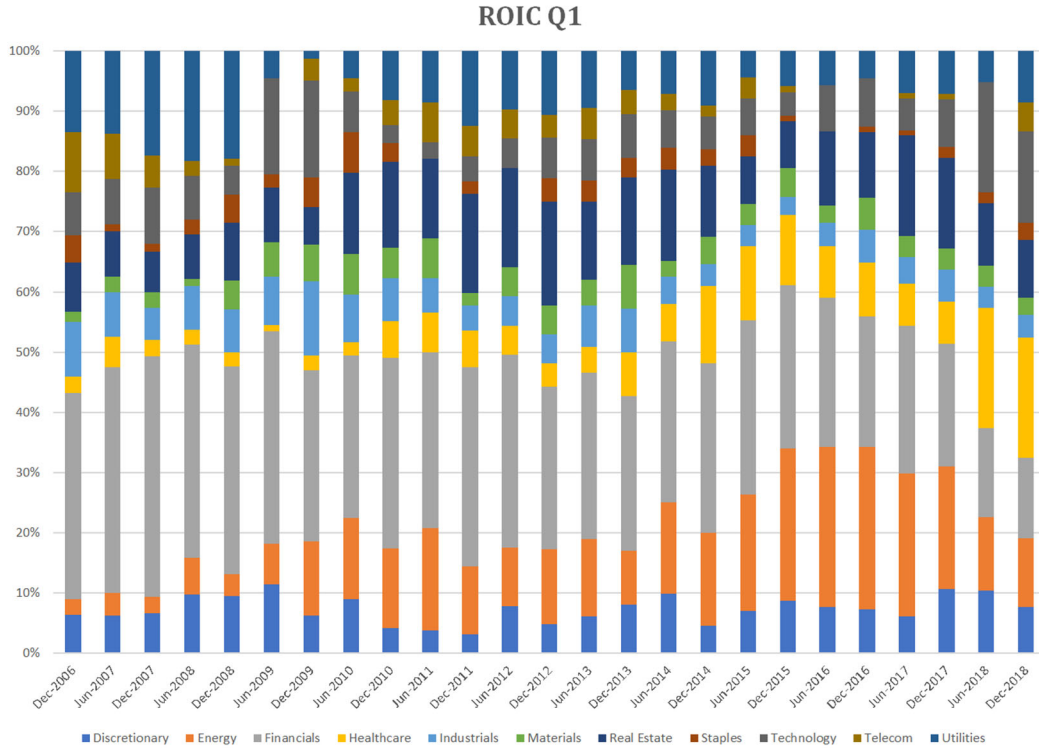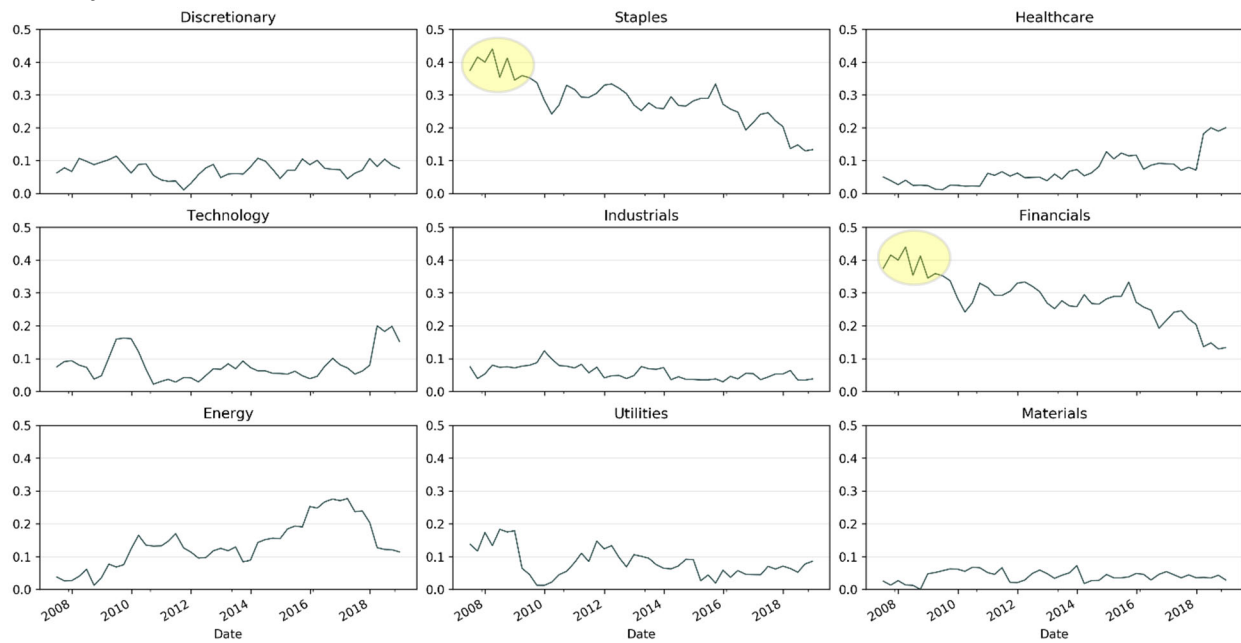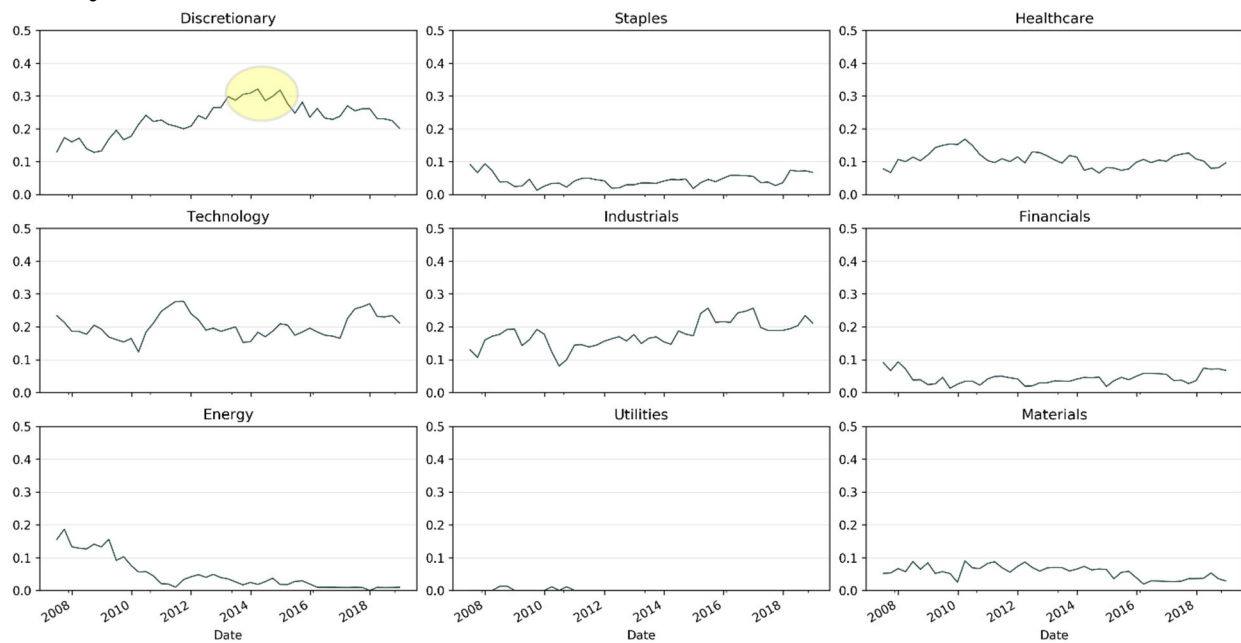

ROIC Q1

ROIC Q5

Exhibit 5 plots individual sector weights over time and shows the quintiles are not as concentrated as is widely believed. It is unusual to see any sector weight in excess of 30-35% at any point in time. These plots are representative of factors and factor quintile sector weightings at large.

EXHIBIT 5 : Sector Weights for ROIC Q1 and Q5 for the Period 2007-2019.

ROIC_Q1:

ROIC_Q5:

The largest sector weights observed for any ROIC quintile are the highlighted 40% weights in staples and financials during the financial crisis of 2008-2009. The decision to overweight staples in a recession would have been a good one. The decision to overweight financials in a recesson caused by a banking crisis would have been devastating. We suggest even the most basic equity screen would likely avoid the bottom quintile of a profitability measure like ROIC duing a recession.

The next largest sector position would have been Consumer Discretionary at approximately 30% in 2014-2015. This sector represents 14% of the S&P500 so this is not much of a concentration and may highlight that the quintiles, if anything, may be too diversified. Regardless, this is a better position to begin the analysis than if concetrations were common.

We offer further insight into sector diversification by comparing these two quintiles at two very different points in time, December 31, 2018 and December 31, 2008 (late in the Great Recession) presented in conventional pie chart format in Appendix D and E.

While each quintile presented so far differs with regards to sector weights all are within the realm of investable by institutional investors with the exception of closet index managers. **We conclude that factor-driven investing does not inherently suffer from a sector concentration problem, that it produces investable quintiles, and it is, therefore, worthwhile to understand the role sector weights plays in a factor's performance.**

# Measuring Sector Influence on Factor Returns

The Sector-Neutral Benchmark
To determine if returns are more attributable to sector or to the factor itself we introduce the factor-specific, sector-neutral benchmark. Each quarter as we construct factor quintiles we create for each factor a corresponding universe return. Not all securities have values for every factor and each factor, therefore, requires its own equal weighted universe return to ensure fair benchmarking. In addition, since the universes are different we also build for each factor its own set of equal weighted sector returns. In the end, each factor compares the performance of its quintiles to the universe from which those quintiles were constructed and a benchmark is constructed using sector returns from the securities in that universe that is sector neutral to the factor quintile. Refer to Appendix C for additional details. In the same way we have a time series of returns for every quintile of the factor '3 Year Revenue Growth' we also have a corresponding time series of its equal weighted universe return and a set of sector returns from that universe that are used to build a benchmark time series that is sector-neutral to each quintile at all points in time.

Does Sector or Factor Drive Returns?
The chart in Exhibit 1 plotted the quintile performance for ROIC and showed the most profitable 5th quintile outperformed the market while the less or unprofitable 1st quintile significantly underperformed. The two charts below plot these same quintile and universe returns but add each quintile's sector neutral benchmark. The results illustrate how effective ROIC is as a differentiating factor.

Exhibit 6: Q1 and Q5 of ROIC versus Sector-Neutral Benchmarks, 2007-2019.
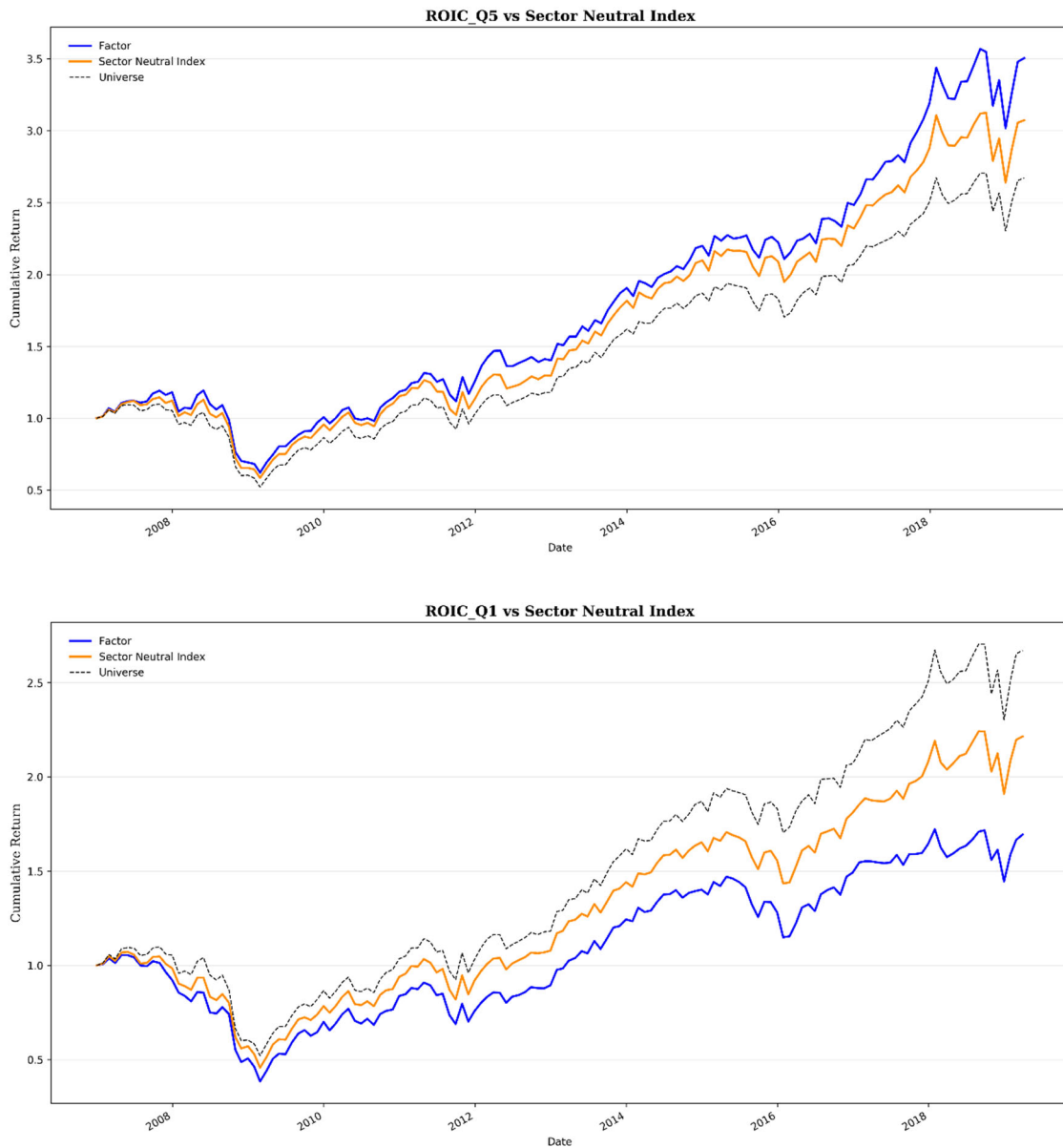
Note the performance of the respective sector neutral benchmarks (orange lines). Q5's neutral benchmark outperforms the universe by 99 bp annually while Q1's benchmark lags the universe return by an astonishing -190 bp annually. The more profitable quintile is driving the selection of better sector weights and perhaps, more importantly, avoiding strong underperforming sectors.

This is a good starting point but can the factor itself add additional return? In the case of Q5 the factor (blue line) adds an additional 118 bp annually to return over its neutral benchmark while Q1 underperforms its underperforming sector neutral benchmark by -231 bp annually. High profitability, as measured by ROIC, is important even after adjusting for sector weights. 1st quintile ROIC companies are weak relative performers because the quintile contains sector weights that cannot keep up with market returns and the group of unprofitable companies within the quintile

cannot keep up with its underperforming sector neutral benchmark. Bad news on both counts. We can generalize the attribution of factor alpha (a factor's return – its universe return) as:

Factor Alpha = Return Due to Sector (Sector Neutral Benchmark Return – Universe Return) –
Return Due to Factor (Factor Return – Sector Neutral Benchmark Return)

- ROIC_Q5 beats the universe return by +218 bp annually. +99 bp of that comes from sector and +118 from factor.

- ROIC_Q1 underperforms the universe return by a remarkable -421 bp annually. -190 bp of that comes from sector and -231 from factor.

Exhibit 7 repeats this exercise for two additional factors, the valuation factor, Enterprise Value / Free Cash Flow ("EV/FCF"), and a price momentum factor, Trailing 1 Year Total Return.

EXHIBIT 7: Performance Attribution for EV/FCF, ROIC, and 1 Year Total Return.
January 1, 2007 – March 31, 2019

Factor	Q	Factor Return	Sector Neutral Return	Universe Return	Due To Sector + Sector - Universe	Due To Factor = Factor - Sector	Total Factor Alpha Factor - Universe
EV/FCF	1	10.72	10.08	9.78	30	64	94
EV/FCF	2	12.18	10.62	9.78	84	156	240
EV/FCF	3	10.30	10.19	9.78	40	12	52
EV/FCF	4	8.46	9.75	9.78	-3	-129	-132
EV/FCF	5	6.85	8.68	9.78	-111	-183	-293
ROIC	1	4.40	6.71	8.61	-190	-231	-421
ROIC	2	8.46	7.80	8.61	-81	67	-14
ROIC	3	8.85	8.81	8.61	20	4	24
ROIC	4	10.19	9.96	8.61	136	23	159
ROIC	5	10.78	9.60	8.61	99	118	218
TRA_1Yr	1	5.83	7.76	8.35	-60	-193	-252
TRA_1Yr	2	9.88	8.75	8.35	39	113	153
TRA_1Yr	3	9.94	9.06	8.35	71	88	159
TRA_1Yr	4	9.95	8.89	8.35	54	106	160
TRA_1Yr	5	5.51	7.21	8.35	-115	-169	-284

Graphs in the form of Exhibit 6 are provided for EV/FCF and TRA_1Yr in Appendix F and G.

EV/FCF is one of the few factors along with ROIC that has quintiles that consistently offer alpha from both sector and factor. The inexpensive quintiles 1, 2, and 3 have sector neutral benchmarks that outperform the market by 30, 84, and 40 bp annually, respectively. The factor is driving the selection of sectors that add value.

Likewise, the factor outperforms the outperforming sector neutral benchmark. Valuation matters independent of sector. Q1 and 2 are terrific factor quintiles from which to select outperforming companies in outperforming sectors. Low EV/FCF quintiles are also well-diversified by sector similar to ROIC quintiles as shown in Exhibits 2, 4, and 5. EV/FCF works in a long/short hedge fund application, as does ROIC, as the difference between Long Q1 and Short Q5 is almost 400 bp annually.

Conversely, most of the results we observe for price-based factors (Trailing 3, 6, or 12 Month Total Returns, Percent from 50 or 200 Day Moving Average, Slope of 3 or 5 Year Trendline) show little value in an UMD application from 2007-2019[2]. The factor, Trailing One Year Total Return ("TRA_1Yr") shows negative returns in an UMD application (5.51% - 5.83% = -32 bp annually). Neither Q1 nor Q5 adds value from sector weights or factor performance. Q5 shows poor absolute performance as a long momentum strategy as well (5.51% - universe return of 8.35% = -284 bp annually). However, the middle three quintiles show above market returns with contributions from both sector and factor. Avoid very weak and overly strong price momentum. These results suggest a better price momentum strategy than Long Q5 / Short Q1 would be long Q 2, 3, and 4 while short liquid sector ETFs weighted to be sector-neutral to those quintiles.


Results For The Full Set of Factors

In total there are 115 unique factor quintiles across the universe of 23 factors. Exhibit 8 plots the relationship between the two sources of return, "Due To Sector" and "Due To Factor". The plot further shows the tendency that when sector is contributing towards a factor quintile's return it is also more likely the factor itself is adding value over its sector neutral benchmark. When one works the other works.

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[2] *We acknowledge strong price momentum from 2000-2007 and long periods of time in the 1980's and 1990's as shown in the original Fama French Three Factor Model. However, being out of favor for the past twelve years presents a large challenge to us in its core adaptation.*

EXHIBIT 8: Performance Attribution For All 115 Factor Quintiles

Return Due to Factor = 3.55 + 1.429 Return Due to Sector
R Squared: 76.6%.   T Stat: 19.2
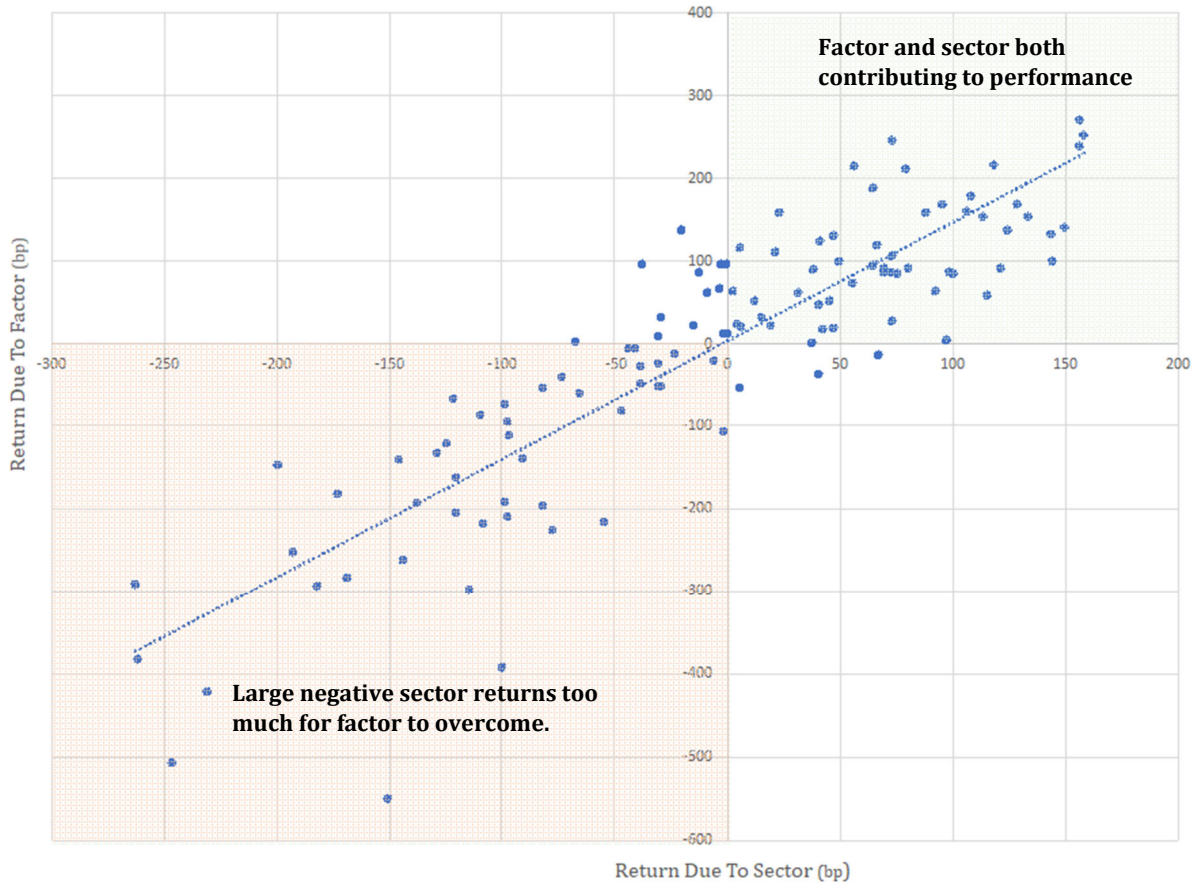
74 of the 115 unique factor quintiles, or 64%, have sector neutral benchmarks that outperform the universe. In general, factor investing is driving a portfolio to sectors that benefit returns. 44 of those 74 factor quintiles also outperform their sector neutral benchmarks. Together, 58 of the 74 (78%) outperform the market.   Only 29% of factor quintiles whose sector-neutral benchmark underperforms the universe overcome this sector handicap and go on to outperform. There is synergy at work but it begins with sector performance.

Which Quintiles Generate Opportunity?
Our convention in building quintiles is to build them the way portfolio managers think of factors. For example, valuation measures are P/E or EV/EBITDA. A negative implication of this is that it makes reaching cross sectional conclusions about quintiles difficult. The 5th quintile of P/E represents high valuation which is generally perceived to be negative.   The 5th quintile of a profitability measure like ROA describes the most profitable companies and is generally perceived to be positive. Grouping the 5th quintile of these two factors to draw general conclusions about the behavior of the quintile would not make sense. Hence, the academic convention of inverting valuation factors to E/P or EBITDA/EV

in order to pair inexpensive valuation, now Q5 rather than Q1, with high profitability, high market cap, high dividend yield, and high price momentum.

We can achieve this result by inverting our valuation quintiles. Q5 becomes Q1. We call this "ordered quintiles". We can then observe the behavior of grouped quintiles where Q1 represents unattractive qualities while Q5 represents attractive qualities. Exhibit 9 below shows this result.

Exhibit 9: Returns by Ordered Quintile, 2007-2019.

	Ordered Quintiles For All 23 Factors					
	Cumulative Return Attribution (bp)			Percent of Quintiles Outperforming		
Quintile	From Sector	From Factor	Factor Alpha	SN > Univ	Factor > SN	Factor > Univ
1	-2348	-2669	-5018	17%	13%	13%
2	207	734	941	70%	61%	70%
3	849	852	1705	78%	74%	83%
4	1131	508	1639	78%	61%	70%
5	141	-418	-278	57%	43%	57%

Abbreviations: SN = Sector Neutral Benchmark. Univ = Universe.

Ordered quintile 1 represents the lowest profitable, most highly valued, lowest yield, and lowest price momentum factor values. Very bad things happen in this quintile. It is a collection of underperforming sectors, underperforming factors returns net of sector effect, and overall factor underperformance.

Quintile 5 contains the opposite company qualities. It is a collection of "everything you would ever want" in a company: low valuation, high profitability, and high price momentum. And, yet, as a group, this quintile underperforms the market as well. Most likely this collection of highest value factors includes a hype premium in price that already reflects every piece of available good news and all potential upside surprise potential. It is a quintile that is too good to be true.

To a hedge fund employing an UMD application this is great news. There are Long Q5/Short Q1 opportunities across many factors that result primarily, from how poorly the collection of ordered Q1 qualities behave. To a long portfolio manager the news is also good but likely not what the manager might expect. That screen designed to capture everything: low valuation, high profitability, with price momentum is likely to disappoint on average. Instead, the middle quintiles represent real opportunity, particularly Q3 and Q4. These are companies with solid fundamentals but absent the hype that turns good companies into average investments. Good growth but not the best. Good profitability but not record breaking.

19 of the 23 factors (83%) have a 3rd quintile that beats the market. 70% of Q2-Q4 quintiles beat the market as well as their sector neutral benchmarks. **Average is not so average, particular when combining factor from multiples disciplines of valuation, profitability, and momentum.**

These middle quintiles earn alpha from both sector as well as the factor itself. Q4 is particularly sector-driven while Q2 and Q3 are more factor driven. If a manager faces tight benchmark sector constraints or simply personal fear of getting too far off benchmark weights look to Q2 and Q3. Returns to those quintiles are more factor-driven and less dependent on being semi-passive to the sector weighs dictated by the factor. Alternatively, a manager more willing to allow factor behavior to drive sector weights, but still working within a sector-diversified portfolio as shown in earlier exhibits, may find Q4 more attractive. **Regardless, stay out of the extremes unless you are a long short manager.**

Is It Factor or Sector Driving performance?
Focusing on the middle quintiles of Exhibit 9 we concluded that while results differ factor to factor, in general, the portion of return that is attributable to sector is, at a minimum, as large as the portion attributable to factor. On average, "Due To Sector" adds 95 bp annually for the set of quintiles while "Due To Factor" adds 71 bp.

Exhibit 10: Conclusion on "Due To Sector" or "Due to Factor" For Middle Quintiles.

	Ordered Quintiles For All 23 Factors					
	Cumulative Return Attribution (bp)			Percent of Quintiles Outperforming		
Quintile	From Sector	From Factor	Factor Alpha	SN > Univ	Factor > SN	Factor > Univ
2	207	734	941	70%	61%	70%
3	849	852	1705	78%	74%	83%
4	1131	508	1639	78%	61%	70%
TOTAL	2,187	1,644	4,285			
AVG	**95**	**71**	**186**	75%	65%	74%

We acknowledge the challenge of taking the average of averages. Hence, our language that the portion of return that is attributable to sector is, at a minimum, as large as the portion attributable to factor. When viewed as a binary condition, however, it is clearly more important to have sector performing than factor. 50% of factor quintiles whose sector-neutral benchmark outperforms the market have positive factor alpha. Only 29% of factor quintiles whose sector-neutral benchmark underperforms the market overcome this sector handicap and go on to outperform the market based on strength of factor performance alone. If you have to pick, you want sector alpha first. Fortunately, there are factor quintiles that offer the ability to add value from both and these come from diverse disciplines of valuation, profitability, and momentum, all within the option of sector diversified quintiles.

There is nothing wrong with factor-driven investment performance being determined by sector bets. In fact, in our view, that is one of the primary benefits of a factor-driven investment approach. A disciplined factor-driven investment approach drives a portfolio to better company attributes (factors) that have the additional benefit of being in better performing sectors.

Appendix A: List of Factors

Factor	Description
10Yr_VComp	Valuation Composite - 10 Year Z score of weighted P/E, P/CF, P/BV.
5Yr_VComp	Valuation Composite - 5 Year Z score of weighted P/E, P/CF, P/BV.
Asset Turnover	Trailing 12M Net Sales / ((Total Assets – Current Period + Total Assets – Prior Year Period) /2)
Debt/Equity	Total Debt/ Shareholder's equity.
EBIT Yield	Trailing 12M Operating Income / Stock Price
EPS 3 Mo % Change - Current Qtr	Change in consensus EPS estimates over the past 3 months for the current quarter.
EPS 3 Mo % Change - Current Year	Change in consensus EPS estimates over the past 3 months for the current full year.
EPS Correlation - 5 Year	Correlation coefficient of quarterly EPS against a series of consecutive integers.
EPS Growth - 3 Year	Compound annual growth rate in diluted earnings per share over the trailing 3 years.
EV/EBIT	Enterprise Value / Trailing 12M EBIT.
EV/EBITDA	Enterprise Value / Trailing 12M EBITDA.
EV/FCF	Enterprise Value / Trailing 12M FCF.
FCF Margin	Trailing 12M Free Cash Flow per Share / Stock Price.
% From 200 Day	The percent difference of closing price of a stock and its 200 day moving average.
3 Mo Implied Volatility	3 month implied volatility at 100% moneyness (at the money).
Market Cap	Standard market cap measure.
Price Correlation - 5 Year	Correlation coefficient of price against a series of consecutive integers.
Revenue Growth - 3 Year	Compound annual growth rate in revenue over the trailing 3 years.
ROA	Trailing 12M Net Income / Average Total Assets.
ROE	Trailing 12M Net Income Available to Common Shareholders / Average Total Common Equity.
ROIC	Trailing 12M Net Operating Profit After Tax / Average Invested Capital.
TL_PctFrom	Similar to '% From 200 Day', measures the percent distance of closing price to a regression line drawn thru 5 years of weekly prices. TL = trend line.
TL_Slope	The slope of the line from 'TL_PctFrom'.

Appendix B

We use the performance of "the universe" interchangeably with "the market" as the two are nearly identical. The chart below shows the universe return constructed from factors that always have raw factors values. These include market cap and price-based factors. This universe is equal-weighted and is highly correlated with the equal-weighted S&P500 Index ("SPW").
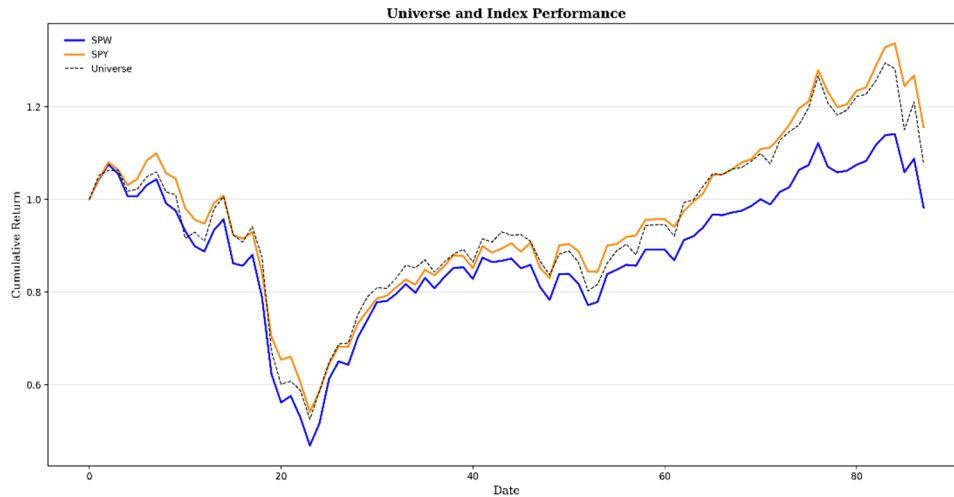
When a factor such as EV/EBITDA or EV/FCF produces a universe of securities that id materially different we have built an equal-weighted universe return consisting of just those securities with values for the factor. In this case, if we state a "quintile outperforms the market" we mean it outperforms its factor-specific universe which is still similar, but may differ slightly from SPW.

Appendix C:
The Construction of Universe and Sector Neutral Benchmark Returns

The task of comparing factor and screen performance against an appropriate benchmark is surprising complex. A few of the challenges are described below.

Challenge 1: Cap Weighted versus Equal Weighted Sector Data

The difference in performance between cap weighted and equal weighted indices has not been significant since 2007-2008 so many have forgotten the issue but it presents a real problem when evaluating equal weighted portfolios over longer periods of time.

2007-2019:
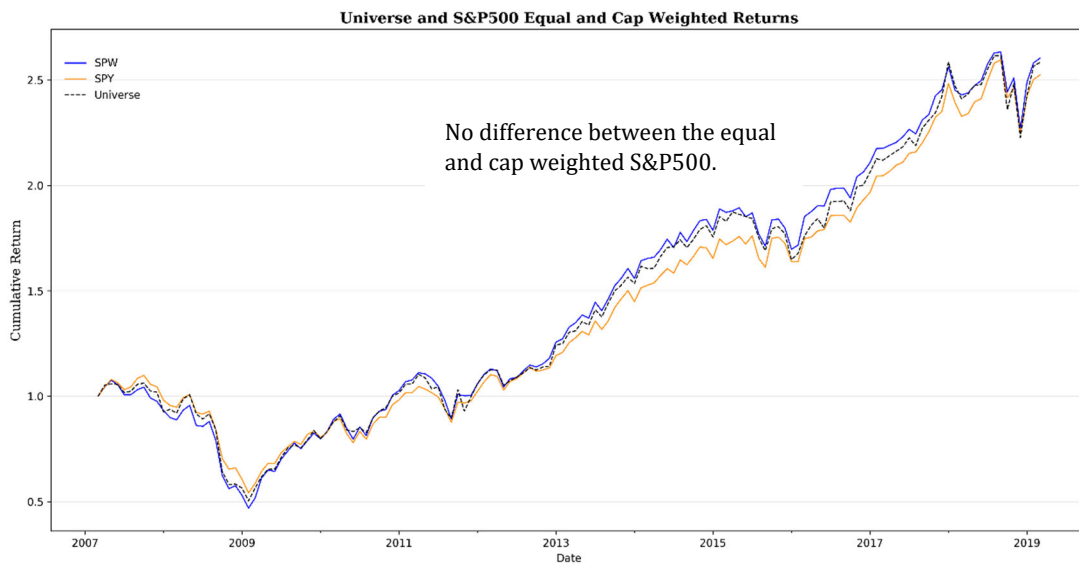
Between 2000-2007 the performance difference was significant:
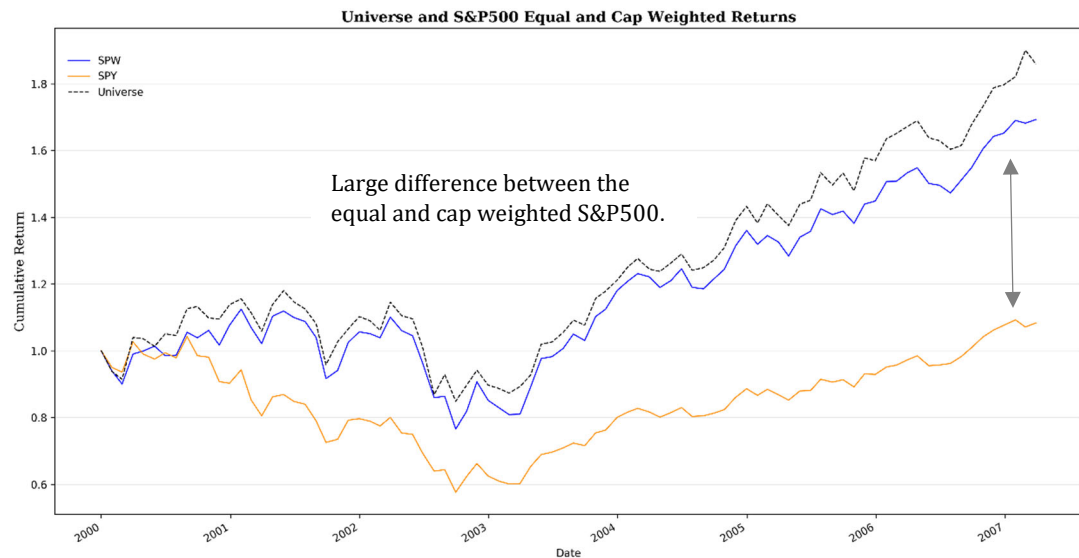
In both cases the research universe used in this paper produces the highest return of either S&P500 index and sets a higher standard. The universe closely follows the SP500 equal weighted index as expected.

We evaluated several data sources when attempting to build sector neutral benchmarks. The obvious solution was to use the liquid SPDR sector ETFs. However, these ETFs are cap weighted and fail to serve as fair sectors against which to compare an equal weighted portfolio prior to 2007. They produce returns that are far too easy to beat in the 2000-2007 time period where SPW outperformed SPX by 600+ bp annually. As such, we rejected the use of SPDRs.

Next we tried the equal weighted sector indices produced by the CME (S15 <Index> and S25 <Index>, for example). These indices solve the cap-weighted problem but the data does not begin until 2007, too late for this research where we require multiple market environments and require the 2000-2002 bear market specifically to ensure we have an additional bear market to evaluate side-by-side with the 2008-2009 bear market. In addition, these indices have market capitalizations that differ from this research universe's cutoff at the 50th percentile of US company market cap. We rejected their use as well.

Challenge 2: Not all factors have the same number of securities and hence, universe.
This is a particularly significant issue for valuation factors that utilize Enterprise Value relative to EBIT, EBITDA, or Free Cash Flow. These metrics are not available for all industries, particularly financials. Comparing EV/FVF quintiles created from a universe without financials to a universe return that includes financials is an unfair comparison, one that works in both directions. EV/FCF quintile performance would exclude financials in the financial crisis of 2008-2009 and returns would be overstated against a universe that includes financials. Alternatively, the spectacular rally financials had from 2013-2015 would be included in the universe return but have no factor representation and hence, understate factor performance.
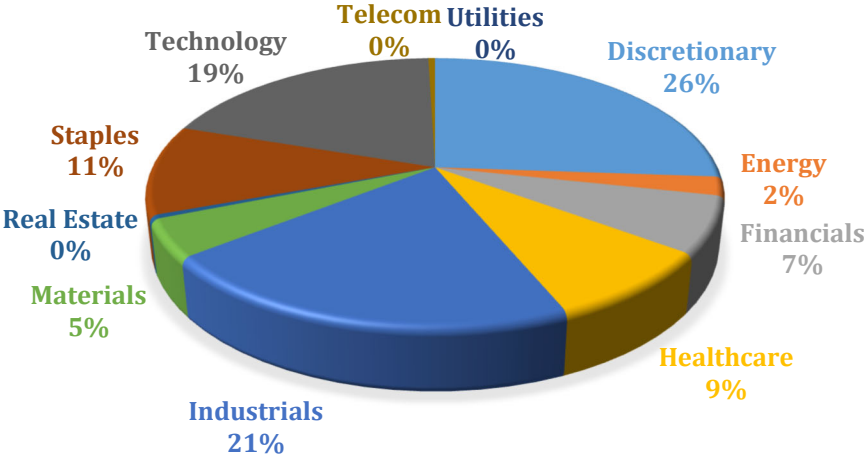
Solution: Build Your Own
We adopt a policy of comparing any factor to the universe of securities for which the factor has values. The universe to compare EV/EBITDA quintile performance is the subset of all securities that have EV/EBITDA values. As a result, there are 23 universes paired with the 23 factors. The universes of "common" factors like market capitalization and price-based measures are identical as all securities have values for these factors. The EV-based factors show the largest differences. A middle group exists for 3 and 5 year growth rates where it takes time for newer companies to reach this quantity of history. Every chart in this paper plots a factor and its quintiles against the factor-specific universe from which quintiles were constructed.
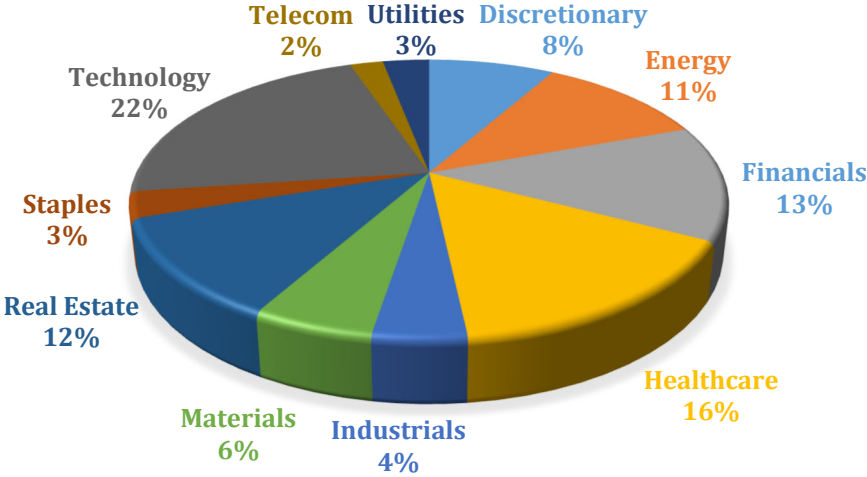
Similarly, when performing performance attribution a factor is compared against a sector neutral benchmark where the sector returns are also constructed from the set of securities that have values for the particular factor. In summary, for each factor we drop all null records. Of the remaining securities we build an equal weighted universe return. We then build equal-weighted sector returns to use in building sector neutral benchmarks for each quintile. For each factor there will be a set of quintile returns, a universe return, and a set of sector returns. We have used those exclusively for benchmarking factor performance in all examples in this paper.

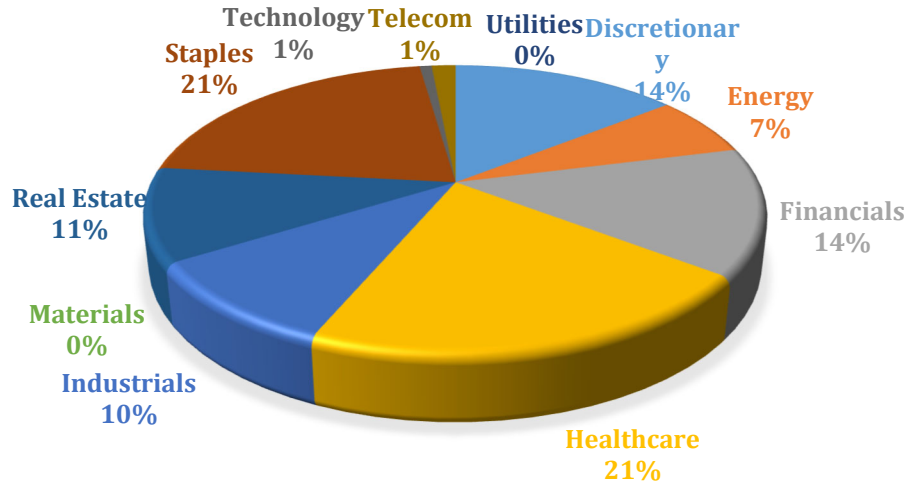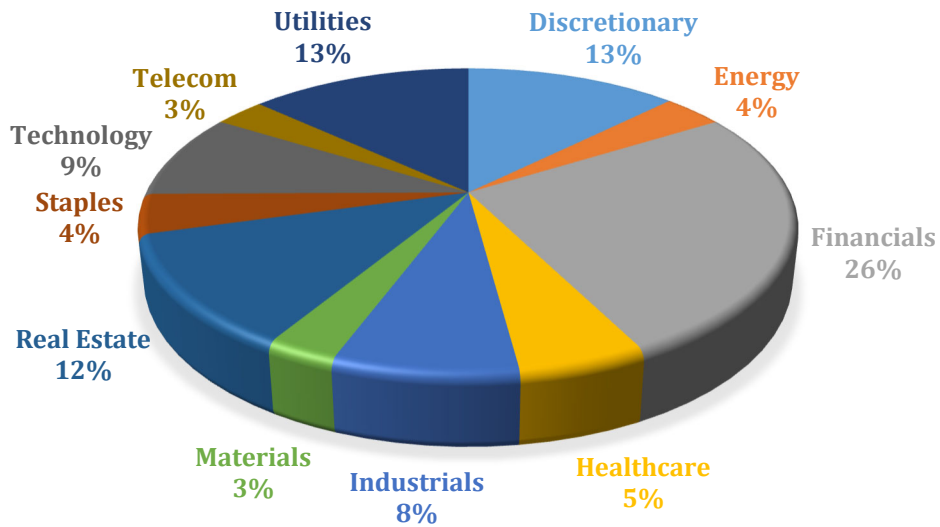**Appendix D:** ROIC Quintiles 1 and 5 as of December 31, 2018

ROIC_Q5

ROIC_Q1

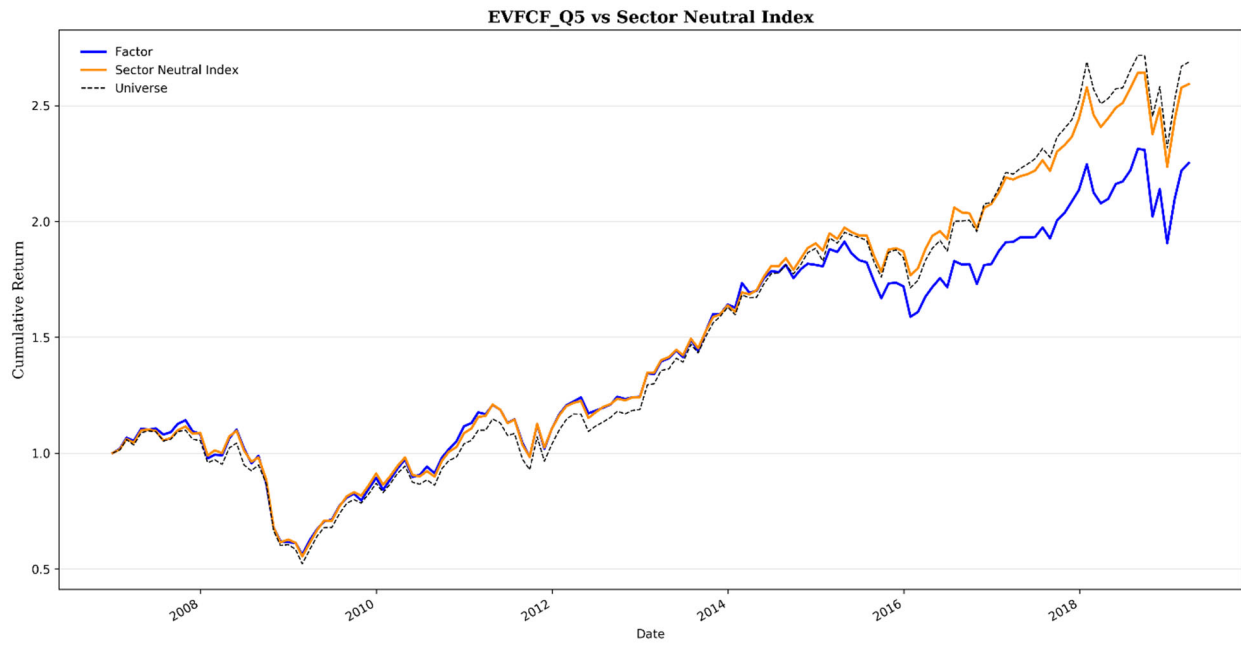**Appendix E:** ROIC Quintiles 1 and 5 as of December 31, 2008

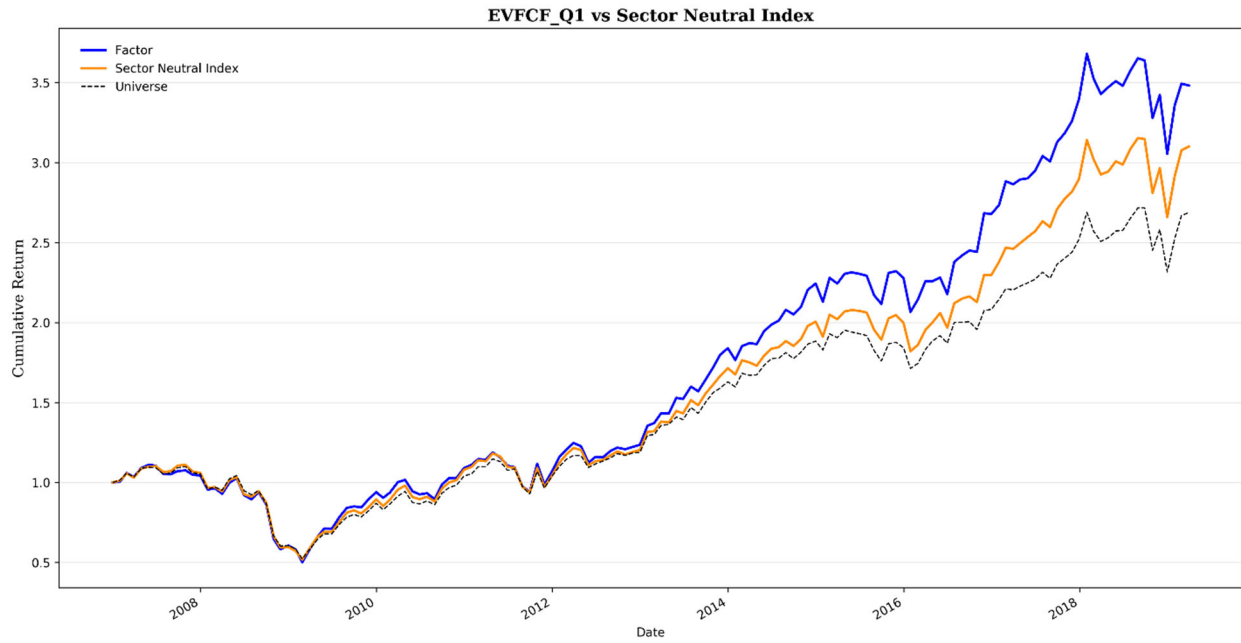**ROIC_Q5**

Segment	Percentage
Technology	1%
Telecom	1%
Utilities	0%
Discretionary	14%
Energy	7%
Financials	14%
Healthcare	21%
Industrials	10%
Materials	0%
Real Estate	11%
Staples	21%

ROIC_Q1

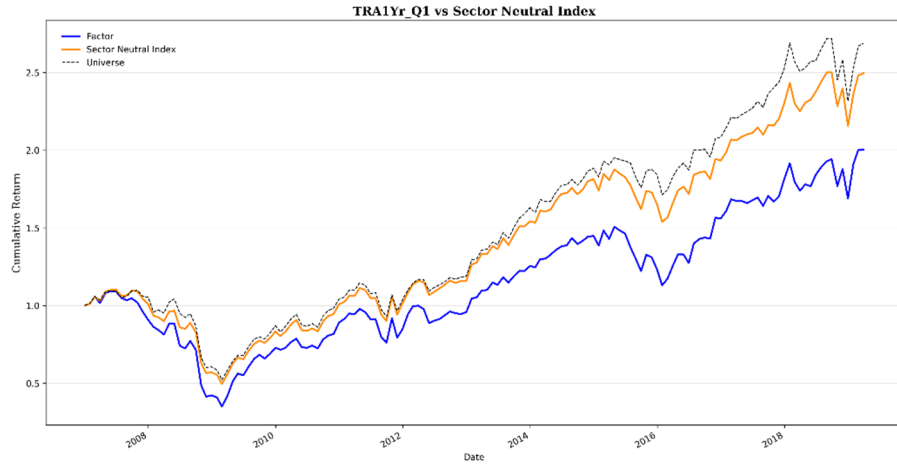| Segment	Percentage
Utilities	13%
Discretionary	13%
Energy	4%
Financials	26%
Telecom	3%
Technology	9%
Staples	4%
Real Estate	12%
Materials	3%
Industrials	8%
Healthcare	5%

Appendix F: EV/FCF Performance Versus Sector-Neutral Benchmark: Q1 and Q5.
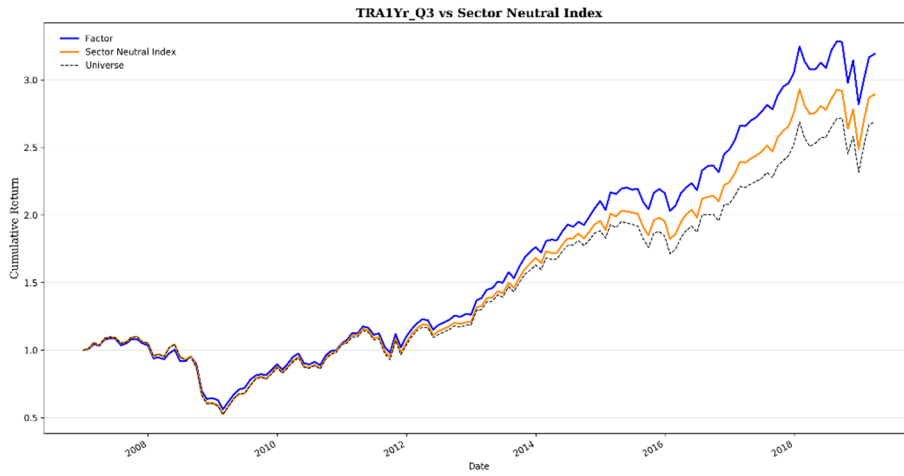
Appendix G: 1 Year Total Return Performance Versus Sector-Neutral Benchmark: Q1, Q3, and Q5.
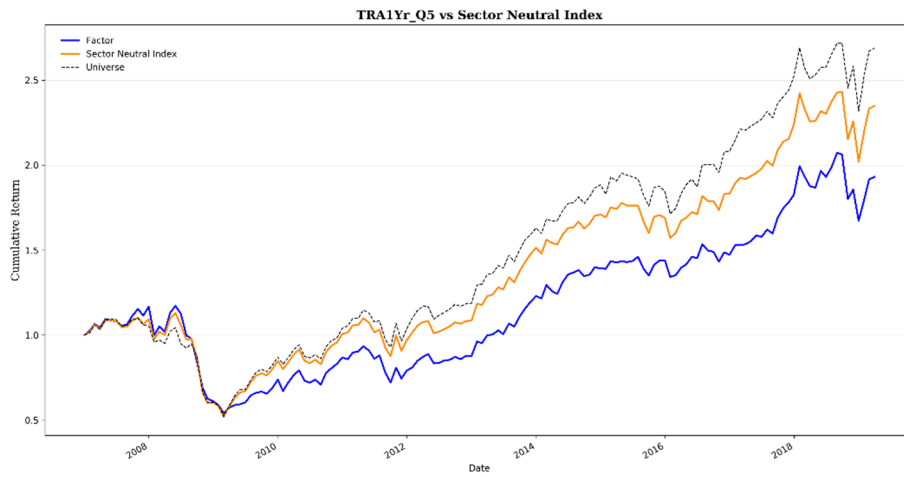
Underperforming Q1:

Outperforming Q3:

Underperforming Q5:

Abstract

Are Factor Returns Really Sector Returns?

Neal Falkenberry, CFA
Chief Investment Officer
Autumn Wind Asset Management, LLC

Date Written: April 7, 2019

Abstract

This paper evaluates the behavior of a wide range of valuation, growth, profitability, and momentum factors and proposes a methodology to determine the degree to which a factor's returns are the result of the sector weights created as the factor is divided into groups (quintiles). The research describes the construction of cross-sectional factor quintiles and the attribution of factor quintile performance between sector-neutral benchmarks and the factors themselves. The paper suggests the literature comparing factors to benchmarks that are sector-neutral is less well researched.

The paper provides evidence that the majority of the performance of factors as a group can be explained by the sector weights that emerge from quintile construction. This has significant ramifications to hedge fund managers employing long/short strategies as a fund may be market neutral yet exposed to significant business cycle risk via sector exposures that do not offset. Similarly, long portfolio managers are in a better position to deploy factor-based strategies if they understand the role sector plays in performance.

A factor-driven investment process benefits from a disciplined sector rotation process in addition to emphasizing attractive company qualities (factors) that are rewarded by the market. This paper provides insight into the relative impact each has on investment returns.