Sector Rotation model
for US markets

February 2, 2016

Continuing our research into regional sector allocation strategies, we introduce the US Sector Rotation model based on the premise that stocks in the same sector are exposed, in general, to a common set of underlying drivers of that business group.

Constructed in a similar fashion to that for the developed Europe markets, the model combines top-down and bottom-up signals to systematically score the relative attractiveness of sector groups.

Our strategy pairs sector level information from Markit's PMI survey data and proprietary CDS, securities lending and ETF sentiment indicators with momentum and fundamental factors to create a robust multi-factor sector signal as part of an overall portfolio strategy

For US large caps, the model delivered an average monthly return spread of 0.53% for favorable versus unfavorable sectors over the development period, extending to 5.42% at a 12-month horizon with positive out-of-sample performance

For an equal-weighted portfolio of favorable Vanguard Sector ETFs, the excess return over the SPDR S&P500 ETF averages 0.19% monthly, extending out to a 2.60% average 12-month return with outperformance in 68% of observations

We also demonstrate positive incremental alpha when overlaying the Sector Rotation model with our proven Value Momentum Analyst II stock selection model, with a decile return spread improvement of 15 bps for the 20% overlay strategy

Introduction

We initiated our research into sector allocation strategies, beginning with European markets (see Sector Rotation model, February 2015) and now covering the US, to address the increasing importance of sector allocation decisions due to globalization's impact on the intermingling of country and industry risk factors.

A portfolio well-diversified across countries may have hidden sector exposures and fully integrated markets would imply that sector effects are of greater importance. Our Sector Rotation model not only incorporates business cycle stages, but also identifies sectors that are expected to perform well in the future, thus increasing potential excess alpha.

The advent of sector ETFs has allowed investors to easily implement sector decisions taking advantage of the principle that investment returns of companies in the same sector can be highly correlated, with prices moving on similar fundamental and economic drivers. Extreme examples include technology stocks during the internet bubble burst in 2000, financial stocks in the 2008 financial crisis and, more recently, energy companies as oil prices plunged during 2014 and 2015. Indeed, sector ETF assets under management and number of products have grown exponentially and US markets, where the strategy originated, still represent nearly 80% of this strategy (Figure 1).

Figure 1: Sector ETF global assets under management, Jan 1998 – Dec 2015
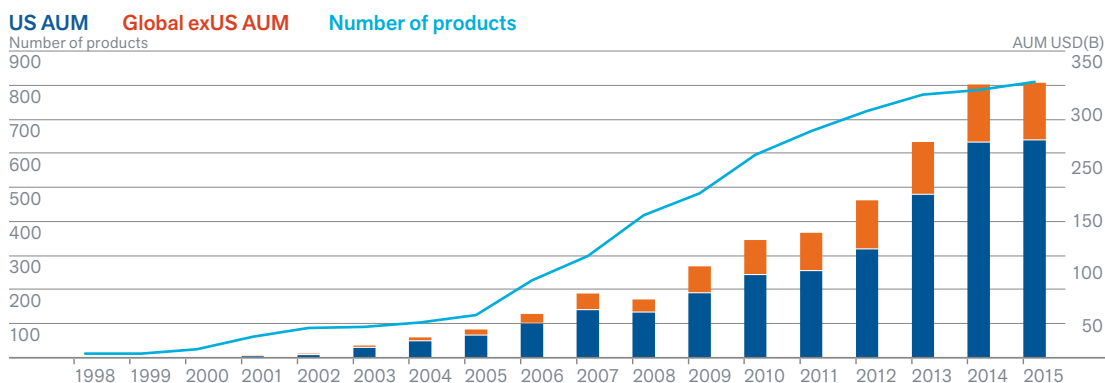
Our Sector Rotation model was built to systematically identify relative sector performance using both top-down and bottom-up strategies to enhance investment returns. Initially constructed for developed European markets, we extend our methodology to US markets, pairing Markit Sector PMI Survey data with fundamental, momentum and sentiment factors to create a robust multi-factor sector signal.

Performance and attribution analysis presented below substantiates its usefulness, along with applications as an overlay to several of our stylistic stock selection models.

Data and methodology

In this application of our sector rotation strategy, we focus on US markets spanned by the Markit US Total Cap universe, which has over 3000 constituents and represents 98% of the US market cap.

Large cap and small cap subgroups represent 90% and the next 91-98% of the cumulative market cap, respectively. These securities are then sorted according to our sector classification scheme [i], with company returns cap weighted to build the overall sector return.

Our model scores

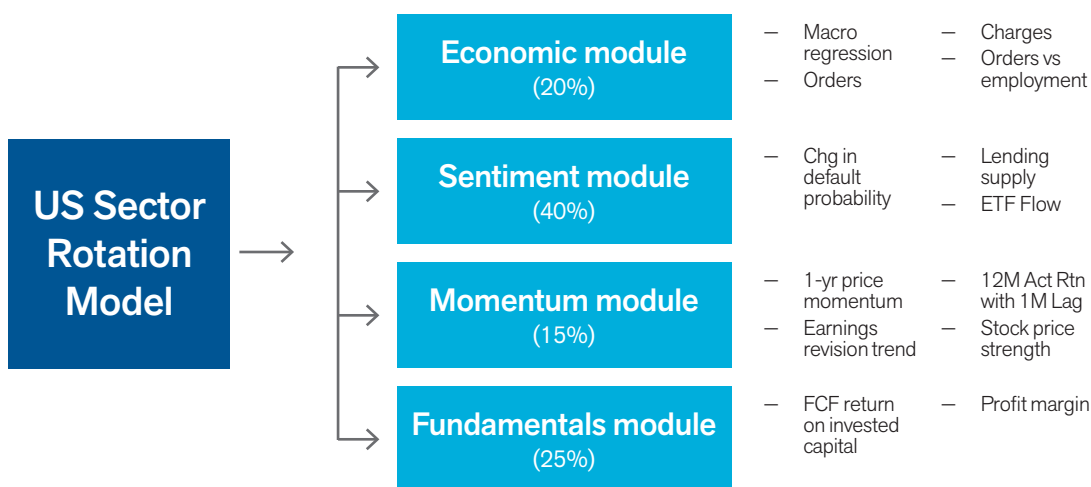|		
Basic Materials	Cyclical Goods & Services	Energy
Financials	Healthcare	Industrials
Non-cyclical Goods & Services	Technology	Telecommunication Services
Utilities		

The test period spans from January 1995 through December 2015, with an in-sample period from January 1995 – December 2011, and an out-of-sample period from January 2012 – December 2015. Performance statistics are computed based on a strategy of going long the buy-list sectors and shorting the sell-list sectors, with robustness statistics that include hit rates representing the percent of positive occurrences for the spreads. We report 1-, 3-, 6- and 12-month statistics for overlapping periods.

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Model construction

Our US Sector Rotation model takes on the same form as its European counterpart, consisting of four main modules – Economic, Sentiment, Momentum and Fundamentals. PMI data continues to be a key component of our strategy, as it has been an accurate and valuable leading indicator for economic conditions versus the less timely official information and can be market moving when released to the public.

Combined with the additional style components, our model creates a systematic allocation strategy incorporating the business cycle stages to take advantage of equity returns in growing sectors and underweight or short contracting sectors. In general, favorable (unfavorable) signals from our composite score are assigned to the top 3 (bottom 3) sectors. Figure 2 displays the model construction as described in further detail below.

Figure 2: Sector Rotation model construction

US Sector Rotation Model	Economic module (20%)	— Macro regression — Orders	— Charges — Orders vs employment
	Sentiment module (40%)	— Chg in default probability	— Lending supply — ETF Flow
	Momentum module (15%)	— 1-yr price momentum — Earnings revision trend	— 12M Act Rtn with 1M Lag — Stock price strength
	Fundamentals module (25%)	— FCF return on invested capital	— Profit margin

Economic module (20%)

PMI data is used by economists to gain insight into underlying economic conditions because it is released well in advance of comparable official economic data (see the Appendix for more detail). Given the importance of PMI information, central banks are known to put considerable weight on the surveys when formulating interest rate decisions.

While the global figures capture the headlines, the input survey information can be aggregated to the sector level for further granularity. This sector data tracks the same variables as standard national PMI surveys, adding depth to the existing PMI coverage and allowing for identification of key growth sectors and associated drivers on a monthly basis. We hypothesize that economic survey information aggregated to the sector level can be used to forecast equity returns.

The dataset contains information across a number of business metrics, though they can differ depending on the type of sector (manufacturing, services or construction). We therefore focus our analysis on the common variables of output, new orders, output prices, backlogs of work, and employment metrics.

Four factors are used in our economic module representing a mix of specific index values and macroeconomic attributes across sectors:

Macro regression (50%) – 60-month rolling regression of macroeconomic variables and monthly returns.

Charges (16.7%) – momentum in the raw value of Charges compared with the past 12-month average. Charges represent the selling prices that companies charge for their goods, in other words, output prices.

Orders (16.7%) – the raw value of Orders component of the US PMI. Orders provide an indication of expected revenue by gauging the flow of new orders.

Orders versus Employment (16.7%) – raw value of Orders minus Employment component in PMI. Increasing orders and decreasing employment levels are an indication of more attractive productivity.

These factors identify relative strength in economic expectations across sectors.

We compute a cross-sectional z-score of the raw value of orders versus employment, charges and orders to determine the aggregate score. Buy (sell) signals are assigned to the largest (smallest) values above 1 (below -1). In other words, the signal uses top level figures from new PMI data to create a scoring system designed to measure the relative attractiveness of each sector.

In the US model, we include an additional factor when compared to the European model in the Economic module made up of a 60-month rolling regression of eight macro indicators that may affect sector performance within the US economy. The indicators used in the regression include Housing Starts, Industrial Production, Inflation, Oil Price, Change in Credit Risk Premium, Yield Spread, Change in Fed Funds Rate and Change in VIX.

Our model seeks to capture sector return exposures to changes in these macroeconomic indicators by regressing sector returns on the systematic factor values. The beta coefficients of the regression are then used to forecast the next month's sector returns. We consider those sectors that have the highest forecasted returns to be favorable and those with the lowest forecasted returns to be unfavorable.

The macroeconomic regression makes up 50% of the overall economic module while the PMI data makes up the other 50%. It should be noted that sector PMI data is not available for Telecommunications, Utilities and Energy sectors; thus their final Economic Module scores are based solely on the macro regression factor.

Sentiment module (40%)

The Sentiment module turns to proprietary Markit data from CDS, securities lending, and ETF markets for additional insights to gauge trends in sentiment and is intended to capture the overall market view of a sector:

Change in Default Probability (33.3%) – market cap weighted 1-year Default Probability minus the previous 12-month average. The factor is aggregated on the US Total Cap universe and the same rating is applied over all three US universes. This measure gauges the overall risk level of the sector based on the relative change in the default probability, with decreasing risk levels preferred.

Lending Supply (33.3%) – percentage of stocks' weights within each sector in the bottom Lending Supply decile. Lending Supply represents the total quantity of stock in lendable inventory relative to shares outstanding and represents a proxy for institutional ownership.

ETF Flow (33.3%) - money flowing into sector ETFs aggregated over the previous 90 days adjusted by the universe's market cap at the beginning of the period. We find ETF flow to be a contrarian indicator, with the theory that it represents retail flow chasing recent returns and reacting slower than institutional flow.

Sectors are then ranked according to each factor and the sum of the ranks is computed to determine the sentiment composite.

Momentum module (15%)

Momentum indicators calculate the rate of change of price, earnings or earnings estimates. Price momentum measures are constructed with the most basic of all security information – historical prices, returns and volumes. They have attracted considerable attention from practitioners and academics alike due to their consistent profitability and challenge to the efficient market hypothesis.

Likewise, earnings momentum strategies have been proven both in research and in practice to add alpha to the investment process. In particular, the market tends to have a delayed response to the full impact of the information content of earnings estimate revisions. As such, estimate revisions provide an incremental catalyst to the earnings momentum investment opportunity set.

The Momentum module is intended to capture overall sector directional movements using three faster moving technical measures:

1-year Price Momentum (25%) – market capitalization weighted 1-year Price Momentum at the sector level. This trend following indicator identifies the directional strength of price trends for stocks in the sector.

12M Act Rtn with 1M Lag (25%) – market capitalization weighted 12M Act Rtn with 1M Lag aggregated at sector level. This measure lags the long-term price trend by one month.

Earnings Revision Trend (25%) – percent of companies within each sector with positive revisions in FY1 earnings forecast minus negative revisions. The direction of revisions indicates changes in analysts' outlook on earnings.

Stock Price Strength (25%) – percent of companies within each sector above versus below their 52-week moving average price. The level of a stock's price relative to its long-term average indicates the direction of price strength.

We remark that 1-year Price Momentum indicator and 12M Act Rtn with 1M Lag, while defined over similar time periods, capture two different aspects of momentum. The former is a volatility-adjusted measure of the underlying price trend and the latter is a pure momentum measure whose lag takes into account the negative effects of short-term reversals. Furthermore, we found a reasonably low correlation of 0.6 between the two measures.

All factors look for positive trends in underlying measures. Sectors are then ranked according to each factor and the sum of the ranks is computed to determine the momentum composite.

Fundamentals module (25%)

Dating back to the teachings of Graham and Dodd, fundamental investing has evolved significantly, but remains a steadfast component of asset pricing. In constructing the Fundamentals module, we include two key fundamental measures intended to capture the health of the underlying industries by looking at signals of overall sector strength, which were found to be more useful in sector selection than price multiple valuation factors:

Free Cash Flow Return on Invested Capital (50%) – market capitalization weighted Free Cash Flow Return on Invested Capital at the sector level minus the past 60-month average. Free Cash Flow Return on Invested Capital is a gauge of a company's cash return from its capital employed.

Profit Margin (50%) – market capitalization weighted Profit Margin at the sector level minus the past 60-month average. Profit Margin is used to measure operating efficiency at a company and signifies its control over costs for generating sales.

Sectors are then ranked according to each factor and the sum of the ranks is computed to determine the Fundamentals composite.

Results

We turn now to performance statistics for the Sector Rotation model.

The model was constructed over three US universes including large caps, representing 90% of cumulative market cap, small caps, encompassing the next 8%, and the combined total cap, each subject to a minimum market cap of $250 million.

We separate the results based on the in-sample development period (from January 1995 through December 2011) and the subsequent out-of-sample performance. We report spreads of equal-weighted sector returns for favorable versus unfavorable sectors along with the hit rates (percent of occurrences of positive spreads). Returns are computed over 1-, 3-, 6- and 12-month holding periods. Results at the module and model level for large and small caps are displayed here and total cap and individual factor performance is included in the Appendix.

For large caps (Table 1), the model delivered an average monthly favorable versus unfavorable spread of 0.53% over its construction period, which extended out to 5.42% over a 12-month holding period. Robustness is confirmed with hit rates of 57% and 70%, respectively.

Individual modules effectively contributed to overall model performance with positive return spreads and hit rates well in excess of 50%. The Sentiment module posted the strongest 1-month average return spread of 0.46%. At the 12-month horizon, the Fundamentals module recorded a significant 5.04% average return spread with a 67% hit rate. The Sentiment and Economic modules followed with similar average 12-month spreads of 2.28% and 2.80%, respectively.

This solid performance carried over to the recent out-of-sample period. Since January 2012, the model has recorded an average 0.79% favorable versus unfavorable spread with outperformance in 60% of months. At the 12-month horizon the model returned an average 4.70% spread with 72% accuracy out of sample.

Table 1: US large cap Sector Rotation model performance statistics, Jan 1995 – Dec 2015

Factor	Favorable – Unfavorable spread (%)				Hit rate (%)			
	1 Mo	3 Mo	6 Mo	12 Mo	1 Mo	3 Mo	6 Mo	12 Mo
In-sample (Jan 1995 – Dec 2011)								
Model	0.53%	1.88%	2.91%	5.42%	57	64	63	70
Economic module	0.13%	0.50%	0.92%	2.80%	53	55	55	57
Sentiment module	0.46%	0.86%	0.72%	2.28%	57	61	58	62
Momentum module	0.35%	0.66%	1.13%	1.22%	52	55	52	55
Fundamentals module	0.28%	1.39%	2.67%	5.04%	53	59	65	67
Out-of-sample (Jan 2012 – Dec 2015)								
Model	0.79%	2.00%	2.01%	4.70%	60	64	60	72
Economic module	0.05%	0.66%	0.41%	3.91%	47	49	50	64
Sentiment module	0.78%	1.78%	1.69%	4.19%	55	64	52	67
Momentum module	0.70%	2.00%	3.53%	6.15%	60	71	74	78
Fundamentals module	0.22%	0.74%	1.08%	1.07%	60	51	55	50

To further illustrate the time series performance of the model using a realistic implementation method, we present 3-month returns (overlapping periods) for the large cap universe over the full sample period.

Figure 3 demonstrates an average 3-month return spread of 1.89% over the full period for favorable versus unfavorable sectors with outperformance in 64% of observations with no major drawdowns in the out-of-sample data. We also observe no extended periods of underperformance in the full test period, which is a desirable feature in application.

Figure 3: Sector Rotation model 3-month return spreads, Jan 1995 – Dec 2015

3-month return spread
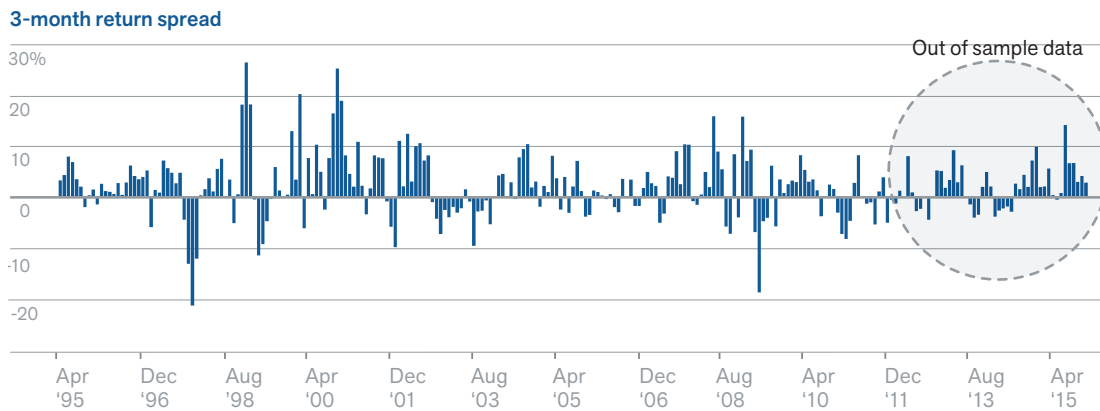
Turning to small caps (Table 2), the model was again positive, though somewhat weaker, perhaps due to the higher idiosyncratic risks associated with names in this space versus more systematic exposures of their large cap counterparts.

During the construction period, the model posted an average monthly favorable versus unfavorable return spread of 0.56% (55% hit rate), which extended out to an average 12-month spread of 2.98% (57%). The Momentum module outperformed at the 1-month horizon with an average spread of 0.72%, while the Economic module was the most effective at 12 months (4.55%).

More recent out-of-sample spread performance exceeded development stage outcomes and with stronger hit rates in general, particularly at the longer holding periods. The model recorded an average spread of 0.34% monthly, but with a significant 12-month average of 5.87% and 69% hit rate. The Sentiment module was the most effective for 1-month spreads (average spread: 0.73%; hit rate 62%), while at the 12-month horizon, its superior performance (average spread: 8.65%; hit rate 81%) was followed by the Economic module (average spread: 5.44%; hit rate 67%).

Table 2: US small cap Sector Rotation model performance statistics, Jan 1995 – Dec 2015

Factor	Favorable – Unfavorable spread (%)				Hit rate (%)			
	1 Mo	3 Mo	6 Mo	12 Mo	1 Mo	3 Mo	6 Mo	12 Mo
In-sample (Jan 1995 – Dec 2011)								
Model	0.56%	1.09%	2.49%	2.98%	55	60	57	57
Economic module	0.10%	0.11%	1.44%	4.55%	51	52	53	58
Sentiment module	-0.04%	-0.05%	-0.57%	-0.20%	49	56	51	57
Momentum module	0.72%	1.35%	2.31%	1.38%	55	55	54	55
Fundamentals module	0.26%	1.23%	1.98%	1.40%	50	54	53	50
Out-of-sample (Jan 2012 – Dec 2015)								
Model	0.34%	1.35%	2.87%	5.87%	51	60	60	69
Economic module	0.08%	1.51%	1.71%	5.44%	51	62	62	67
Sentiment module	0.73%	2.39%	4.87%	8.65%	62	73	69	81
Momentum module	0.53%	0.82%	1.71%	3.97%	55	56	55	61
Fundamentals module	-0.52%	-1.60%	-3.40%	-6.38%	45	36	31	22

Turnover

Before we move on to applications of the Sector Rotation model, we first look at turnover statistics associated with the model ratings to gain more insights into its ease of implementation.

We consider scenarios where ratings change from favorable/unfavorable to neutral and vice versa along with changes between favorable and unfavorable. Large and small cap model monthly turnover statistics over the full analysis period are presented in Table 3 (see Table A2 in the Appendix for total cap statistics).

Model ratings demonstrate low turnover at the 1-month horizon for large (small) caps with 58.8% (56.0%) of monthly observations across all sectors maintaining the same ratings. Furthermore, only 4.5% (5.0%) of monthly sector ratings swing between favorable and unfavorable ratings in aggregate.

As expected, turnover increases as holding periods extend. Focusing on a medium term buy-and-hold strategy, 48.6% (44.3%) of sector ratings for large (small) caps remain the same on average across a 6-month period. Only 9.8% (11.1) of sectors move between the favorable and unfavorable extremes. In sum, the model turnover is low, meaning the strategy is feasible to implement without incurring high transaction costs from rebalancing.

Table 3: Sector Rotation model turnover statistics, Jan 1995 – Dec 2015

Holding Period	No Change (%)		Change between favorable/ unfavorable and neutral (%)		Change between favorable and unfavorable (%)	
	Large cap	**Small cap**	**Large cap**	**Small cap**	**Large cap**	**Small cap**
1 month	58.8	56.0	36.7	39.0	4.5	5.0
3 months	52.9	48.1	40.0	43.8	7.1	8.1
6 months	48.6	44.3	41.5	44.6	9.8	11.1
12 months	42.1	37.9	44.6	46.9	13.3	15.3

Application

Sector ETF application

We round out the report with examples of practical applications of the model. In our first set of examples, we examine the effectiveness and feasibility of trading the Sector Rotation model signals over a set of sector ETFs. Rather than focusing on the US market based on broad sector and market constituents cited above, here we apply the model to a more conventional portfolio setting using sector ETFs as proxies for typical sector portfolios:

We use ETFs to ensure the model is able to use tradable investment vehicles to produce positive results outside of our previously defined sector portfolios

Sector ETFs are one of the most likely vehicles for a direct sector rotation strategy, along with futures or custom sector portfolios. These conveniently provide out of sample return time series to use in strategy testing

Managers may not use ETFs in a direct sector rotation strategy, but may add ETFs to an existing portfolio where the ETFs could add to sector allocations

The first test is a broader application using the total cap model and is conducted on Vanguard sector ETFs which are mapped to 10 sectors used in the model development (Table 4). The ETFs hold 250 large, mid and small cap stocks on average and are thus a reasonable representation of the broad market segments.

Table 4: Total cap sector ETF mapping

Sector	ETF
Energy	Vanguard Energy ETF (VDE)
Basic Materials	Vanguard Materials ETF (VAW)
Industrials	Vanguard Industrials ETF (VIS)
Cyclical Goods & Services	Vanguard Consumer Discretionary ETF (VCR)
Non-cyclical Goods & Services	Vanguard Consumer Staples ETF (VDC)
Financials	Vanguard Financials ETF (VFH)
Healthcare	Vanguard Health Care ETF (VHT)
Technology	Vanguard Information Technology ETF (VGT)
Telecommunication Services	Vanguard Telecommunication Services ETF (VOX)
Utilities	Vanguard Utilities ETF (VPU)

Performance statistics are computed based on a strategy of going long the favorable list of sector ETFs and shorting the SPDR S&P 500 ETF (SPY) as a proxy for the market, with robustness statistics that include hit rates representing the percent of positive occurrences for the spreads. We report 1-, 3-, 6- and 12-month statistics for overlapping periods beginning in October 2004 when return data for all 10 sector ETFs is available (Table 5).

The model and most of its subcomponents provide strong and consistent signals. For the simple strategy of holding the favorable ETFs from the model, the return averages 0.19% monthly over the market with a 54% hit rate.

The positive outcomes extend out to a 12-month horizon where the returns averaged 2.60% higher than the market and associated hit rate of 68%.

Among the performance of the subcomposites, the results are consistent with our previous research, effectively contributing to overall model performance with positive return spreads and hit rates well in excess of 50% in general. The Fundamentals module was a strong module, with a 12-month spread for the favorable ETFs versus the market of 2.90% and a hit rate of 61%. Though the spreads were slightly lower, the Sentiment module posted superior spreads across most holding periods.

Table 5: Total cap Sector Rotation model performance statistics for the strategy going long favorable ETFs and short the SPDR S&P 500 ETF, Oct 2004 – Dec 2015

	Favorable - Market Spread (%)				Hit Rate (%)			
	1 Mo	3 Mo	6 Mo	12 Mo	1 Mo	3 Mo	6 Mo	12 Mo
Model	0.19	0.81	1.35	2.60	54	60	64	68
Economic Module	0.04	0.47	1.12	1.82	48	55	64	56
Sentiment Module	0.17	0.55	0.63	2.23	54	60	58	68
Momentum Module	0.21	0.39	0.84	1.31	56	58	59	62
Fundamentals Module	0.19	0.76	1.62	2.90	54	56	60	61

We also consider a strategy of going long the favorable list of sector ETFs and shorting the unfavorable list of sector ETFs (Table 6). Positive performance carried over in general to the long/short strategy.

The model delivered an average 0.33% favorable versus unfavorable monthly spread with outperformance in 55% of months.

For 12-month holding periods, the model generated a dollar neutral return of 3.49%. The Fundamentals module was the strongest among the four, with a favorable versus unfavorable spread of 2.93% and hit rate of 61%.

Table 6: Total cap Sector Rotation model performance statistics for the strategy going long favorable ETFs and short unfavorable ETFs, Oct 2004 – Dec 2015

	Favorable - Unfavorable Spread (%)				Hit Rate (%)			
	1 Mo	3 Mo	6 Mo	12 Mo	1 Mo	3 Mo	6 Mo	12 Mo
Model	0.33	1.32	1.82	3.49	55	63	60	67
Economic Module	-0.04	0.62	1.35	1.93	49	52	58	59
Sentiment Module	0.49	1.09	0.96	2.76	58	60	54	59
Momentum Module	0.32	0.25	0.33	0.67	57	55	58	54
Fundamentals Module	0.12	0.73	1.52	2.93	48	55	58	61

To further illustrate the trend in model performance, we present a time series chart of monthly returns. Here we focus on 6-month returns (overlapping periods) representing a reasonably long buy-and-hold portfolio strategy.

Figure 4 demonstrates an average 6-month return spread of 1.35% over the full period for the favorable versus market strategy with outperformance in 64% of observations.

Figure 4: Total cap Sector Rotation model 6-month return spreads for the strategy going long favorable ETFs and short the SPDR S&P 500 ETF, Oct 2004 – Dec 2015

6-month return spread
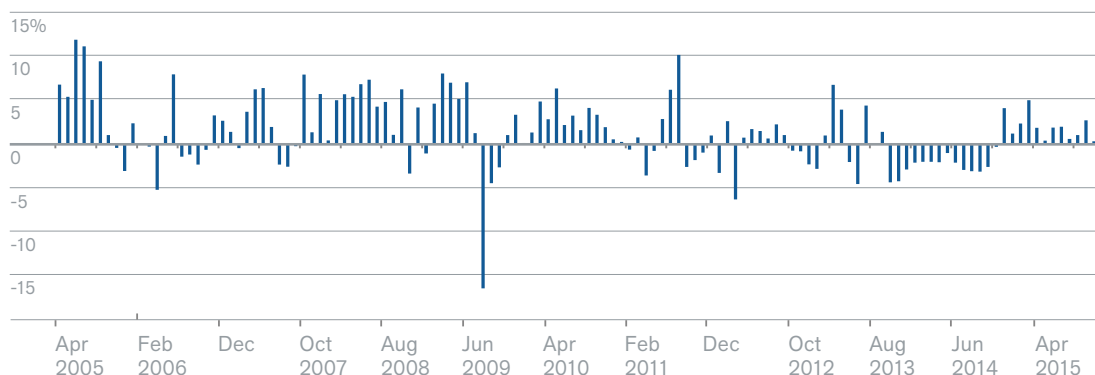
Our second example uses the large cap model and is conducted on SPDR sector ETFs which are mapped to 9 sectors used in the model development along with the iShares US Telecommunications ETF (see Table A3 in the Appendix). The SPDR ETFs track the S&P 500 sectors and the full set of ETFs hold 53 large stocks on average and are thus a reasonable representation of large cap sectors.

The analysis again begins in May 2000 when return data for all 10 sector ETFs is available (Table 7) and once more provides strong and consistent signals.

The strategy of holding favorable ETFs returned a 1-month (12-month) average of 0.30% (3.15%) over the market with a 61% (68%) hit rate. Results for the subcomposites also effectively contributed, with the Fundamentals module posting a 12-month spread of 3.51% and a hit rate of 64%. (See Figure A1 in the Appendix for a graph of 6-month return spreads demonstrating a practical application.)

Table 7: Large cap Sector Rotation model performance statistics for the strategy going long favorable ETFs and short the SPDR S&P 500 ETF, May 2000 – Dec 2015

	Favorable - Market Spread (%)				Hit Rate (%)			
	1 Mo	3 Mo	6 Mo	12 Mo	1 Mo	3 Mo	6 Mo	12 Mo
Model	0.30	0.99	1.63	3.15	61	62	65	68
Economic Module	0.06	0.60	1.12	1.69	52	55	64	56
Sentiment Module	0.25	0.61	0.61	1.96	55	60	56	67
Momentum Module	0.22	0.67	1.03	1.13	51	55	60	58
Fundamentals Module	0.26	0.96	2.02	3.51	55	56	63	64

For the strategy of going long the favorable list of sector ETFs and shorting the unfavorable list of sector ETFs (see Table A4 in the Appendix), we confirm that positive performance carried over to the long/short strategy.

The model delivered a 0.53% (4.47%) average 1-month (12-month) favorable versus unfavorable spread with outperformance in 56% (68%) of months.

The Sentiment (Fundamentals) module was the strongest at the 1-month (12-month) horizon with a favorable versus unfavorable spread of 0.59% (4.72%) and hit rate of 59% (66%).

Multi-factor model overlay

In our next example, we demonstrate how to apply the Sector Rotation model in combination with our Value Momentum Analyst II model (VMA II is a comprehensive approach including factors that span the value, price and earnings momentum style spectrum). VMA II is our top performing multi-factor style model for the period January 1995 through December 2015, thus providing a high hurdle for this strategy.

The base case for our application is centered on equal-weight stock returns for decile 1 (D1) and decile 10 (D10) names as identified by the VMA II stock selection model. The test case begins by adjusting D1 stocks in favorable-rated (unfavorable-rated) sectors with an overweight (underweight) in aggregate of 20%. Stocks in neutral-rated sectors maintain the same weights as in the base case. Within D10, we establish

opposite positions on stock weightings (i.e., aggressive shorting of stocks within unfavorable-rated sectors, lighter shorting of those within favorable-rated sectors). We also include a 30% adjustment for an additional robustness check.

Results are based on 1-month holding periods using the large cap Sector Rotation model over the analysis period (Table 8). The 20% sector model overlay with VMA II posted an average 1-month return spread of 1.63% compared with the base model spread of 1.48%. This 15 bp difference furthered to 26 bps using the 30% overlay (1.74% return spread). We also remark that the spread differential was somewhat stronger for D10 excess returns where the 20% (30%) overlay provided an additional 8 (16) bps of underperformance.

Table 8: VMA II decile returns, Jan 1995 – Dec 2015

	D1-D10 return spread (%)	D1 absolute return (%)	D10 absolute return (%)
VMA II with 20% Sector Rotation model overlay	1.63	1.76	0.12
VMA II with 30% Sector Rotation model overlay	1.74	1.79	0.04
VMA II	1.48	1.68	0.20

Conclusion

We extend the application of our Sector Rotation model to US equities, using our Europe model (introduced in February 2015) as a foundation.

Based on a common framework, the model is built using four modules encompassing Economic, Sentiment, Momentum and Fundamentals styles. It computes a buy/hold/sell score across 10 sectors from multiple data sources including PMI, fundamental data, price data, CDS spreads and securities lending data to aggregate more focused sector level information to gain better insight and take advantage of key drivers within a market.

More specifically on the construction of each module, the Economic module is a top-down measure computed using a scoring system designed to measure changes in momentum between sectors based on Markit Sector PMI survey data paired with a classic econometric regression model. The Fundamentals module is a gauge of fundamental value, while the Momentum and Sentiment modules capture technical sector attributes. The former focuses on price and earnings momentum and the latter turns to CDS and securities lending markets for additional insights in sentiment trends.

Turning to performance analytics, the model demonstrated efficacy over the construction period delivering an average monthly favorable versus unfavorable 1-month (12-month) spread of 0.53% (5.42%) for large caps and 0.56% (2.98%) for small caps. Solid performance carried over to the recent out-of-sample period (since January 2012), where the model has recorded an average 0.79% spread (60% hit rate) extending to 4.70% (72% hit rate) at the 12-month horizon for large caps. Likewise for small caps, positive 1-month spreads of 0.34% (51% hit rate) extended out to 12-month spreads of 5.87% (69% hit rate).

Focusing on the 3-month holding period for large caps for a practical application, the model demonstrates desirable performance features exemplified by no major drawdowns in the out-of-sample data along with no extended cycles of underperformance across the full analysis period.

In an application using the Sector Rotation model ratings in a straight-forward framework for investment in sector ETFs, the model demonstrated efficacy delivering an average monthly favorable return of 0.19% (54% hit rate) in excess of the market extending to 2.60% (hit rate 68%) at the 12-month horizon. Solid performance carried over to a favorable versus unfavorable strategy, where the model recorded an average 1-month (12-month) spread of 0.33% (3.49%).

A second application using the Sector Rotation model in combination with our proven VMA model demonstrates the benefits of adding a sector rotation overlay to this investment process. The 20% (30%) overlay strategy posted average monthly decile return spread improvements of 16 (27) bps beyond the base model, especially driven by enhanced D10 underperformance.

Appendix

PMI data

Across the world's largest developed and emerging economies, Purchasing Managers' Index (PMI) surveys for the manufacturing, services and construction sectors have become key benchmark indicators of economic conditions. Based on monthly questionnaires provided to over 20,000 companies across more than 30 countries, the surveys are designed to track changes in variables such as output, new orders, inventories, employment and prices.

More specifically, manufacturers are asked questions regarding output, new orders, new export orders, inventories of finished goods, employment, backlogs of work, input prices, output prices, suppliers' delivery times, quantity of purchases and inventories of purchases. Construction companies are asked about business activity (output), incoming new business, housing activity, civil engineering activity, commercial activity, employment, input prices, suppliers' delivery times, quantity of purchases, future business activity, sub-contractor usage, sub-contractor rates, sub-contractor availability and subcontractor quality.

Service sector companies answer questions about business activity (output), incoming new business, backlogs of work, employment, input prices, output prices and future business activity.

The survey data sets are based on diffusion indices, which are calculated across all variables. The indexes vary between 0 and 100 with a level of 50.0 signaling no change from the previous month. Readings above 50.0 signal an increase relative to the previous month, while reading below 50.0 indicates a decrease. Thus, the greater the divergence from 50.0, the greater the estimated rate of change signaled.

Given the extensive global coverage of whole economy PMI panels, Markit Economics has recently derived sector indices at a Global, European, US and Asian level. Defined according to Markit classifications, this sector data tracks the same variables as standard national PMI surveys, adding depth to existing global PMI coverage and allowing for the identification of key growth industries and associated drivers on a monthly basis.

Factor performance

Table A1: US total cap Sector Rotation model performance statistics, Jan 1995 – Dec 2015

Factor	Favorable – Unfavorable spread (%)				Hit rate (%)			
	1 Mo	3 Mo	6 Mo	12 Mo	1 Mo	3 Mo	6 Mo	12 Mo
In-sample (Jan 1995 – Dec 2011)								
Model	0.41%	1.27%	2.11%	4.10%	54	63	63	68
Economic module	0.22%	0.42%	0.95%	3.02%	54	53	58	59
Sentiment module	0.30%	0.70%	0.54%	2.00%	56	61	60	60
Momentum module	0.30%	0.57%	1.29%	1.24%	55	58	55	58
Fundamentals module	0.33%	1.05%	2.00%	4.21%	50	58	62	65
Out-of-sample (Jan 2012 – Dec 2015)								
Model	0.53%	1.49%	1.84%	4.69%	55	60	55	78
Economic module	-0.15%	0.30%	0.23%	4.15%	45	47	48	64
Sentiment module	0.78%	1.71%	2.02%	4.66%	60	62	55	67
Momentum module	0.88%	1.69%	2.52%	5.09%	70	62	67	75
Fundamentals module	0.08%	0.54%	0.87%	0.61%	53	51	48	44

Table A2: Total cap Sector Rotation model turnover statistics, Jan 1995 – Dec 2015

Holding Period	No Change (%)	Change between favorable/ unfavorable and neutral (%)	Change between favorable and unfavorable (%)
1 month	58.5	36.7	4.8
3 months	52.4	40.6	7.0
6 months	46.8	43.3	9.8
12 months	40.0	46.4	13.6

Table A3: Large cap sector ETF mapping

Sector	ETF
Energy	Energy Select Sector SPDR Fund (XLE)
Basic Materials	Materials Select Sector SPDR Fund (XLB)
Industrials	Industrials Select Sector SPDR Fund (XLI)
Cyclical Goods & Services	Consumer Discretionary Select Sector SPDR Fund (XLY)
Non-cyclical Goods & Services	Consumer Staples Select Sector SPDR Fund (XLP)
Financials	Financials Select Sector SPDR Fund (XLF)
Healthcare	Health Care Select Sector SPDR Fund (XLV)
Technology	Technology Select Sector SPDR Fund (XLK)
Telecommunication Services	iShares US Telecommunications ETF (IYZ)
Utilities	Utilities Select Sector SPDR Fund (XLU)

Table A4: Large cap Sector Rotation model performance statistics for the strategy going long favorable ETFs and short unfavorable ETFs, May 2000 – Dec 2015

	Favorable - Unfavorable Spread (%)				Hit Rate (%)			
	1 Mo	3 Mo	6 Mo	12 Mo	1 Mo	3 Mo	6 Mo	12 Mo
Model	0.53	1.85	2.56	4.47	56	63	64	68
Economic Module	0.06	0.68	1.13	1.60	53	55	58	58
Sentiment Module	0.59	1.25	0.95	2.85	59	61	56	59
Momentum Module	0.33	0.53	0.39	0.04	57	54	51	51
Fundamentals Module	0.14	1.28	2.67	4.72	53	61	63	66

[1] We use an internal sector classification system that is broadly in line with the widely accepted classification schemas.

More information

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