

# **BOTTOM-UP EQUITY SECTOR ANALYSIS**

Our portfolio design has two important cornerstones: the quantitative model which provides insights on the levels and dynamics of key economic variables related to security valuations and the investment team which interprets the model's output and provides context to the signals. Perhaps paradoxically, no quantitative modeling approach can be completely objective. The simple reality is that it takes ideas and a thorough understanding of the financial theory and mathematical techniques to develop any quantitatively based decision process. As such, all investment teams must constantly challenge themselves in a perpetual effort to improve the decision process in order to always offer the best possible investment solutions.

Our quantitative model is steeped in the extensive academic literature and enriched by the practical experience of the committee. The model output is more than a one-dimensional "buy" or "sell" signal. In fact, the model considers an extensive number of factors that are known to identify environments that favor different investment exposures. The model has been put to the test in extensive back-tests, and the committee continually scans the investment literature and the ever-increasing data points available to identify new factors and new modeling techniques. In this regard, the quantitative approach to portfolio management is "dynamic." Realizing that our approach must be dynamic and innovative, the committee continually looks for opportunities "to get smarter," or identify new factors and modeling techniques to improve our existing framework.

As we regularly do, this monthly commentary provides a preliminary review of some research results that are a byproduct of our effort to identify ways to enhance our framework. The present results are focused toward our recent research that is ongoing and primarily geared toward the Sector Rotation Portfolio. Like we did for our Country Rotation Portfolio (see our April 5, 2013 commentary), we are currently investigating the investment implications of our bottom-up analysis. This commentary is the first in a series on this topic as our research progresses. Progress by our terms is not necessarily measured by discovering viable improvements to our current framework (though that is desired), but to exhaust what we believe *a priori* might be a productive area of research. Historically, we have expended great time and effort only to end up in a proverbial cul de sac. While this can be frustrating, it is a necessary process in our vigilance to improve our decision process. It also forces us to select projects that we deem to have the highest likelihood of a desired outcome. Either way, however, we improve.

## **BACKGROUND**

Traditionally, the number of academic and practitioner studies on sector rotation has been limited. More recently, however, several academic papers on this topic have emerged. Some papers have found that the potential benefits from sector rotation strategies have increased over the past decade, since the cross-sectional sector return spread has steadily increased over time in several regions. Higher sector return dispersion creates potentially more scope for achieving excess returns from sector rotation strategies. While earlier studies, such as Heston and Rouwenhorst (1994), find that correlations between country equity indices are almost completely due to country-specific sources of return variation, rather than sectors, more recent research, such as Baca, Garbe and Weiss (2000), has found that country effects no longer dominate sector effects. In a related paper, Cavaglia, Brightman and Aked (2000) identify the increasing importance of global sector factors relative to country factors as determinants of security returns.

Previous studies on sector rotation strategies can be broadly categorized depending on whether they use a time-series or a cross-sectional approach. Typically a time-series approach uses macroeconomic variables to predict sector returns, whereas a cross-sectional approach uses sector characteristics that help differentiate between different sectors. Exhibit 1 shows an overview of studies that fall into one of the two categories with a list of factors they use to forecast sector returns as well as their main findings.

**Exhibit 1: Overview of Sector Rotation Studies** 

Study	Region	Factors Used	Findings
	Region	Factors Used	Findings
Time-Series Approach	T		
Beller, Kling &	U.S.	Term spread, default spread,	Statistically significant returns
Levinson (1998)		commercial paper minus T-Bill	of about 1.7% per month from
		spread, aggregate dividend	1981 to 1995 for a long/short
		yield, real interest rates,	portfolio
		expected inflation	
Johnson & Sakoulis	U.S.	S&P 500 dividend yield, term	Statistically significant results
(2003)		spread, oil price default spread	for each of the factors examined
Citigroup Smith	Europe	EPS forecasts, CPI forecasts,	Long/short portfolio of the five
Barney European	_	exchange rates, 3-month/10-	top ranked and five bottom
industry rotation		year interest rate, oil price,	ranked industries generated
model (2003)		commodities index, growth	average annual return of 12.3%
		minus value index, earnings	between 1995 and 2003
		beta price momentum	
Cross-Sectional Approa	ach		
Sorensen & Burke	U.S.	Price momentum	Equally weighted long-only
(1986)			portfolio based on top-ranked
` ´			stocks generated "significant"
			abnormal return over 1972-1982
			period
Capaul (1999)	MSCI	Book-to-price, earnings-to-	Mixed results over period 1990-
1.1	Developed	price, price momentum	1998
	Market	F, F	
	Universe		
O'Neal (1999)	U.S.	Price momentum	Long-only portfolios have
			higher return than S&P 500 but
			also higher risk (mixed results)
Cavaglia & Moroz	MSCI	Price momentum, dividend	Long/short portfolio based on
(2002)	World	yield, two-year EPS forecast,	factors generates average
(2002)	Universe	analyst revisions, expected long-	annualized returns between 3%
	Cinverse	term earnings growth	and 4.5% from 1990 to 2001
Citigroup Smith	U.S.	Return on equity, price	Equally weighted long/short
Barney S&P 500	0.5.	momentum, earnings-to-price,	portfolio of attractive industries
industry rotation		cash flow-to-price	and unattractive industries
model (2003)		cush now-to-price	generated an average annual
1110401 (2000)			return of more than 12% from
			1995 to 2003
Boni & Womack	U.S.	Analyst recommendation	Mixed results
(2004)	0.5.	changes	WILKOU LESUIUS
(2004)	1	Changes	

SOURCE: Innealta Capital

While these and other studies find moderate evidence of sector return predictability, the findings are generally not very strong and often depend substantially on the research design. Such sensitivity casts doubt on the robustness of some of the findings.

Despite these findings, we are convinced that we have come up with a novel and interesting approach to sector rotation, which we describe in the following sections.

#### **OUR BOTTOM-UP SECTOR ANALYSIS**

The current research described in this month's commentary illustrates our ongoing quest to expand and enhance our modeling framework. Complementing the top-down approach used in most of our modeling, we aggregate individual stock level data to a sector level in this research project. An advantage of this bottom-up analysis is that it allows us to incorporate additional information that isn't readily available on a sector level. For instance, certain accounting metrics are available at the individual firm level, but often are not available at the sector level. Additionally, working with the more granular data gives us additional control over the data and enhances our understanding of the aggregated series.

Our analysis is innovative in the sense that there are relatively few academic studies on sector rotation, as we have seen in Exhibit 1 above. Many more studies focus on cross-sectional return anomalies at the individual stock level. For example, Fama and French (1992) demonstrate that in addition to market returns there are at least two other risk factors that forecast subsequent stock returns, namely size and value. They show that over long periods of time smaller companies have outperformed their larger counterparts and companies with lower market value relative to their accounting value subsequently outperform. In other words, value stocks outperform growth stocks. According to Fama and French, these factors capture common risks across stocks: small companies are more risky than large companies and value stocks have higher distress risk than growth stocks. Investors willing to take these risks can expect to be rewarded.

Practitioners and academics also have found trends in stock returns. In their now very famous study, Jegadeesh and Titman (1993) find that stocks with high (low) past returns over the last six to twelve months tend to continue to have high (low) returns for at least another several months. This phenomenon is known as the momentum effect, which exists globally across all asset classes. Momentum's robustness makes it an important phenomenon. Momentum is present not only in the cross-section of individual securities, but also at the sector and country levels.

In addition, an extensive asset pricing research literature exists that connects many other variables as sources of excess return in the cross section. These include factors related to earnings quality, profitability, net stock issuance, seasonality and many others. A researcher faces the daunting challenge of discerning which factors are truly connected to excess returns and which are due to "back-test bias." Back-test bias arises when researchers essentially "go fishing" and search the historical record for relations. Even though a relation may be evident in the historical record, this does not imply that the relation will hold in the future. Instead, it may be that some other unobserved or unknown variable accounted for the back-test result. Additionally, relations between economic variables and excess returns may be dynamic, changing through time or across market conditions. In this context, it is important to remember the role of economic theory. Without sound intuition backed by economic theory, a researcher risks falling into the data mining trap.

While these factors have been examined extensively on an individual stock level, very few studies aggregate individual security-level metrics, such as momentum or accounting ratios, to the broader sector level in a tactical strategy. We view these cross-sectional studies as an opportunity to apply our modeling skills to the sobering number of potential variables purportedly related to excess returns. Our objective is to combine the

richness of the individual security level data with our tactical strategies. Doing so allows us to harness the information in a broader set of variables, enabling us to obtain a more complete view of the investment landscape. With this motivation in mind, we now turn to analysis of individual security level data.

## **Sources of Excess Return**

We begin the exploration by examining a broad variety of fundamental and technical characteristics. We construct metrics by grouping different characteristics to capture the operating performance and share price behavior of a company, the financial market environment and the opinions of market participants. Taken together these composite, or grouped, metrics comprise a diverse set of return sources and provide information about companies' expected excess returns.

The components that we use to build the composites are well defined, empirically validated variables that have been shown to exhibit reliable predictive power at the individual stock level. Our objective is to examine whether these factors can be used to identify different investment environments on a sector level as well. That is, we would like to use these factors to decide which market sectors to overweight and underweight in our sector strategy.

In any empirical analysis one has to be vigilant about data mining, or finding spurious relationships that exist purely due to chance and therefore should not be extrapolated into the future. To avoid data mining we only use characteristics that are sensible and intuitive drivers of stock returns and that are based on sound economic theory. Moreover, we require our return factors to be robust in the sense that they are effective in different economic environments and sub-periods. While the strength of the return factors may differ along those dimensions, the basic economic principles should always hold. This approach is consistent with those we used to develop the existing framework. Since the genesis of our framework, we have remained extraordinarily sensitive to the quantitative trap of data mining. Examples of investment professionals falling into this trap, which corrupts investment discipline, are prevalent throughout our industry. We are adamant about sound financial theory forming the foundation of our framework. The temptation of "what would've worked last quarter?" will never pollute our conceptual foundations.

The fundamental characteristics that we examine can broadly be classified into the following factor types:

- Valuation (Value): Valuation compares a stock's market price with its intrinsic value measured by accounting information. Value stocks, or low-priced stocks, tend to outperform growth stocks, which are often perceived by investors as more "glamorous" and therefore tend to be overvalued. We measure the intrinsic value of a company using a variety of different metrics that are generally available on an individual company level only.
- Operating Efficiency (Op Eff): Equity investors often place too much emphasis on companies'
  growth potential and ignore less "glamorous" companies with lower growth, but higher profit margins
  and cash generating ability. A host of empirical research has shown that companies with superior
  bottom-line performance tend to outperform companies in a high-growth phase, but lower return on
  investment.
- Quality: In addition to the level of earnings relative to capital invested (Operating Efficiency), we can decompose earnings into a cash component, which tends to be fairly stable over time, and a more transitory accrual component, which is more difficult to measure and therefore more subject to manipulation. As a result, the higher the accrual component of earnings is relative to the cash component, the lower the quality of earnings and the poorer a company's future prospects will be.
- Management Behavior (Mgmt): This factor type captures management's informational advantages relative to outsiders (investors) as well as managerial biases and self-interests. Managers

possess superior information than outside investors regarding the company's future earnings and, thus, its fundamental valuation. In this context, referred to as asymmetric information, investors infer signals from managers' actions, such as the choice of external financing. Under asymmetric information, managers choosing to issue shares are those having the worst private information regarding future earnings. Thus, an equity issuance is perceived as a negative signal. In contrast, a share repurchase is perceived as a positive signal of management's private information. Moreover, company management often has an incentive to use the firm to serve their own self interests. For example, managers may extract private benefits (use of the corporate jet), or engage in empire building rather than maximizing shareholders' value. Hence, companies sometimes overinvest and use excessive debt. Management Behavior type factors capture these as well as other indications of management's motivations.

- Momentum (Mom): Factors of this type capture trends in stock returns that may be due to investors underreacting to new information about companies. As news is gradually incorporated into a stock's price, we see trends over various horizons. It may also partly be due to herding among institutional investors. Trends in stock returns can be observed at various frequencies and there is a seasonal component to these trends as well. A comprehensive investigation of these effects nicely complements the momentum factor that we already are using in our models. Valuation and Momentum are naturally diversifying as they are negatively correlated, but both generate positive returns on average. As a result, the intersection of value and momentum is more effective than each factor individually.
- Volatility (Vol): Previous academic and practitioner research has shown that for a variety of
  reasons high current volatility/risk is associated with low future returns on an individual stock level
  (see, for example, Ang, Hodrick, Xing and Zhang (2006)). Moreover, different effects have been
  known to exist for total risk and company-specific risk. Using company-specific risk aggregated to the
  sector level in order to identify different investment environments complements our existing model.

We should point out that all factors examined carry some risk as they are systematic risk factors as well as return drivers. However, our objective is to find those factors that exhibit a particularly attractive risk-return trade-off. Moreover, we would also like to find a set of diverse factors in the sense that each captures different and complementary attributes such that the correlation between factors is generally low. Combining multiple factors provides a broad and diverse set of information on which to base our analysis of equity return environments.

While researchers have mostly examined and rationalized these factors on an individual stock level, the economic intuition outlined above applies similarly if these factors are aggregated to a sector level and subsequently used to overweight and underweight sectors in a portfolio.

Since sectors differ in nature, some of the raw factors we examine may not be directly comparable between sectors. For example, Financial Services companies tend to have considerably higher levels of leverage (i.e. total assets, including debt, relative to shareholders' equity) than companies in other sectors, such as Consumer Discretionary or Utilities. The higher levels of leverage are due to the nature of the industry and unrelated to the Financial Services sector being overvalued or undervalued relative to other sectors. In order to make our fundamental bottom-up factors comparable between sectors, we "normalize" factor exposures first for each sector and then compare the normalized exposures across sectors, as opposed to the raw exposures.

Not only do sectors differ in nature, but the influence of any given factor likely varies across sectors as well. Thus, some factors may be important for one sector, but not another. The first step in our research is to begin expanding our horizons by incorporating the additional cross-sectional variables. In the next step (a topic for

future commentary), we will apply filters that are guided by financial theory and sound judgment, to build sector-specific composites. By including the factors most relevant to each specific sector, our objective is to sharpen the information content and reduce the noise (i.e. marginalize the influence of factors that are least applicable to a particular sector while increasing the influence of the most influential). Such an approach should enhance our ability to identify investment environments and supplement our tactical signaling.

To normalize factors, we compute a sector's current factor exposure, such as a sector's book-to-price ratio (book value of a company relative to its market value), relative to its average historical factor exposure (measured over the last ten years). As a result, for each of the factors we examine as return predictors we compute the deviation of each sector's factor exposure from its long-term mean or equilibrium level.

To provide further intuition, consider leverage. The financial sector tends to be heavily leveraged. The fact that a sector uses a high level of leverage, per se, may not be a sign that the sector is over- or undervalued, but instead stems from the specific industry's organizational structure and the nature of the firms' assets. However, a sector's leverage far above or below its mean, which proxies for the equilibrium level, may indicate that the sector is over- or undervalued relative to other sectors.

The factor normalization approach is used to make return factors comparable across sectors. This approach makes economic sense and it also improves our sector rotation strategy substantially.

## **Back-Test Design**

We run our historical simulations (or back-tests) using monthly portfolio rebalancing.¹ Each month and for each factor we compare sector factor ranks over our entire cross-section of sectors included in our U.S. Sector Rotation Strategy. We equally weight all sectors in our portfolio with factor ranks exceeding a certain threshold. The remainder of the portfolio is invested in U.S. domestic bonds (the Barclays Aggregate). Not surprisingly, this is very similar to how we manage our Rotation portfolios. The sector composition within the equity portion changes over time depending on the stability of the factor that we use to identify the return environments for each sector. In other words, if the information contained in a factor is updated frequently, then the sector factor ranks are likely to change frequently, resulting in higher turnover within the equity portion of our portfolio. Initially, we build one portfolio for each factor and then examine the performance of each factor portfolio over time.

In a second step, we examine correlations between factors in order to evaluate how much overlapping information they contain. If two factors have low (or even negative) correlation, then they tend to complement each other well (i.e. each of them adds information that is not already captured by the other factor). In fancy terms, orthogonality across factors is important. It ensures that we are minimizing overlap across actionable information in terms of investments. This characteristic has been at the heart of our framework since its genesis. By having multiple orthogonal criteria we can better span the information set and distinguish between what is superfluous and what best assists with identifying different investment environments.

#### **Back-Test Results**

Exhibit 2 shows a list of the factors (and factor types from above) that exhibit particularly promising results in terms of their performance. We present performance information for our entire sample period (1999-2013) as

<sup>&</sup>lt;sup>1</sup> Note that we are extremely careful regarding data availability and in-sample phenomena. Great care has been taken to ensure that the analysis does not violate any econometric or theoretical assumptions.

well as three sub-periods.<sup>2</sup> As we need to preserve the proprietary nature of our model while still giving as much detail as possible, we only name the factor types and refer to the individual factors within each category simply as Factor1, Factor2, etc. To provide some intuition, but without giving away the secret recipe, consider a potential factor such as financial leverage. Leverage proxies for risk, and as such, high leverage may be associated with greater volatility. Such an environment might not provide an attractive tradeoff between risk and excess returns.

The first panel shows annualized active portfolio returns over and above our benchmark, which is a static blend of U.S. sector equity returns and U.S. domestic bonds. The second panel shows the corresponding active risk of these portfolios. Annualized active returns per unit of risk, commonly known as information ratios, are shown in the third panel.

Exhibit 2: Performance of Factors (1999–2013)

Annualized Active Returns		Last 3 years	Last 5 years	Last 10 years	Since Inception
Value	Factor1	1.44%	1.62%	0.83%	0.14%
Op Eff	Factor1	1.60%	1.95%	1.74%	1.83%
Op Eff	Factor2	1.37%	1.25%	0.96%	1.16%
Op Eff	Factor3	0.83%	0.25%	0.88%	1.35%
Op Eff	Factor4	1.12%	1.08%	0.88%	1.31%
Op Eff	Factor5	0.77%	1.55%	1.21%	1.75%
Op Eff	Factor6	1.66%	2.01%	1.79%	1.93%
Op Eff	Factor7	0.79%	0.73%	1.17%	1.64%
Op Eff	Factor8	0.14%	0.07%	0.61%	1.30%
Quality	Factor1	0.66%	0.12%	0.53%	1.46%
Mgmt	Factor1	0.74%	1.98%	1.74%	2.41%
Mgmt	Factor2	1.63%	0.72%	0.98%	2.02%
Mgmt	Factor3	0.36%	0.48%	0.77%	1.48%
Mgmt	Factor4	1.45%	1.80%	1.28%	1.73%

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<sup>&</sup>lt;sup>2</sup> Note that while we have data going back to the end of 1980s, we need ten years of data to compute our mean/equilibrium factor level which the current factor exposure is measured against for each sector. Therefore, our back-test period begins in 1999

Exhibit 2: Performance of Factors (1999–2013) (cont.)

Annualized Active Risk		Last 3 years	Last 5 years	Last 10 years	Since Inception
Value	Factor1	1.87%	2.22%	1.91%	2.70%
Op Eff	Factor1	1.92%	2.11%	2.10%	2.38%
Op Eff	Factor2	1.79%	2.38%	1.91%	2.27%
Op Eff	Factor3	1.70%	1.98%	1.80%	2.24%
Op Eff	Factor4	1.60%	2.08%	1.94%	2.38%
Op Eff	Factor5	1.76%	2.72%	2.29%	2.77%
Op Eff	Factor6	1.76%	2.06%	1.78%	2.29%
Op Eff	Factor7	1.83%	2.37%	2.01%	2.78%
Op Eff	Factor8	1.34%	2.00%	1.80%	2.60%
Quality	Factor1	1.57%	1.97%	1.80%	2.80%
Mgmt	Factor1	2.08%	2.16%	1.89%	3.07%
Mgmt	Factor2	1.39%	1.74%	1.73%	2.59%
Mgmt	Factor3	1.80%	2.04%	1.70%	2.92%
Mgmt	Factor4	1.83%	1.90%	1.75%	2.41%

Information Ratio		Last 3 years	Last 5 years	Last 10 years	Since Inception
Value	Factor1	0.77	0.73	0.44	0.05
Op Eff	Factor1	0.83	0.92	0.83	0.77
Op Eff	Factor2	0.77	0.53	0.50	0.51
Op Eff	Factor3	0.49	0.13	0.49	0.60
Op Eff	Factor4	0.70	0.52	0.45	0.55
Op Eff	Factor5	0.43	0.57	0.53	0.63
Op Eff	Factor6	0.94	0.97	1.01	0.84
Op Eff	Factor7	0.43	0.31	0.58	0.59
Op Eff	Factor8	0.10	0.03	0.34	0.50
Quality	Factor1	0.42	0.06	0.30	0.52
Mgmt	Factor1	0.36	0.92	0.92	0.79
Mgmt	Factor2	1.17	0.42	0.57	0.78
Mgmt	Factor3	0.20	0.24	0.45	0.51
Mgmt	Factor4	0.79	0.95	0.73	0.72

SOURCE: Innealta Capital

The annualized active returns presented in Exhibit 2 look very promising. Spanning all time horizons, and across all factors, the average annual returns are positive. This indicates that relative to the passive portfolio that is a blend of U.S. stocks and U.S. bonds, sector portfolios formed based on any of the individual factors we considered exhibit higher returns relative to the benchmark. The size of the performance gap varies across the factors. For the value factor, since inception the active return is only 14 basis points annually. Among other factors, such as Operating Efficiency Factor 6 and Managerial Factors 1 and 2, the annual active returns have been quite large, ranging from 193 basis points to 241 basis points.

Referring to the next panel, which presents annualized active risk of the portfolios based on the individual factors, we see the annualized active risk to the factors generally have been low. The tradeoff between returns and risk are important in our portfolio context. Thus, it is important to view the returns discussed above in the context of the risk taken to achieve these returns. For this reason, we next present the information ratios, which are the ratios of the active returns to the active risk.

As can be seen in Exhibit 2, all factors exhibit consistent performance across all periods at relatively low levels of risk. This leads to strong (high) information ratios, or risk-adjusted returns. On a risk-adjusted basis, nearly all portfolios based on the individual factors exhibit strong performance during the back-test period, over the multiple horizon lengths presented. Several stand out. Specifically, Operating Efficiency Factor 6 achieves the highest information ratio, at 0.84 units of active return per unit of active risk across the full period. With the exception of the Value factor, all factors have information ratios ranging from 0.50 to 0.84, which are promising both in size and in consistency.

Depending on the factor type and how frequently the information used to compute the factor changes, the factor portfolio turnover ranges from about 50% per year to more than 400% per year. While higher turnover causes higher trading costs in real portfolios, our utilization of ETFs allows us to marginalize or greatly reduce transactions costs associated with turnover. Additionally, a sound quantitative investment strategy does not consider one factor in isolation. Thus, although the turnover numbers can be quite high on an individual basis, when we proceed to form composites of multiple factors, averaging across multiple factors will reduce the portfolio turnover. As a result, while our analysis examines so-called "paper portfolios," which ignore trading costs, we know that the expected returns substantially exceed realistic trading cost estimates.

Exhibit 3: Average Factor Exposure Correlations over Time (1999–2013; by Factor Type)

		Value	Op Eff	Quality	Mgmt	Mgmt	Mgmt	Mgmt							
		F1	F1	F2	F3	F4	F5	F6	F7	F8	F1	F1	F2	F3	F4
Value	F1	1.00	0.02	-0.02	-0.02	-0.02	0.34	0.05	0.22	0.06	0.08	0.15	0.13	0.11	0.22
Op Eff	F1		1.00	0.62	0.30	0.49	-0.15	0.95	0.21	0.52	-0.41	0.23	0.25	0.04	0.17
Op Eff	F2			1.00	0.43	0.73	-0.11	0.61	0.09	0.61	-0.49	0.11	0.17	-0.18	-0.02
Op Eff	F3				1.00	0.38	-0.15	0.29	0.05	0.57	-0.25	0.33	0.12	0.16	0.09
Op Eff	F4					1.00	-0.08	0.50	0.07	0.64	-0.45	0.19	0.19	-0.02	0.10
Op Eff	F5						1.00	-0.17	0.44	-0.17	0.06	0.03	0.09	0.05	0.16
Op Eff	F6							1.00	0.20	0.54	-0.40	0.19	0.25	0.01	0.15
Op Eff	F7								1.00	0.27	0.08	0.29	0.27	0.26	0.21
Op Eff	F8									1.00	-0.27	0.43	0.38	0.21	0.13
Quality	F1										1.00	0.11	-0.05	0.27	0.01
Mgmt	F1											1.00	0.51	0.85	0.32
Mgmt	F2												1.00	0.46	0.25
Mgmt	F3													1.00	0.29
Mgmt	F4														1.00

SOURCE: Innealta Capital

Exhibit 3 shows the average factor exposure correlations over time for the same factors. Referring to the Exhibit, factors within a certain factor type tend to have relatively high positive correlations that often exceed 0.5. As expected, these factors contain quite a lot of overlapping information. Examining the correlations of factors across categories generally reveals substantially lower correlations, consistent with the interpretation that they tend to capture distinct sources of information. One notable example is the negative correlation that can be observed between the Quality factor and several of the Operating Efficiency (Op Eff) factors. These factors tend to be naturally diversifying so that if they are combined in a portfolio they tend to produce relatively low-risk diversified returns.

In addition to factor performance, factor correlations are one of the main criteria we use to decide which factors to combine into composites. Based on the information shown in Exhibit 2 and Exhibit 3, we decided to form seven composite factors that each combines two or more of our individual factors. The objective behind forming

composites is to come up with "super-factors" that have more attractive risk/return properties than individual factors and that are more diversified. As a result, we greatly reduce much of the noise normally associated with time series data.

Correlations also help with eliminating redundancy across factors and composites, thereby enabling us to avoid the "kitchen sink" approach, which is steeped with theoretical and practical issues. Occam's Law is extremely important within any investment process—simplicity and straightforward interpretation are key characteristics.

Exhibit 4 shows performance information for the seven composites during the entire sample period (1999-2012) as well as three sub-periods. The table follows the same format as Exhibit 2.

Exhibit 4: Performance of Composite Factors (1999–2013)

Annualized Active Returns	Last 3 years	Last 5 years	Last 10 years	Since Inception
Composite 1	0.46%	1.63%	1.50%	1.98%
Composite 2	1.27%	1.32%	1.39%	1.97%
Composite 3	1.57%	1.87%	1.36%	1.57%
Composite 4	0.84%	1.10%	0.85%	1.06%
Composite 5	1.51%	1.57%	1.12%	2.04%
Composite 6	1.51%	1.62%	1.36%	1.68%
Composite 7	0.96%	0.69%	0.57%	0.99%
Annualized Active Risk	Last 3 years	Last 5 years	Last 10 years	Since Inception
Composite 1	1.69%	2.31%	2.06%	2.56%
Composite 2	1.85%	2.20%	1.93%	2.77%
Composite 3	1.95%	2.12%	2.04%	2.39%
Composite 4	1.44%	1.89%	1.81%	2.20%
Composite 5	2.17%	2.72%	2.21%	2.92%
Composite 6	1.59%	1.89%	1.87%	2.76%
Composite 7	1.74%	2.03%	1.69%	2.43%
Information Ratio	Last 3 years	Last 5 years	Last 10 years	Since Inception
Composite 1	0.27	0.71	0.73	0.77
Composite 2	0.68	0.60	0.72	0.71
Composite 3	0.81	0.89	0.67	0.66
Composite 4	0.58	0.58	0.47	0.48
Composite 5	0.70	0.58	0.50	0.70
Composite 6	0.95	0.86	0.73	0.61
Composite 7	0.55	0.34	0.34	0.41

SOURCE: Innealta Capital

As can be seen in Exhibit 4, all factor composites show stable active returns over time with limited risk. This is reflected in very attractive information ratios, which are close to one in a few cases. An information ratio of one means that for each unit of risk we are compensated with the same unit of return.

Exhibit 5 presents a graph of the cumulative factor composite performance over time. The plots confirm visually the favorable historical return performance of the positive active returns to the composites. First, visual inspection reveals generally positive slopes. Positive slopes indicate the returns are steady and consistent through time, as opposed to specific to one outlying observation.

While periods of drawdowns exist, all factors added significant value over time. Drawdowns usually occur during periods of irrational investor behavior or market turmoil in general, such as the Tech Bubble of 1999/2000 and the Global Financial Crisis during the fall of 2008. However, each time our factor composites experienced a significant drawdown, there was a strong rebound shortly afterwards.

0.35 0.30 0.25

Exhibit 5: Cumulative Active Returns of Factor Composites (1999–2013)



SOURCE: Innealta Capital

Exhibit 6 shows the maximum drawdowns that each of the factor composites experienced over our sample period from 1999 through 2013 compared to a U.S. equity investment. The maximum drawdowns range from about 20% to 25%, while an investment in U.S. equities would have experienced a drawdown of almost 55%.

Exhibit 6: Maximum Drawdowns (1999–2013)

	Maximum Drawdown
Composite 1	24.7%
Composite 2	23.1%
Composite 3	20.9%
Composite 4	25.2%
Composite 5	24.0%
Composite 6	23.8%
Composite 7	24.2%
U.S. Equity Market	54.9%

SOURCE: Innealta Capital

As a result, if we had invested using the factors shown above over the last 15 years, the maximum drawdown of this investment would have been less than half the maximum loss incurred in a passive U.S. equity strategy over the same period. At the same time we would have achieved higher risk-adjusted returns than the U.S. equity market.

## SUMMARY AND CONCLUSION

Our bottom-up sector rotation research provides one example of new sources of excess return that we are looking to incorporate into our existing portfolios. We are currently considering different ways to incorporate these factors with our existing sector rotation model. We know already that the new factors provide strong independent sources of return, which can be expected to further enhance the risk/return profile of our Sector Rotation Portfolio. Whilst we are planning to make these model enhancements in due course, our research in this area is ongoing as we are trying to stay ahead of the curve in order to continue generating superior performance for our clients.

Continuing with our research agenda, our next research project will consider certain factors for specific sectors only. In other words, we are planning to examine sector-specific factors. Up to now our focus has been to use the same factors, such as certain value or operating efficiency factors for all sectors. However, since each sector differs by nature, there is scope, supported by sound economic rationale, for examining particular factors that are influential to certain sectors only. To illustrate, an obvious example is that one of the main economic drivers of the airline industry's performance is the price of jet fuel, which is highly correlated with the price of crude oil. While the oil price is a crucial factor for airlines, driving much of the cost structure and affecting margins, other sectors are not as directly affected by this factor.

Among the factors that we have tested so far, we already have seen differing performance patterns across sectors that are quite consistent over time. The next step in our sector research will build upon these findings in an attempt to exploit them on an individual sector level. Some of the differences we see between sectors are phenomena that we had suspected before based on our experience, but we have only obtained a clear picture of them now that we formally investigated the effects. This is an example of how our research hypotheses are guided along the way as we investigate economic behavior more closely. The research process is a constant interplay between empirics and theory. We must first empirically validate our a priori expectations, and this first phase of the research has done just that. Now we begin the next phase of our research, which will include testing investment structures that are more sophisticated and that coincide more and more closely with our current products. We hope to share these results with you as well in coming months.

Our sector-specific research is an exciting area that holds a lot of promise. As few people have investigated sector-specific factors in a systematic way, we will be expanding our efforts to largely uncharted territory. It is a perfect example of the cutting edge research which is crucial to stay ahead of our competition.

## **PORTFOLIO UPDATE**

Recent decisions in regard to the use of the extra collateral within our Risk-Based Opportunity Portfolios have included incremental additions to target exposures to a leveraged inverse (short) Europe exposure, the initiation of a long exposure to expectations for short-term market volatility and a round-trip long investment in U.S. Gold Miner equity.

As noted last month, on April 24 we added a two-times (2x) inverse European market exposure (via the ProShares UltraShort MSCI Europe ETF, ticker: EPV) to the Risk-Based Opportunity portfolios. The weights in the Conservative, Moderate and Growth portfolios were 3%, 4% and 5%, in that order. We added 1% to the target for each of those positions on April 29 and again on May 3.

On May 6, we initiated a position in the ProShares VIX Short-Term Futures ETF (VIXY), which seeks to reflect changes in expectations for short-term equity market volatility. Initial portfolio weights were 3%, 4% and 5%, in the Conservative, Moderate and Growth portfolios, in that order. On June 3, we exited the position, having seen a total return of 7.95% across the portfolios we directly manage, which equates to a 177% annualized total return.

Finally, on May 14 we purchased an unleveraged long position the U.S. gold mining equity space via the Market Vectors Gold Miners ETF (GDX) at weights of 2%, 3% and 4% in the Conservative, Moderate and Growth portfolios, respectively. We added 1% to the target for each of those positions on May 17 and exited the position on May 30. Across the portfolios we directly manage, the total return for the trade was 5.2% over the holding period, which equates to a 212% annualized total return.

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