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The Benefits of Dynamic Factor Weights

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3Q 2009

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The AIP U.S. Equity Investment process is predicated on a fundamental belief in active management. However, no static, single “one-size-fits-all” approach to stock selection can be applied across all stocks under all market conditions. The success of our active investment process relies on four important conceptual building blocks.

1) Definable market segments should be evaluated independently

Definable market segments – such as the large cap growth style segment or the technology sector – have distinct dynamics. Therefore, each stock is independently evaluated relative to the overall universe, its size/style category, and its economic sector to yield a more accurate composite return expectation.

2) A spectrum of valuation factors is critical

Stock returns are driven by a variety of factors. Therefore, a diverse set of stock selection metrics needs to be considered for more robust return expectations and more consistent results.

3) Factor weights should be dynamic

Individual stock selection metrics exhibit variation in their ability to forecast returns through time. Thus, factor weights are systematically adapted to evolving patterns of effectiveness.

4) Optimization is the best way to construct portfolios

Careful portfolio construction goes hand-in-hand with individual stock selection. Therefore, return expectations must be captured as active portfolio risk, whereas unintended active risks should be minimized.

Our intent is to outperform targeted equity benchmarks by using a series of quantitative stock selection models to systematically differentiate between attractive and unattractive stocks; carefully managing portfolio risk relative to the benchmark using equity risk models; and ensuring every trade will improve the portfolio's expected risk/return profile after accounting for anticipated transaction costs.

With the recent economic, financial and market challenges, the last few years have been difficult for all investors. We have experienced the subprime mortgage crisis, the corporate credit crunch, the quant liquidity crunch, and ultimately, a global economic crisis. For quantitative investors, these disruptions led many standard stock selection factors to experience considerable volatility in their effectiveness, and frequently to cease working as typically expected for extended periods of time.

Some say we're in a new normal while others caution us against thinking things are going to be different this time. So which is it – new normal, same-old-same-old, or something in between?

The necessity for successful investors to have an answer to this proposition is one reason we believe factor weights should be dynamic – inherently adapting to evolving market dynamics.

AIP's Dynamic Factor Weighting Approach

We generate a relative return expectation for each security using a combination of three independent quantitative analyses: Broad Universe – valuation relative to all stocks in the investment universe; Style Specific – valuation relative to all other stocks with the same combined market capitalization and style profile; and Sector Specific – valuation relative to all other stocks in the same economic sector.

Each analysis is designed to provide a slightly different valuation perspective. These three analyses act as multiple experts and because they are not perfectly correlated, the robustness and accuracy of the combined composite expectation exceeds the skill of any one single analysis. Those stocks with higher (lower) relative return expectations are considered strong buy (sell/avoid) candidates. This approach of relying upon multiple analyses provides a quality check on the reliability of our expectations, similar to the age-old convention followed by carpenters, “measure twice, cut once”.

Within each of the analyses' models, the emphasis (weight) assigned to the underlying stock selection factors vary through time, based on the evolving association of that factor with observed stock returns. As factors drift into (out of) favor, the weight applied to the factor will be increased (decreased) to reflect prevailing trends. If a factor is currently out of favor, we may assign a negative weight (i.e., go “short” that factor) even if the long term average return to the factor is positive. We believe this willingness to bias against a factor is a key differentiator of our process relative to other quant processes, and that the dynamic weighting process is an important contributor to our models' success.

There are three distinct stages to our process of dynamically weighting stock selection factors within each of the Broad Universe, Style Specific and Sector Specific models.

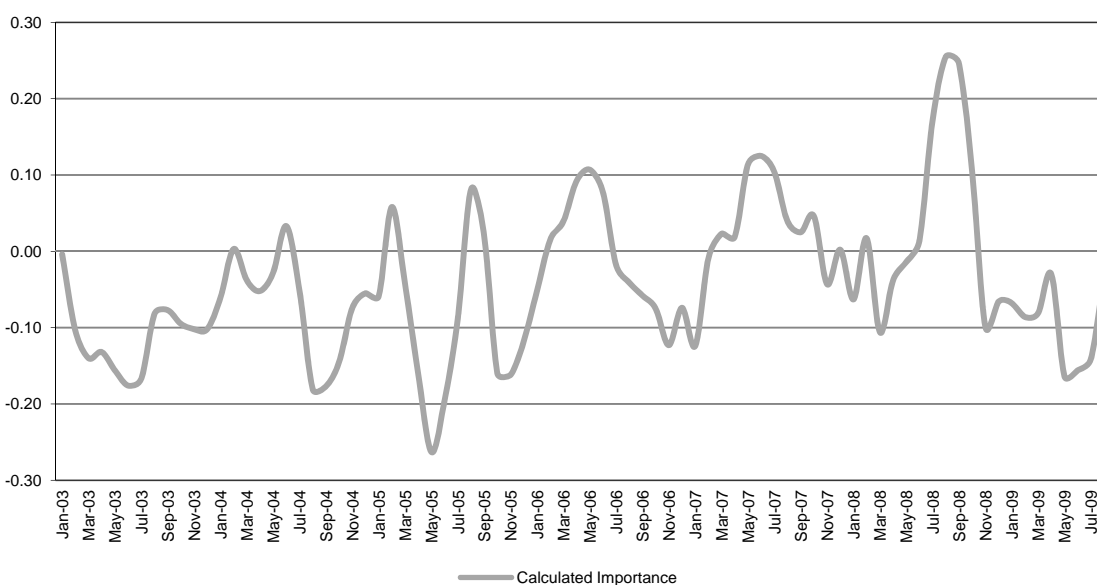
Stage 1

The first stage of the process calculates each factor's historical importance in estimating stock returns through time. This stage segregates the data history into weekly slices, with each slice containing factor values and one quarter subsequent returns for every stock relative to the Russell 3000 Index. Using regression techniques, the importance of each stock selection factor in explaining stock returns is determined for each of the Broad Universe, Style Specific and Sector Specific models.

These calculated measures of individual factor importance represent the contribution every stock selection factor has made towards estimating each stock's relative return over time for each model. Figure 1 displays the calculated importance of our Entropy factor (a metric related

to market capitalization bias) within the Broad Universe model. What we have observed over the time period is a fluctuating, but typically association between Entropy and stock returns; i.e., smaller cap stocks have generally – but not always – yielded better returns than larger cap stocks.

Figure 1: Entropy



Stage II

We now know how the factors contributed in the past. The objective of the second stage is to forecast the expected relative importance of each stock selection factor for the upcoming time period based upon the history of factor importance as determined within Stage I. Many approaches to dynamically determining valuation factor importance simply use the most recent period's calculated relative factor importance as the forecast for the factor's expected importance during the coming period. This naïve approach does not take into account prevailing trends in factor importance (i.e., has the factor's return been rising or falling). Forecasts of a factor's importance can be greatly improved when you consider what the factor has done recently and where it appears to be trending.

To begin the forecasting of factor importance, Stage II collects the time series of historical importance for each valuation factor for a trend analysis. As seen with the Entropy factor in Figure 1, the time series of a factor's importance typically follows an evolving cycle with choppy movements from one time segment to the next. Our factor importance forecasts use an algorithm which evaluates the last three years of calculated importance with a rising level of influence up to 13 weeks ago, thereby capturing the longer-term momentum in factor importance, and then a constant level of influence up to the present week. This rising scheme

for weighting the factor's time series of importance during Stage II forecasting is referred to as the Trapezoid Weighting Scheme (see Figure 2).

Figure 2: Trapezoid Weighting Scheme

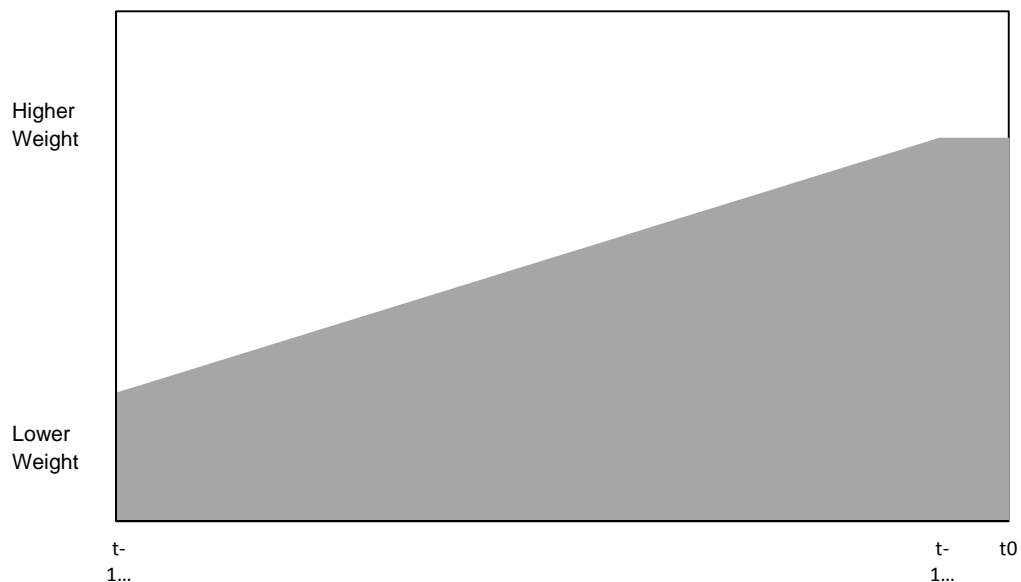
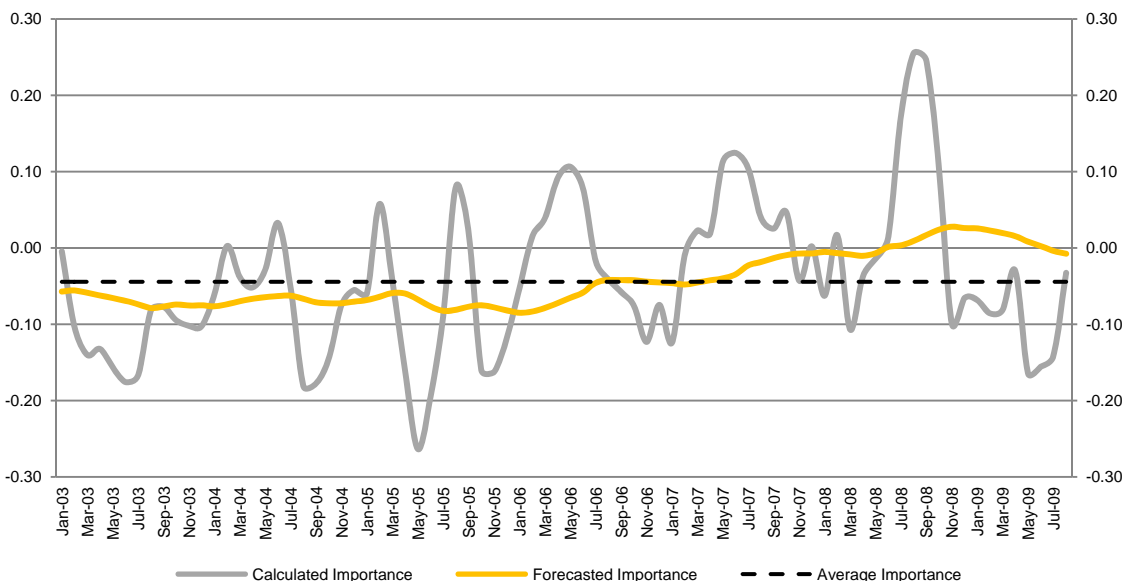


Figure 3 overlays two additional lines on Figure 1's Entropy importance chart: a dashed line showing the average importance and a second solid line that represents our forecasted importance for Entropy over time. What you see is that the forecasted factor importance is a much smoother cycle without attempting to mimic the choppy nature of the actual calculated importance through time. This smoother evolution of a factor's forecasted level of importance results in greater consistency in attractiveness assessments from one period to the next, which also results in lower levels of resultant portfolio turnover. Therefore, we are able to enhance valuation accuracy by capturing the underlying signal embedded within the factor's evolving importance, while not overreacting to the unprofitable, noisy step-wise progression through time.

Figure 3: Entropy



The dashed line displaying Entropy's average importance captures the negative association with stock returns and the general outperformance of smaller cap stocks over this time period. Thus, a more static approach to forecasting this factor might yield a steady bias towards smaller cap stocks. However, our dynamic forecasting process led to a smaller than average bias up until mid-2006, and then a steady upward bias until larger cap stocks were preferred by mid-2008 as represented by the forecasted importance being positive. Currently, the model's Entropy – or market cap bias – is rather neutral with a forecast around zero.

Stage III

The final stage, Stage III, generates the attractiveness rating for each stock, which will be used for making stock selection decisions. From Stage II we have the forecasted level of factor importance for each factor for the upcoming time period to be used in determining each stock's rating within each of the Broad Universe, Style Specific and Sector Specific models. Each stock is rated by multiplying its factor exposures by each factor's predicted importance and then summing these values to compute the stock's composite attractiveness rating for each model. This calculation is made for each stock which results in the rating of all stocks from most attractive to least attractive within the Broad Universe, Style Specific and Sector Specific models. And finally, the three model ratings are combined to form our overall assessment of the attractiveness of each stock.

Over time, this dynamic scheme for forecasting valuation factor importance has been superior to the alternative approach of relying upon static expectations of factor importance through time. Given the challenging environment of the last couple of years, let's compare the results of two alternatives – dynamic versus static factor weights.

Dynamic vs. Static Factor Weights: July 2007 – September 2009

Throughout our research, we have consistently found that dynamically weighting stock selection factors has been superior to a static factor weighting approach. Given the market challenges that have been incurred since mid-2007, it is instructive to assess how our dynamic weighting approach held up during this period of volatility.

As discussed previously, we assess the relative attractiveness of securities by performing three independent analyses from three perspectives – Broad Universe, Style Specific, and Sector Specific – then combine the analyses for a single composite measure for selecting stocks. So let's look at how each of these three analyses fared on a real time basis with dynamic factor weighting versus the results that would have been realized if we maintained static, equal-weighting for the July 2007 through September 2009 time period. Focusing on our LargeCap stock universe (the approximately 600 largest market cap stocks within the U.S. market), Table 1 summarizes each model's results using dynamic and static factor weights.

Table 1
Stock Selection Model Results
Universe: LargeCap
Time Period: July 2007 through September 2009

	Dynamic Factor Weights				Static Factor Weights			
	Average IC	IC T-stat	Average Monthly Top/Bottom Spread	Average Annual Top & Bottom Turnover	Average IC	IC T-stat	Average T/B Monthly Top/Bottom Spread	Average Annual Top & Bottom Turnover
Broad Universe	0.04	1.13*	5.51	70.16	0.01	0.15	3.71	72.72
Style Specific	0.05	1.92***	5.18	76.73	0.01	0.49	2.88	79.60
Sector Specific	0.03	1.57**	1.85	68.34	0.01	0.85*	1.31	80.64

* p > 0.25

** p > 0.10

*** p > 0.05

**** p > 0.01

Each one of our stock selection analyses benefitted from a dynamic approach to factor weighting during the period under review. Furthermore, the improved information coefficients (IC) and Top/Bottom Spreads came with no increase in underlying turnover.

Within the Style Specific and Sector Specific analyses there are component analyses for each Style and Sector market segment. Table 2 provides a summary for each of the Style Specific component models.

	Dynamic Factor Weights				Static Factor Weights			
	Average IC	IC T-stat	Average Monthly Top/Bottom Spread	Average Annual Top & Bottom Turnover	Average IC	IC T-stat	Average T/B Monthly Top/Bottom Spread	Average Annual Top & Bottom Turnover
Style Specific	0.05	1.92***	5.18	76.73	0.01	0.49	2.88	79.60
Larger Cap Value	0.07	2.27***	6.52	83.71	0.02	0.89*	3.83	88.14
Larger Cap Growth	0.06	2.50****	1.47	77.94	0.03	1.39**	0.52	64.41
Smaller Cap Value	0.03	0.81*	0.55	74.43	-0.01	-0.33	-0.77	87.03
Smaller Cap Growth	0.05	2.11***	1.46	77.15	0.01	0.31	0.07	87.99

* p >0.25

** p >0.10

*** p >0.05

**** p >0.01

For each one of the Style Specific component models – where a stock’s attractiveness is assessed relative to its own cap/style peer segment – our dynamic weighting approach provided material improvements throughout. Once again the model improvements did not come at the expense of materially greater turnover.

Table 3 provides a summary for each of the Sector Specific component models.

Time Period: July 2007 through September 2009

	Dynamic Factor Weights				Static Factor Weights			
	Average IC	IC T-stat	Average Monthly Top/Bottom Spread	Average Annual Top & Bottom Turnover	Average IC	IC T-stat	Average T/B Monthly Top/Bottom Spread	Average Annual Top & Bottom Turnover
Sector Specific	0.03	1.57**	1.85	68.34	0.01	0.85*	1.31	80.64
Consumer Durables	0.02	0.58	1.08	79.22	0.02	0.68	1.67	83.83
Consumer Staples	0.03	0.80*	1.26	59.32	0.01	0.22	-0.24	89.99
Energy	0.03	1.01*	2.02	57.56	-0.01	-0.26	0.59	78.85
Financials	0.02	0.46	0.65	70.21	0.02	0.47	1.16	84.27
Health Care	0.05	1.51**	0.89	89.73	0.02	0.90*	0.48	89.98
Industrials	0.03	0.84*	1.86	98.69	0.05	1.96***	0.60	88.21
Materials	0.08	2.33***	4.63	63.06	0.05	1.65**	1.14	92.22
Retail Trade	-0.05	-1.36**	1.01	57.52	-0.03	-1.07*	1.45	69.28
Services	0.01	0.30	1.10	58.35	0.01	0.45	1.66	76.05
Technology	0.04	1.81***	2.88	67.93	0.00	-0.05	0.19	81.27
Utilities	0.00	0.06	0.95	75.76	-0.01	-0.20	0.58	108.05

* p > 0.25

** p > 0.10

*** p > 0.05

**** p > 0.01

While there is an improvement in the overall Sector Specific analysis, the results within the economic sector components – where a stock’s attractiveness is assessed relative to its economic sector peer segment – are mixed. The greatest improvements from dynamic weighting came in the Energy, Technology, Materials, and Consumer Staples sectors, which are among the largest sectors and therefore this had an important positive impact on our portfolios. Within the Retail Trade sector, our stock selection proved to be poor regardless of a dynamic or static approach to factor weighting and is a clear area for additional research.

Overall, this difficult time period once again demonstrated the benefits of our process of dynamically adapting our factor weightings within our stock selections models. This benefit can in part be traced to our ability to short individual factors that were trending out of favor as well – such as, shorting momentum and favoring underperforming shares at times such as earlier this year, plus being able to go both long and short fundamental valuation metrics such as earnings yield and book/price at the same time. While this study covers a relatively short period of time, we have seen these favorable results hold for longer periods (and especially during less volatile periods for factor returns) as well.

In summary, the investment environment over the past 2 ½ years has been unusually volatile, with factors producing outsized returns from both positive and negative tilts, with sudden shifts

between extremes. Over this period, therefore, it has been important to be nimble and recognize that factors may not behave in their expected fashion. We hope (and expect) heightened factor volatility to settle down eventually, but even if it doesn't we will be well prepared – adapting to market changes as they occur.

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